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GRAND ETHIOPIAN RENAISSANCE DAM AND BEYOND: A New Era of Water Management in Nile Delta; Risk Reduction in Nile Delta (RRIND) through Water Supply Chains

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Abstract: Water productiveness in agriculture is multi-faceted, hard to be relevant beyond a mere material interpretation of it, and commonplace to plenty of disciplines, each one in every one of them with its very own interpretation of the scales of analysis, the targets of the evaluation and the terms of the signs used. However, if one realizes the risks, the water efficiencies method may be useful in a given situation – defined by a specific scale of evaluation, a specific sub-region or farming system, a spatial and temporal perimeter – to discover the capability of "improving" the productiveness of present water resources and convey extra food in step with unit of water. In this research, a cross-analysis of the management of the water irrigation scheme (RRiND) and the overall performance of the water supply chain, depending on this scheme, is undertaken to discover the opportunities for enhancing the water productiveness through better coordination in the irrigated water supply chain. Water productiveness in agriculture is multi-faceted, hard to be relevant beyond a mere material interpretation of it, and commonplace to plenty of disciplines, each one in every one of them with its very own interpretation of the scales of analysis, the targets of the evaluation and the terms of the signs used. However, if one realizes the risks, the water efficiencies method may be useful in a given situation – defined by a specific scale of evaluation, a specific sub-region or farming system, a spatial and temporal perimeter – to discover the capability of "improving" the productiveness of present water resources and convey extra food in step with unit of water. In this research, a cross-analysis of the management of the water irrigation scheme (**RRiND**) and the overall performance of the water supply chain, depending on this scheme, is undertaken to discover the opportunities for enhancing the water productiveness through better coordination in the irrigated water supply chain.

Key words: water productivity, water supply chain, water management

INTRODUCTION

Though politicians and the press have a tendency to downplay the idea, "A Great River Faces a Multitude of Threats, The Nile River is under assault on two fronts

– a big dam under construction upstream in Ethiopia and growing sea levels main to saltwater intrusion downstream", environmental degradation is frequently an underlying motive of worldwide crises — from the deforestation, erosion, and decreased agricultural production that set the stage for the Rwandan genocide of the 1990s. Egypt could end up the modern example, its ninety-five million human beings the likely sufferers of a slow-motion catastrophe introduced on through grand-scale environmental mismanagement. It's occurring now within the Nile River delta, a low-lying area fanning out from Cairo more or less a hundred miles to the sea. About 45 or 50 million human beings live within the delta, which represents just 2.5 percentage of Egypt's land area. The rest live inside the Nile River valley itself, a ribbon of green winding via hundreds of miles of wilderness sand, representing another one percentage of the nation's total land area. Though the delta and the river together had been long the source of Egypt's wealth and greatness, they now face relentless attack from both land and sea. The present-day threat is a massive dam scheduled to be completed this year on the headwaters of the Blue Nile, which supplies 59 percent of Egypt's water. Ethiopia's national authority has largely self-financed the $five billion Grand Ethiopian Renaissance Dam (GERD), with the promise that it'll generate 6,000 megawatts of power. That's a big deal for Ethiopians, three-quarters of whom now lack get entry to electricity. The sale of excess power to different countries within the vicinity may also carry in $1 billion a year in badly needed foreign exchange revenue (CONNIFF, 2017).

Grand Ethiopian Renaissance Dam (GERD) can solely begin to meet those promised benefits, however, via holding Back Nile water that could otherwise pass down the Nile to Sudan and then Egypt, and that's obviously a huge deal for each those countries. Where the Grand Ethiopian Renaissance Dam is being built on the Ethiopian-Sudanese border at the Blue Nile, which elements 59 percentage of Egypt's water. The dam will create a reservoir extra than twice the scale of the Hoover Dam's Lake Mead, the largest reservoir inside the United States. It will in the end store 74 billion cubic meters of Blue Nile water (That's about sixty-four million acre-feet, or the quantity of water need to cover 100,000 square miles of land one foot deep). Filling it can take anywhere from 5 to 15 years. "During this time of fill," a new study inside the Geological Society of America's journal GSA Today reports, "the Nile's freshwater glide to Egypt can be reducing by 25 percent, with a lack of a third of the electricity generated by means of the Aswan High Dam." That is, of course, Egypt's own large dam on the Nile, finished in 1965, more or less 1,500 miles downstream. The GSA study, led via Smithsonian Institution geologist Jean-Daniel Stanley, says Egypt faces "serious country-huge freshwater and power shortage via 2025." Agriculture within the delta, which produces as much as 60 percent of Egypt's food, may also be afflicted by shortages of irrigation water. The GSA study has a look at makes clear, moreover, that the new dam is only one of a chain of environmental threats now dealing with Egypt.

