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SUSTAINABLE FOOD SECURITY VIA CLIMATE–SMART AGRICULTURE

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Abstract: Climate-smart agriculture (**CSA**) can be well-known sustainably growing agricultural productivity and incomes, adapting and building the ability to weather change, and decreasing greenhouse gas emissions. The emergence of newly developed varieties which can be tolerant of heat, drought, and salinity is likewise a better strategy. It is necessary to distinguish regions and plants that are very a whole lot liable to climate change in order that these have to be repositioned to more appropriate areas. The climate forecast and early warning structures may be very beneficial to decrease the threats of weather losses. Computer-aided crop simulation models can guide to find out the possible hazard of climate variant on future crop yields, weather smart agriculture development, and mitigation procedures. The crop models allow variant of environmental elements inclusive of the water regime and temperature and simulate the crop reaction through many anticipated development parameters like crop yield. This research focuses on giving attention to resolution makers on the seriousness of those dangers and to aspect out how risk administration and insurance techniques can help within the survival of their economies. The value chain has been formulated to concentrate on the scientific linkages among adaptability to climate changes as a Sea level rise and laser land leveling as a prerequisite to lessen saline groundwater on Mediterranean Sea Coast in North Egypt and adaptability to warming in Upper Egypt to study accomplishing efficiency and equity in cropping styles in Egypt through focusing on the Strategic present global climate adjustments Preparedness Plan, the methodologies and precise action to combat drought. As an end result of most suitable cropping styles, farm profits would growth by 30.391, 190.818 %, water use lower by 28.159, 28.180 %, CO_2 emission lessen by 20.582, 22.840 %, and energy reduce by way of 23.654, 28.546 % in the old and new lands in Egypt.

Keywords: Climate smart agriculture assessment (**CSAA**), environmental climate smart agriculture assessment (**ECSAA**) and environmentally extended input–output climate smart agriculture analysis (**EEI-OCSAA**) as a value chains.

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INTRODUCTION

The climate-smart agriculture (CSA) notion is gaining considerable traction at global and national levels to meet the challenges of addressing agricultural plans under climate change. Climate-smart agriculture CSA is a concept that requires the integration of the need for adaptability and the possibility of mitigation in agricultural development strategies to prop food security. Several states around the globe have expressed intent to adopt climate-smart agriculture CSA methods to managing their agricultural sectors. It is crucial to building an extra formal basis for the climate-smart agriculture CSA concept and methodology and in equal time providing illustrations of how the idea may be applied across a range of conditions (Lipper *et al.*, 2018).

This research increase and formalize the conceptual foundations of climate-smart agriculture CSA drawing upon idea and concepts from agricultural development, institutional, and resource economics. The research is also committed to a case study illustrating the economical foundation of climate-smart agriculture in terms of decreasing vulnerability, growing adaptive ability, and ex-post risk coping. It also addresses policy issues associated with climate change focusing on the implications of the empirical findings for devising effective strategies and policies to prop resilience and the consequences for agriculture and climate change policy at countrywide, local and international levels. The research offer to development community and practitioners, policymakers, civil society, research, and academia in addition to special sector the tested suitable practices and innovative techniques of promoting climate-smart agriculture CSA system at a homeland level.

Climate change poses a primary and developing threat to global food security. Population boom and growing incomes in a good deal of the growing international have pushed call for food and other agricultural merchandise to unmatched levels. FAO has predicted that, on the way to meet food demand in 2050, annual international production of crops and livestock will want to be 60% better than it became in 2006. In developing states, about 80% of the required raise will require to come from high yields and increased cropping density, and only 20% of the growth of arable land. Meeting food require for a growing population is already formidable defiance for the agriculture sector, however, it can be further exacerbated via climate change (FAO, 2010). The expected results of climate change – higher temperatures, extreme climate events, water shortages, growing sea levels, the disruption of ecosystems and the lack of biodiversity – will generate massive consequences on the distinctive dimensions and determinants of food security via affecting the productivity of crops and forage, reducing water availability and changing the severity and distribution of crop. Through its effects on agriculture, climate change will make it extra hard to meet the key Sustainable Development Goal of finishing hunger, attaining year-spherical food security, and ensuring sustainable food production systems by 2030 (Asfaw *et al.*, 2018).

The size and velocity of climate change, and the effectiveness of adaptability and alleviation efforts in agriculture, will be vital to the destiny of huge segments of the globe's populace. Integrating the consequences of climate change into agricultural development plans is a chief gauntlet. This requires engineering and politicking measures to reduce vulnerability and increasing the ability of producers, in particular smallholders, to efficaciously adapt. At the equal time, given agriculture's role as the main source of greenhouse gasoline emissions and the high rate of emissions growth with recent conventional intensification strategy, there may be a want to search for low emissions growth possibilities and adequate guidelines. Policymakers are as a result challenged to ensure that agriculture contributes to addressing food protection, improvement, and climate change. In this frame, Climate Smart Agriculture (CSA) is an approach that requires the integration of the want for adaptation and the possibility of mitigation in agricultural growth strategies to support food security (WCED, 1987).

METHODOLOGY

Climate clever agriculture (CSA) is an approach to guide the administration of agriculture within the era of weather change. The notion was first launched in 2009, and ever after then has been reshaped through inputs and interactions of multiple stakeholders worried in growing and implementing the concept. Climate-smart agriculture CSA targets to provide globally applicable concepts on coping with agriculture for food security below climate change that would provide a foundation for policy guidance and recommendations (Post *et al.*, 2001). The major features of the climate-smart agriculture method had been developed in response to limitations inside the worldwide climate policy arena in the comprehension of agriculture's role in food security and its capacity for occupying cooperative interaction synergies among adaptability and mitigation (Ringius, 2002). This research expands and formalizes the conceptual foundations of climate-smart agriculture drawing upon concept and ideas from agricultural development, institutional and material economics. The research focuses especially on the adaptability/resilience dimension of climate-smart agriculture. Climate-smart agriculture assessment (CSAA) specializes in macro-queries on resource use sustainability, effectiveness, irritability, and protection. Environmental climate-smart agriculture assessment (ECSAA) concentrates on the comparative assessment of the environmental effects of production. Environmentally extended input-output climate-smart agriculture analysis (EEI-OCSAA) as a value chain is specialized to grasp how natural useful resource use and environmental influences may be traced throughout the economy.

MATHEMATICAL MODEL

The research expands and formalizes the conceptual foundations of Climate-Smart Agriculture (CSA) drawing upon theory and general notions from agricultural development, institutional, and materials economics. To focuses especially on the adaptability/resilience size of Climate-Smart Agriculture, seeing that that is the least nicely evolved in the economics literature. A blend of conceptual analyses, including concept, empirical and politicking analyses, and case studies appearance at: (1) ex-ante reduction of vulnerability, (2) growing adaptive ability via policy reaction, (3) growing adaptive capability through system-level response and (4) increasing adaptive ability through farm-level off response.

The research supplies to a case study to demonstrate that these general notions have strong real-world applicability. The case study technique will offer concrete illustrations of the conceptual and theoretical framework, taking into consideration the high standard of diversity in agro-ecological and socioeconomic situations faced by agricultural planners and policy-makers today. Case examine assesses problems of measurement of vulnerability to climate change and damage resulting from it.

And address issues of enhancing adaptive capacity, and the ex-post impact of different politicking measures. In the research, economists and policy-makers will discover an interpretation and operationalizing of the notions of resilience and adaptive ability within the context of agricultural development for food security. The blending of methodological analyses of weather smart agriculture and empirical analyses based on a case study from the Southeast Mediterranean Sea is unique. We aren't aware of other researches that contain all of this integrated know-how in one location and offer a perspective on its lessons.

The research is arranged according to a plan as follows: the conceptual framework, an outline of climate-smart agriculture concept, method, and its major components. Where this component relates the principal capabilities of the climate-smart agriculture paradigm to core economic concepts and seeks to clarify how the ideas of resilience, adaptive ability, innovation, technology adoption, and establishments relate to each different and the economic concepts of climate clever agriculture. The part next to a case study from the Southeast Mediterranean Sea from agricultural development economists geared toward illustrating the economic basis of climate-smart agriculture in the expression of lowering vulnerability and increasing adaptive ability. It makes a clear difference between responses to constructing adaptive capacity at politicking, system, and farm levels. Addresses policy troubles associated with climate change and provide a top-level view of climate-smart agriculture paradigm based on economic principles.

Sustainable food security via climate smart agriculture (SFSVCSA) as a value chain consists of

Climate smart agriculture assessment (CSAA) as a value chain

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

Z1 : Total amount of productions cultivated in the scheme of old land

Evy_1 : Economic value of production old land before adaptation to climate change

Evy_2 : Economic value of production old land after adaptation to climate change

Z2 : Total amount of productions cultivated in the scheme of new land

Evy_3 : Economic value of production new land before adaptation to climate change Evy_4: Economic value of production new land after adaptation to climate change

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

Environmental climate smart agriculture assessment (ECSAA) as a value chain

$$\text{Minimize EAGA}=\sum_{y1=1}^{Z1}(\text{Evy2-Evy1})+\sum_{y2=1}^{Z2}(\text{Evy4-Evy3}) \qquad (3)$$

Z1 : Total amount of crop emission in cultivated in the scheme of old land

Evy_1 : Amount value of crop emission in old land before adaptation to competition

Evy_2 : Amount value of crop emission in old land after adaptation to competition

Z2 : Total amount of crop emission in cultivated in the scheme of new land

Evy_3 : Amount value of crop emission in new land before adaptation to competition Evy_4: Amount value of crop emission in new land after adaptation to competition

Subject to

$$Qy = Ry \ . Ay \qquad (4)$$

Q_y : Quantity of crop emission in production y

R_y : Yield of crop emission in production y

A_y : Area allocated to production y

Environmentally extended input–output climate smart agriculture analysis (EEI-OCSAA) as a value chain

$$\text{Maxmize EEI-OAGA}=\sum_{y1=1}^{Z1}(\text{Evy2-Evy1})+\sum_{y2=1}^{Z2}(\text{Evy4-Evy3}) \qquad (5)$$