Rising sea levels, introduced on by using weather change, are the maximum apparent of them. Much of the Nile Delta is handiest a meter or so above sea stage, and a 2014 analysis led by means of Assiut University geologist Ahmed Sefelnasr anticipated that a half-meter upward thrust in sea degree would decrease the delta by 19 percentage, that was the conservative scenario. If the sea degree rises by one meter in this century, as many climate scientists think likely, a 3rd of the delta may want to disappear below the Mediterranean (CONNIFF, 2017).

The delta is becoming less fertile because it's not replenished each year by a hundred million tons of flood sediments from the Nile. Instead, those sediments now drop out wherein the Nile enters the reservoir created by way of the Aswan High Dam. A new delta is now forming there, however underwater. Studies have attributed super fated seismic activity inside the region to the burden of the dam and the water stored at the back of it. In addition to the almost certain lack of land area in the delta, the mixture of sea-level rise thrust and land subsidence will also boom saltwater intrusion. Egypt is already one of the poorest nations in the globe in terms of water availability consistent with capita; it has just 660 cubic meters of freshwater a year for each resident, compared, for instance, to 9,800 cubic meters in the United States. But depending on Studies, saltwater intrusion from a one-meter upward thrust in sea level could jeopardize more than a third of the freshwater volume within the delta. "If you communicate to farmers in the northern delta they'll inform you they've lost production consistently, and that saline wedge is moving closer to the middle of the delta, so it doesn't look like a totally happy thing," especially with Egypt's population set to double over the subsequent 50 years.

So how have to Egypt, with its struggling economy, address what are obviously life-threatening challenges? In 2015, Egypt, Ethiopia, and Sudan signed a mutual do-no-harm agreement, but a formal settlement on precisely how to share Nile resources is still lacking. Ethiopia ought to limit the immediately downstream damage via lengthening the time it takes to fill the reservoir. But that means delaying the advantages of the dam, which Ethiopia may have already got oversold.

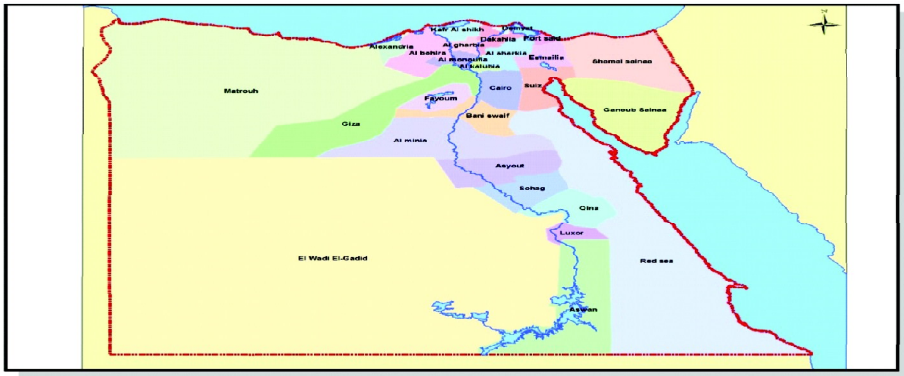
METHODOLOGY

Last May, the European Parliament launched a report titled:" A stable Egypt for a stable region: Socio-financial demanding situations and prospects "about the challenges which can be facing with Egypt and their impact on the country's socio-financial and political stability in the next two decades. Among the most crucial demanding situations dealing with the North African country become the strain on water resources with the intention to have with disastrous effect on water and food crisis. In this context, it appears that evidently that water shortage and the issues of the Nile Delta started out to hit Egyptian farmers. The Nile water deliver is already suffering to maintain the developing Egyptian population, and troubles along with water contamination and salinization as a result of growing sea levels are badly affecting farming within the Delta. But the problems inside the Nile Delta were decades in the making. Rising sea levels within the Mediterranean have extended the salinity of underground water and the soil. The population boom has put more stress on current water resources, whilst the mass dumping of industrial waste in irrigation canals has polluted waterways. Above all these issues, a scenario is growing upstream in Ethiopia, which includes an existential threat to the Egyptian Nile's essential place in the country's economy. The Grand Ethiopian Renaissance Dam (GERD) located on the Blue Nile, which is set to house the largest hydroelectric plant in Africa, is nearing of completion. Once the production of the dam is finished, the reservoir it will contain can be filled over a three to five-year period, vastly depleting the volume of water flowing into Egypt for the duration of that time.

As Ethiopia's Grand Renaissance Dam nears completion built, Egyptian fears that the dam will have an effect on its historical Nile water share remain unchanged. Egypt's share of 55.5 billion square meters is the country's main delivery of drinking water and irrigates the Nile Delta and generates nearly half of the needs of the country's electricity by way of the operation of the Aswan High Dam. In 2015, Egypt, Ethiopia, and Sudan signed a statement of principles in Khartoum in which the three nations agreed to take all measures to avoid causing harm to the others and to provide compensation in case of any harm. While the Ethiopian aspect has reportedly reassured Egypt that its water share will no longer be affected, Egyptians are worried the dam would impact the agricultural output. The question is how we will reduce possible damages that could occur because of the Renaissance Dam.

The study area was the old and new lands of Egypt with an area of 2149252.56 and 677504.94 hectares and located in the Nile River valley and Nile River Delta (MALR, 2020), which contains 13 governorates (Alexandria, Gharbia, Menoufia, Ismailia, Kafr El Sheikh, Qaliubiya, Dakahlia, Port Said, Sharqia, Damietta, Suez, El-Behaira, and Cairo) in the Nile River Delta and 9 governorates (Giza, Fayum, Beni Suef, Mania, Assuit, Sohag, Qena, Luxor and Aswan) in the Nile River valley (Figure 1). The study area has a typical southern Mediterranean climate, the average annual catchment rainfall is low, which occurs mainly in winter and the summer temperatures are almost elevated. The old and new lands in the Nile Valley is the main area that grows in Egypt and is characterized by a pattern of growing crops for a complex year, where crops are cultivated over three consecutive cropping seasons; winter, summer, and nili. The Nile River is the main source of renewable and fresh surface water in Egypt.

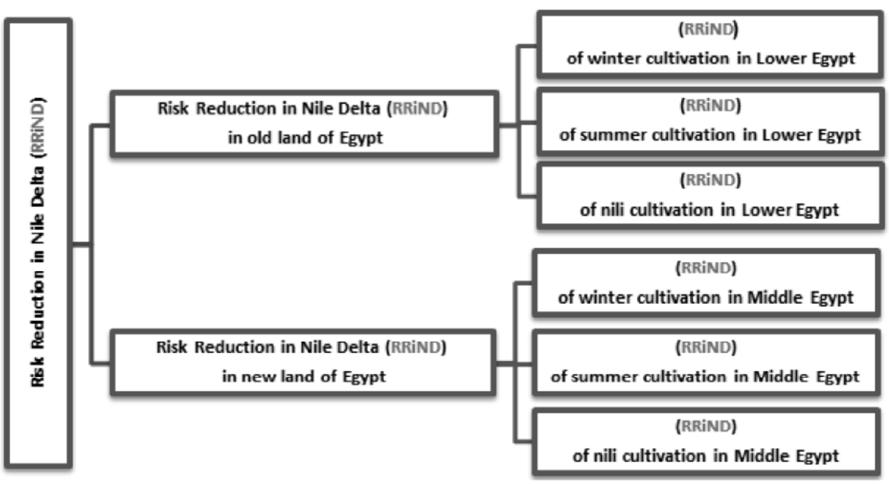
Risk reduction in Nile delta (RRiND) is a model formulated as an analytical device for applying the water use gadget within the antique and new lands of Egypt inside the agriculture region in the Nile valley in light of water scarcity in Egypt (Figure 2). To assess the sustainability of agriculture, it's miles essential to consider



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 2016)

Figure 1: Nile River valley



Source: (RRiN model 2020)