Z1 : Total amount of productions cultivated in the scheme of old land

Evy_1 : Economic value of production old land before adaptation to competition

Evy_2 : Economic value of production old land after adaptation to competition

Z2 : Total amount of productions cultivated in the scheme of new land

Evy_3 : Economic value of production new land before adaptation to competition

Evy_4 : Economic value of production new land after adaptation to competition

V : Total annual volume of water used in the scheme

Subject to

$$EVy = Qy \,.\, Py - Cy \tag{6}$$

$$Qy = Ry \,.\, Ay \tag{7}$$

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

Climate-smart agriculture assessment (CSAA), Environmental climate-smart agriculture assessment (ECSAA) and Environmentally extended input-output climate-smart agriculture analysis (EEI-OCSAA) as a value chain formulated as an analytical tool for applying the production value chain within the old and new lands of Egypt in the agriculture region in Nile valley below the constraints of water resources and adaptability to climate changes in Egypt. The study area was the old and new lands of Egypt with an area of 1154964.32 and 236527.21 hectares (MALR, 2020), which contains 13 governorates (Alexandria, Menoufia, Gharbia, Kafr El Sheikh, Ismailia, Dakahlia, Qaliubiya, Sharqia, Port Said, Suez, Damietta, El-Behaira, and Cairo) within the Nile River Delta and 9 governorates (Giza, Beni Suef, Fayum, Assuit, Mania, Qena, Sohag, Luxor and Aswan) in the Nile River valley (Figure l). The old and new lands in the Nile Valley is the primary area that cultivates in Egypt and is characterized by a pattern of cultivating crops for a complicated year, where crops are cultivated over 3 consecutive cropping seasons; winter, summer, and nili. The Nile River is the primary source of renewable and fresh surface water in Egypt. The economic and financial analysis and risks have been moreover studied, similarly to the inner annual rate of return for crop production.

Several steps have been pursued to carry out Climate-smart agriculture assessment (CSAA), Environmental climate-smart agriculture assessment (ECSAA) and Environmentally extended input-output climate-smart agriculture analysis (EEI-OCSAA) as a value chain (Figure 2): The first step has been the optimal cropping pattern for cultivating crops in winter within the old and new lands of Egypt. The second step was to simulate the optimal cropping pattern for Egypt. The third step was to simulate the most efficient cropping pattern inside the area with the existing cropping pattern (2014/2015-2016/2017) to reallocate crop acreage in step with production and technical hazard control. To fill within the model, field data reported through farmers turned into used. The vital statistics have been amassed via comprehensive survey and special inputs for crop fields on a winter season agriculture foundation only, and comprehensive records connected into related to the agricultural status quo and its associated socio-economic conditions. Crop space, yield, and cost data have been acquired from the Egyptian Ministry of Agriculture and Land Reclamation (MALR, 2020), whilst water consumption facts were accrued from the Egyptian Ministry of Water Resources and Irrigation (MWRI, 2020). The necessary statistics associated with the cropping pattern enter the extraordinary producing systems have been gathered from the number one asset and transformed into appropriate cropping sample values. Greenhouse fuel emissions were calculated and expressed according to the power input. The data provided in this research represented common and/or average data recorded over the successive years of 2014/2015-2016/2017. Current cultivation and its valuation offered within the venue and the season in old and new lands are supplied in table 1, where the base year data is obtainable to clarify the zone crops and their space in addition to cultivation evaluation from their source (ECAPMS, 2020).

To evaluate the sustainability of agriculture, it's some distance that might vital to don't forget about the water use efficiency in the farming system; water use performance can regularly be increased via lowering water use from inputs or via the approach of developing outputs including crop product. To use technical risk administration it is able to be reallocated the land use to increase farm earnings; wherein the model changed into adjusted to the change in the land to accompany variation in soil and water kind after laser leveling of the land in the vintage and new lands of Egypt. Table 2 indicates the economic valuations of ultimate cultivation based mostly on climate-smart agriculture assessment (CSAA) as a value chain and through the use of laser land leveling of land within the vintage and new lands of Egypt and in comparison with the existing state of affairs in Egypt. Figures 3 and 4 illustrate modifications in climate-smart agriculture value chains in cultivation in the region in wintry weather season from common 2014/2015-2016/2017 to climate-smart agriculture assessment (CSAA) within the old lands of Egypt. And figures 7 and 8 illustrate variations in agriculture growth in cultivation inside the area in wintry weather season from common 2014/2015-2016/2017 to climate-smart agriculture assessment (CSAA) within the new lands of Egypt. Table 3 shows the economic evaluations of optimum cultivation based mostly on environmental climate-smart agriculture assessment (ECSAA) as a value chain and through using laser land leveling of land within the old and new lands of Egypt and in comparison with the current situation in Egypt. Figures 5 and 6 illustrate alters in environmental climate-smart agriculture value chains in the vicinity in wintry climate season from common 2014/ 2015-2016/2017 to environmental climate-smart agriculture assessment (ECSAA) within the old lands of Egypt. And figures 9 and 10 illustrate changes in environmental climate-smart agriculture inside the region in wintry weather season from common 2014/2015-2016/2017 to environmental weather smart agriculture assessment (ECSAA) in the new lands of Egypt. Table 4 indicates the environmentally valuations of most effective cultivation based on environmentally extended input-output climate-smart agriculture analysis (EEI-OCSAA) as a value chain and via the use of laser land leveling of land in the vintage and new lands of Egypt and valuation with the current scenario in Egypt. Figures 5 and 6 illustrate modifications in environmentally extended enter-output analysis in cultivation within the area in wintry weather season from common 2014/ 2015-2016/2017 to environmentally extended input-output climate-smart agriculture analysis (EEI-OCSAA) in the vintage lands of Egypt. And figures 9 and 10 illustrate shifts in environmentally extended input-output analysis in cultivation in the area in wintry weather season from common 2014/ 2015-2016/2017 to environmentally extended input-output climate-smart agriculture analysis (EEI-OCSAA) in the new lands of Egypt. The environmental climate-smart agriculture assessment (ECSAA) as a value chain supplied much less greenhouse gas emissions than the existing model for all agricultural operations, wherein pollution cause damage to the ecosystem, structures, and human health. The social value according to greenhouse gas emissions and air pollution calculated to obtain data at the suitable use of water in old and new lands in Egypt.