Figure 2: Structure model of Risk reduction in Nile delta (RRiND) in the Water supply chain in Egypt

the water use efficiency of the farming system; water use efficiency can frequently be elevated through lowering water use from inputs or by means of growing outputs such as crop production. In addition, the model had the ability to introduce many forms of water use as a prerequisite for efficiency and equity inside the agricultural sector in light of water supply change and global climate change, which reduces the cost in order to compete within the worldwide market and reduce the social cost of pollutants on agricultural crops. The economic and financial analysis and risks had been additionally studied, as well as the internal annual rate of return for crop production. To fill within the model, field data reported by farmers was used. The vital data have been collected via a comprehensive energy survey and different inputs for crop fields on a winter season agriculture basis only, and comprehensive data attached into attached to the agricultural status quo and its related socio-economic conditions. Crop area, yield, and cost data have been obtained from the Egyptian Ministry of Agriculture and Land Reclamation (MALR, 2020), while water consumption data had been gathered from the Egyptian Ministry of Water Resources and Irrigation (MWRI, 2020). The important data related to the input of the cropping pattern of the different production systems have been amassed from primary resources and transformed into appropriate cropping pattern values. Greenhouse gasoline's emissions had been calculated and represent per unit of energy input. The data provided during this research represented typical and/or average data recorded over the three consecutive years (2014/2015-2016/2017).

Risk reduction in Nile delta (RRiND) in Water supply chain can be written as:

$$\text{Minimize} \quad \text{RRiND} = \text{STDEV} \sum_{y1=1}^{Z1} \sum_{y2=1}^{Z2} (Evy2 - Evy1)/Evy1 \qquad (1)$$

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

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

Evy_1: economic value of production land before

Evy_2: economic value of production land after

V: total annual volume of water used in the scheme

Subject to

$$EVy = Qy \,.\, Py - Cy \qquad (2)$$

$$Qy = Ry \,.\, Ay \qquad (3)$$

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

SOLUTION AND RECOMMENDATIONS

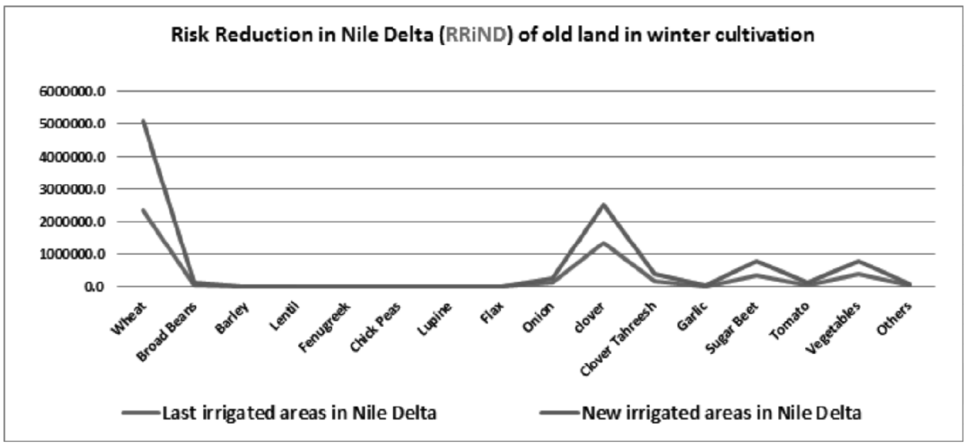
Risk reduction in Nile delta (RRiND) in Egypt is a model that became formulated as an analytical tool for developing 'generic' methods and tools for improving the value created via irrigated supply chains and therefore irrigation water productiveness that would be of interest in Nile valley inside the agriculture sector in light of water scarcity in Egypt (Figures 1 and 2). To assess the sustainability of agriculture, it's miles vital to do not forget the water use efficiency of the cropping system. Water use efficiency is regularly increased through reducing water use from inputs or by increasing outputs together with crop production. Beyond the Risk reduction in the Nile delta (RRiND) scheme, this research aims at developing 'generic' techniques and tools for improving the value created by irrigated supply chains and as a result irrigation water productivity that would be of interest for different cases. The anticipated precise outputs of the research relate to (1) knowledge on both the quality control in the course of the water supply chain and the layout and management of Risk reduction in Nile delta (RRiND) systems underneath numerous constraints (water, land, capital) and (2) management (information systems, databases) and simulation tools. In addition, the model has the power to introduce many styles of water use as a precondition for accomplishing efficiency and equity in the agricultural sector in mild of monetary and global climate change, which reduces the cost to end up capable of competing within global markets and decrease the social cost of pollutants on agricultural crops. Financial and economic analysis, risks and the internal annual rate of crop yield have additionally been investigated.

Several steps were followed to implement the RRiND model: The first step was the optimal cropping pattern for growing crops in winter in 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 optimal cropping pattern in the region with the current cropping pattern (2014/2015-2016/2017) to reallocate crop acreage according to production and technical risk management. To fill in the model, field data reported by farmers was used. The data were collected through a comprehensive production survey and also system management and alternative inputs to crop fields on a seasonal basis, and comprehensive data set were enclosed to the farm enterprise and associated socio-economic conditions. Crop area, yield, and cost data were obtained from MALR (2020). Information on water consumption was collected from MWRI (2020). The necessary data related to the cropping pattern input of the different production systems were collected from primary sources and converted into appropriate cropping pattern values. Greenhouse gas emissions were calculated and expressed per unit of the energy input. The data presented in this research represented typical and/or average data recorded over the successive years of 2014/2015-2016/2017. Current cultivation and its economic evaluation in Egypt presented in the region and the season in old and new lands are presented in Tables 1 and 2. The remaining base year data is available from the sources in Tables 1 and 2 places of crops in a larger view, which clarifies the place crops and their area as well as cultivation from their source (ECAPMS, 2020).

Risk reduction in Nile delta (RRiND) may be a model that should be used. To use production and technical risk management it can be reallocated to increase farm income; the model was adjusted regardless of the change in the land to accompany changes in soil and water type after laser leveling of the land in the old and new lands of Egypt. The model structure for optimum cultivation based on the appropriate soil type and water in Lower Egypt is shown in Figure 2. Moreover, Table 3 shows the economic assessments of optimal cultivation based on Risk reduction in Nile delta (RRiND) and laser leveling of land in the old and new lands of Egypt and was compared with the current situation in Egypt. Figures 3 and 4 illustrate changes in water efficiency in cultivation within the region and winter season from average 2014/2015-2016/2017 to RRiND in the old and new lands of Egypt. The results showed that the total water consumption for optimum cultivation decreased by 28.159 and 28.181% in the old and new lands of Egypt and that the total area of crops would be 931749.034 and 319914.983 hectares planted in the old and new lands of Egypt, as well as the expected model, provides a higher net benefit than the current model. The total net profit of the heterogeneous case was 186530.800 and 69395.275 million EP higher than the total of the homogeneous case (166259.954 and 20074.227 million EP) after applying the model as well as the total cost of crops in heterogeneous case 40629.067 and 13102.565 million EP that did not reach the total homogeneous case (34968.102 and 8436.099 million EP). This result may indicate that the difference between the heterogeneous cases had a significant impact on the optimal solution. For this reason, the RRiND model of the heterogeneous character of the land area is applicable to cultivation based on production and managing technical risks after laser land leveling in the old and new lands of Egypt.

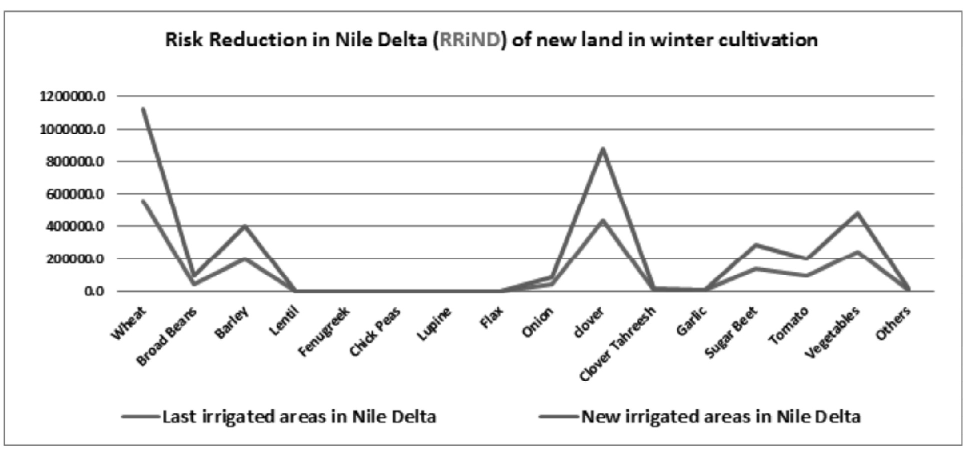
A classification of agro-climatic adaptation (per crop) ought to be established within a suitable type to match crops with climate and soil resources and the cost of crop production specified for every soil and geographical region, convenient to evaluate whether yields exceed expenses or now not. According to financial and economic analyzes, the internal annual rate of return (IRR) became better than the current model of the zone and increased by way of 14.98 and 118.32% in the old and new lands of Egypt. The absolute risk of optimal cultivation is decreased by 23.31 and 65.61% (Table 3). The proposed model provided less greenhouse gasoline emissions than the present model for all agricultural operations. Pollutants cause harm to the ecosystem, structures, and people’s health. The social cost per ton of greenhouse gas emissions and air pollution was calculated to obtain data at the optimum use of water in antique and new lands in Egypt in Table 4. Finally, farmers must level the land by laser because it is the best solution to the Egyptian question, as it is low-cost (261.904 EP) per hectare in Egypt.