The results in table 2 showed that the whole water consumption for optimum cultivation decreased by 28.159 and 28.181% within the old and new lands of Egypt and that the overall region of crops may be 931749.034 and 319914.983 hectares planted in the old and new lands in Egypt, in addition to the predicted model affords a better net benefit than the existing model.

The general net income of the heterogeneous case become 186530.800 and 69395.275 million EP better than the whole of the homogeneous case (166259.954 and 20074.227 million EP) after applying the model, in addition to the overall cost of crops in heterogeneous case 40629.067 and 13102.565 million EP that did not attain the total homogeneous case (34968.102 and

8436.099 million EP). This end result may moreover propose that the difference between the heterogeneous cases had a massive effect at the most ideal solution.

According to financial and economic analyzes in table 3, the internal annual rate of return (IRR) became higher than the present model of the area and elevated by 14.98 and 118.32% inside the vintage and new lands of Egypt, and the absolute risk of optimal cultivation is decreased by 23.31 and 65.61%. For this reason, Sustainable food security through climate-smart agriculture (SFSVCSA) as a value chain may be applied in the agriculture sector inside the land of Egypt. Finally, farmers should level the land via laser because it is the best solution to the Egyptian question, as it's low-cost (261.904 EP) for every with hectare in Egypt.

CONCLUSION

Climate-Smart Agriculture (CSA) is an approach to manual the management of agriculture inside the epoch of climate change. The abstract idea was first released in 2009, and due to then has been reshaped through inputs and interactions of stakeholders concerned in growing and achieving the concept. Climate-smart agriculture goals to supply globally relevant standards on dealing with agriculture for food security underneath climate change that could provide a foundation for politicking guides and pointers through multilateral organizations, inclusive of UN's FAO. The major features of the climate-smart agriculture approach have been grown in reaction to limitations in the international climate politicking arena in the grasp of agriculture's role in food security and its capability for shooting synergies among adaptability and mitigation.

Recent controversies that have arisen over climate-smart agriculture is rooted in longstanding debates in each climate and sustainable agricultural developed policy spheres. These include the role of growing countries, and especially their agricultural sectors, in reduction worldwide GHG emissions, as well as the choice of technologies that may be enhanced sustainable shapes of agriculture. Since the term climate-smart agriculture' becomes widely adopted before the evolution of an official conceptual frame to perform the approach, there has been substantial variation in meanings applied to the term, which also contributed to controversies. As the body of work on the concept, methods, apparatus, and programs of the climate-smart agriculture technique expands, it's far turning into clearer what it may offer. Ultimately, climate-smart agriculture's utility might be judged by way of its effectiveness in integrating climate change reaction into sustainable agricultural growth strategies on the ground. The aim of this

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

Winter cultivation in old land of Egypt				
	Mean	*CSAA*	*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	*CSAA*	*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) **CSAA** model (2020) (3) ECAPMS, (2020)

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 CSAA
(Green is values that have increased, red are values that have decreased)

Winter cultivation in old land of Egypt				
	Mean	*CSAA*	*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	*CSAA*	*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) **CSAA** model (2020) (3) ECAPMS, (2020)

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 CSAA
(Green is values that have increased, red are values that have decreased)

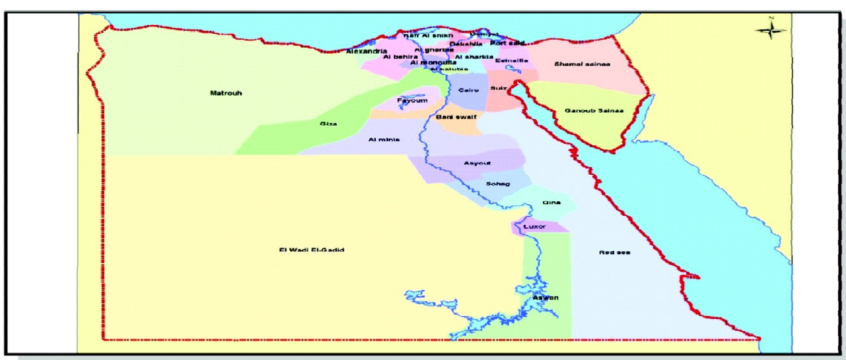
Winter cultivation in old land of Egypt				
	Mean	*CSAA*	*Change*	*%*
Irrigated area of crop in old land	2149252.6	2218450.1	69197.5	3.2
Main crop yield	98.5	128.9	30.4	30.9
Secondary crop yield	33.0	43.1	10.2	30.8
Main crop price	7947.8	10282.3	2334.4	29.4
Secondary crop price	494.7	509.4	14.7	3.0
Crop 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	*CSAA*	*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) **CSAA** model (2020) (3) ECAPMS, (2020)

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 ECSAA (Green is values that have increased, red are values that have decreased)

Winter cultivation in old land of Egypt				
	Mean	*ECSAA*	*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	*ECSAA*	*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) **ECSAA** model (2020) (3) ECAPMS, (2020)



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				

Figure 1: Nile River valley

Source: (Hamada 2020)

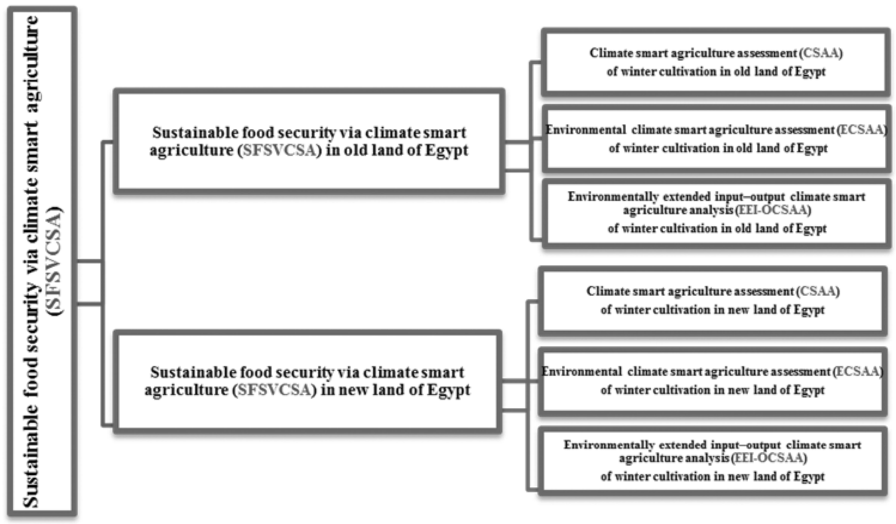


Figure 2: Structure model of Climate smart agriculture assessments (CSAA) as a value chain in Egypt

Source: (CSAA model 2020)

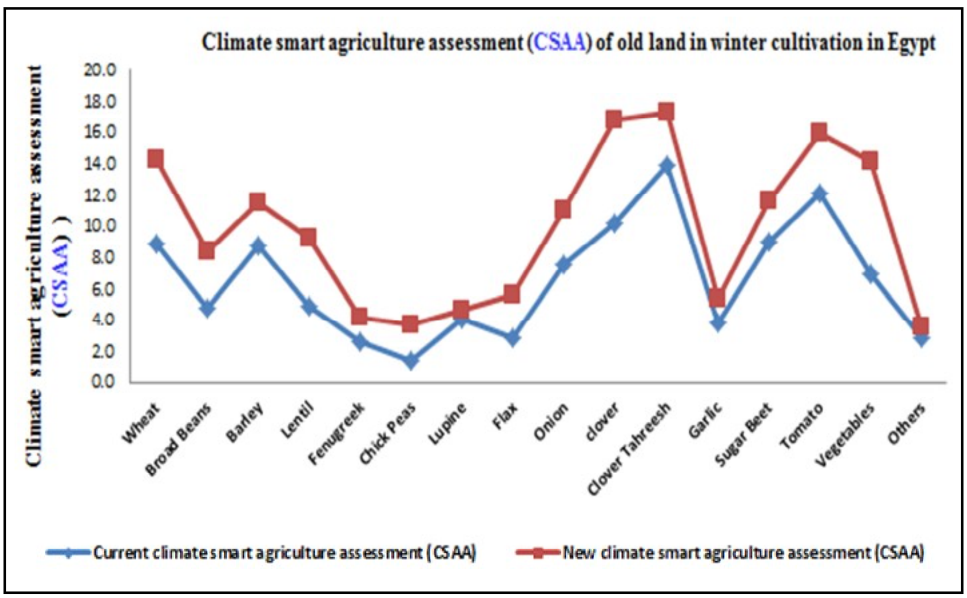


Figure 3: Changes climate smart agriculture assessments (CSAA) from 2014/2015-2016/2017 to CSAA

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

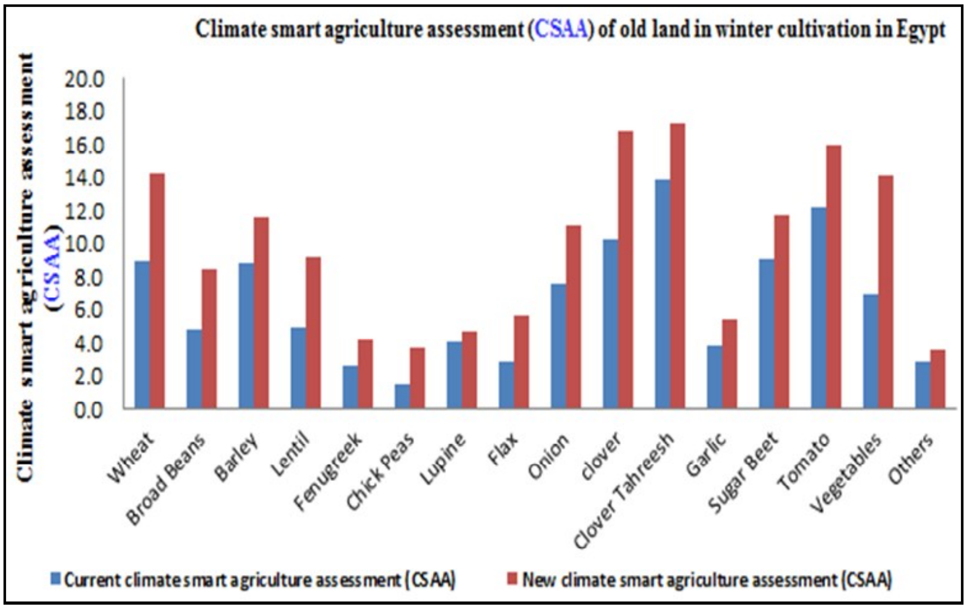


Figure 4: Changes climate smart agriculture assessments (CSAA) from 2014/2015-2016/2017 to CSAA

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

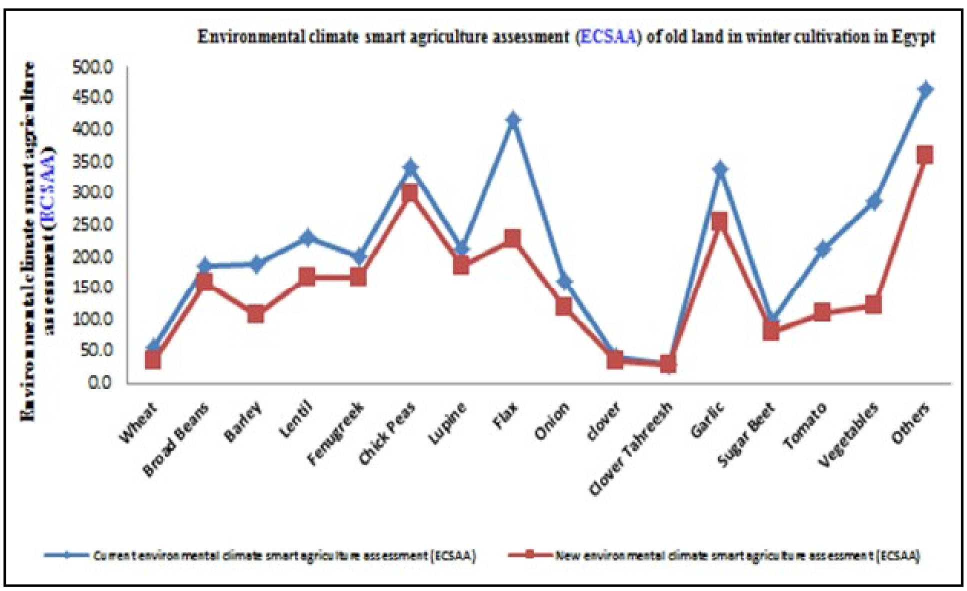


Figure 5: Changes environmental climate smart agriculture assessment (ECSAA) from 2014/2015-2016/2017 to ECSAA

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

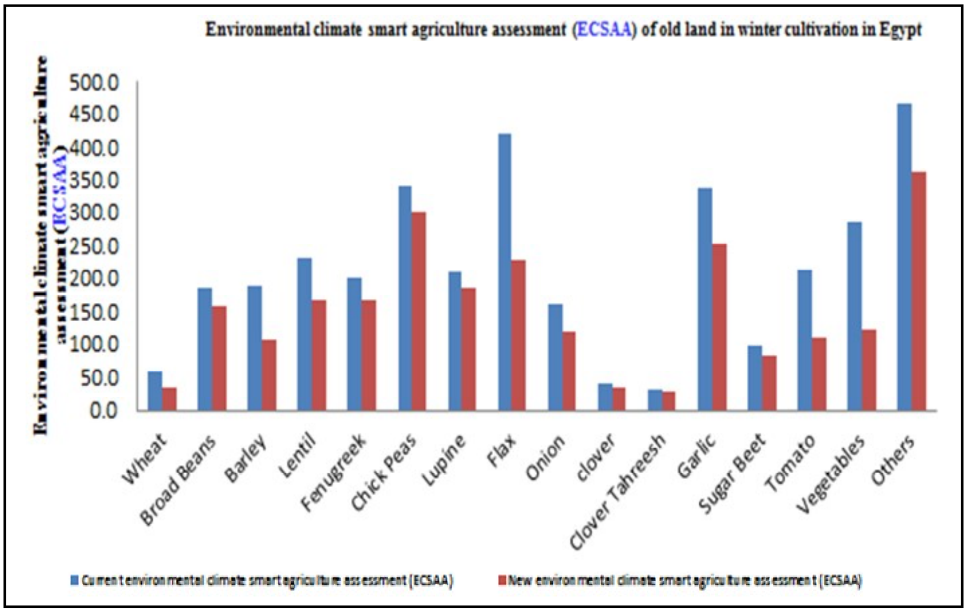


Figure 6: Changes environmental climate smart agriculture assessment (ECSAA) from 2014/2015-2016/2017 to ECSAA

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

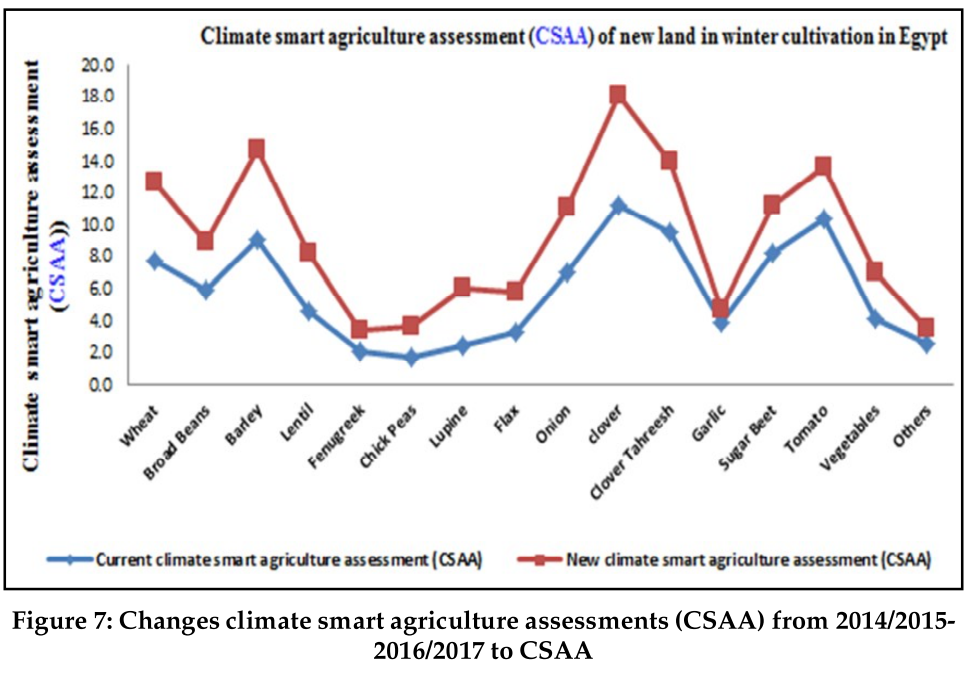


Figure 7: Changes climate smart agriculture assessments (CSAA) from 2014/2015-2016/2017 to CSAA

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

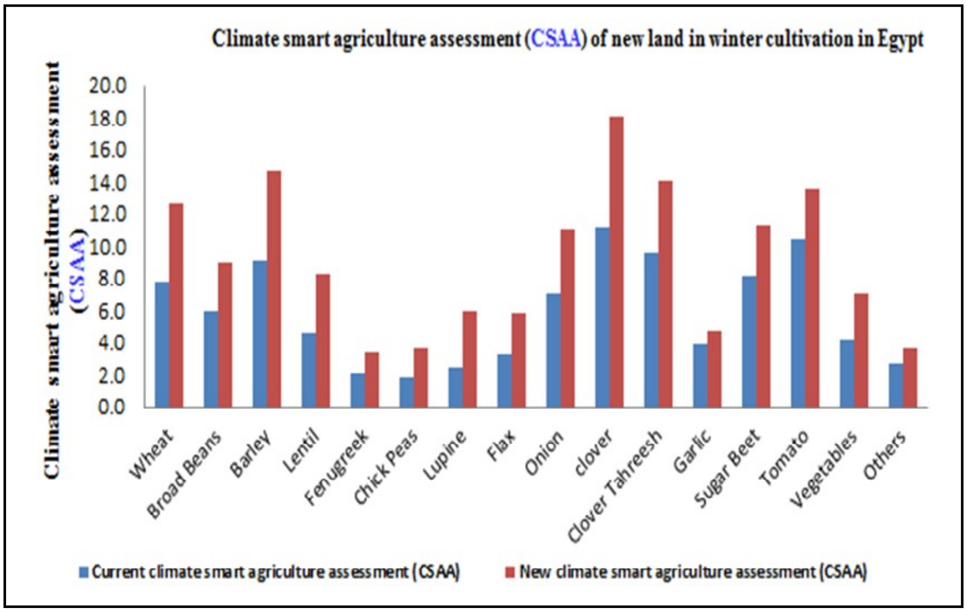


Figure 8: Changes climate smart agriculture assessments (CSAA) from 2014/2015-2016/2017 to CSAA

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

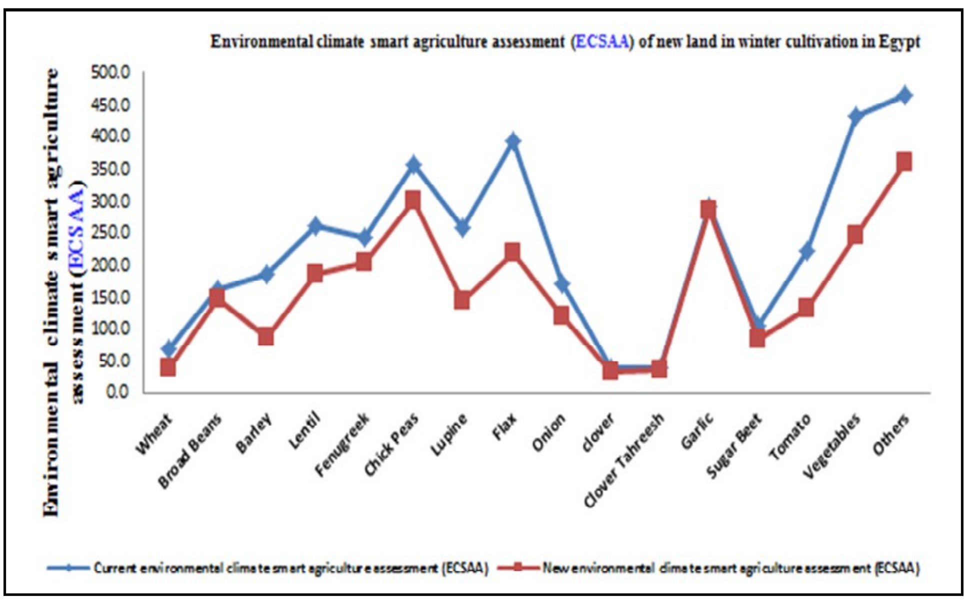


Figure 9: Changes environmental climate smart agriculture assessment (ECSAA) from 2014/2015-2016/2017 to ECSAA

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

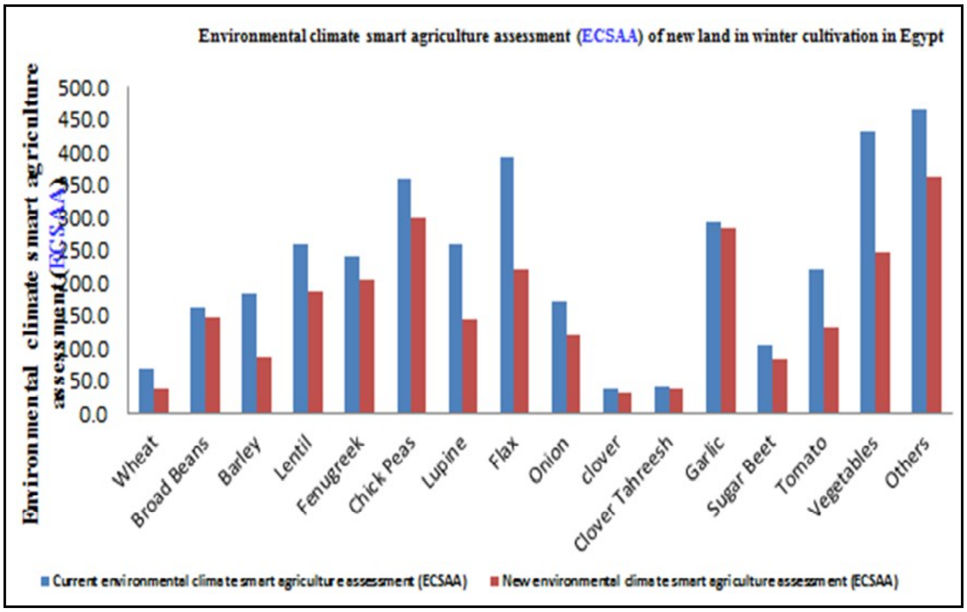


Figure 10: Changes environmental climate smart agriculture assessment (ECSAA) from 2014/2015-2016/2017 to ECSAA

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

research is to compare three techniques to trace performance in Sustainable food security via climate-smart agriculture (SFSVCSA) value chains: Climate-smart agriculture assessment (CSAA), Environmental climate-smart agriculture assessment (ECSAA) and environmentally extended input-output climate-smart agriculture analysis (EEI-OCSAA).

The consequences of Climate-smart agriculture assessment (CSAA), Environmental climate-smart agriculture assessment (ECSAA) and Environmentally extended input-output climate-smart agriculture analysis (EEI-OCSAA) as a value chain confirmed that the complete water consumption for optimum cultivation reduced thru 28.159 and 28.181% within the old and new lands of Egypt and that the overall place of crops might be 931749.034 and 319914.983 hectares planted in the old and new lands of Egypt, further to the expected model gives a higher net benefit than the existing model. The general net financial gain of the heterogeneous case become 186530.800 and 69395.275 million EP better than the entire of the homogeneous case (166259.954 and 20074.227 million EP) after applying the model, in addition to the entire cost of crops in heterogeneous case 40629.067 and 13102.565 million EP that did not reach the overall homogeneous case (34968.102 and 8436.099 million EP). This end result may additionally mean that the distinction some of the heterogeneous instances had a big impact on the top-rated solution. According to financial and economic analyzes, the internal annual rate of return (IRR) became higher than the present model of the region and increased by 14.98 and 118.32% in the vintage and new lands of Egypt, and the absolute risk of optimal cultivation is decreased by 23.31 and 65.61%. For this reason, the Growth complementarity among agriculture and industry (GCBAAI) as a value chain may be applied in the agriculture sector inside the land of Egypt.

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