These equations underline numerous ways to improve water productiveness through better irrigation supply chain management. A first common direction is in reducing the water amount used, either by means of enhancing the distribution and application efficiency or by selecting on crops with decrease water requirements. Various practical actions can be carried out to achieve these objectives: on the scheme level by using reallocating water to low consumer crops or by making an investment in infrastructures that decrease conveyance losses; on the farm level through changing each crop selection and irrigation practices. These adjustments might also even pave the manner for authentic solutions, for instance by advocating



Source: (1) MALR (2020) (2) RRiND model (2020)

Figure 3: Changes area in winter cultivation of old land in Egypt flow values from mean 2014/2015-2016/2017 to RRiND



Source: (1) MALR (2020) (2) RRiND model (2020)

Figure 4: Changes area in winter cultivation of new land in Egypt flow values from mean (2014/2015-2016/2017) to RRiND

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

Winter cultivation in old land of Egypt

	Mean	*RRiND*	*Change*	*%*
Wheat	418898.0	485085.0	66187.0	15.800
Broad Beans	13597.4	8308.6	-5288.8	-38.896
Barley	1782.3	1949.9	167.6	9.402
Lentil	442.8	250.7	-192.1	-43.386
Fenugreek	457.9	598.7	140.8	30.740
Chick Peas	748.3	223.3	-525.0	-748.289
Lupine	32.8	82.6	49.7	151.613
Flax	2487.2	1308.9	-1178.4	-47.376
Onion	24849.5	22091.8	-2757.7	-11.097
clover	240983.0	205229.2	-35753.8	-14.837
Clover Tahreesh	35303.5	38393.8	3090.4	8.754
Garlic	4142.0	3973.1	-169.0	-4.080
Sugar Beet	67039.8	74728.9	7689.1	11.469
Tomato	11979.0	12176.2	197.2	1.646
Vegetables	70550.1	71669.4	1119.3	1.586

Winter cultivation in new land of Egypt

	Mean	*RRiND*	*Change*	*%*
Wheat	128023.0	99341.4	-28681.6	-22.40
Broad Beans	7140.7	8655.8	1515.1	21.22
Barley	14608.0	35324.8	20716.8	141.82
Lentil	6.4	0.0	-6.4	-100.00
Fenugreek	223.0	118.7	-104.3	-46.76
Chick Peas	0.2	49.4	49.2	27900.00
Lupine	57.5	0.0	-57.5	-100.00
Flax	4.4	54.2	49.7	1128.00
Onion	11317.6	8064.7	-3253.0	-28.74
clover	23720.0	77615.8	53895.8	227.22
Clover Tahreesh	1836.1	1477.5	-358.6	-19.53
Garlic	1312.1	1325.1	13.1	0.99
Sugar Beet	23162.7	25284.8	2122.1	9.16
Tomato	20834.4	17811.1	-3023.3	-14.51
Vegetables	49096.0	42812.1	-6283.9	-12.80

Data source: (1) MALR (2020) (2) RRiND model (2020)

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

Winter cultivation in old land of Egypt

	Mean	*RRiND*	*Change*	*%*
Irrigated area of crop in old land	5117.3	5282.0	164.8	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	26235.4	40629.1	14393.7	54.9
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	3189.3	2532.9	-656.5	-20.6
Energy consumption in cultivation TJ	100.8	76.9	-23.8	-23.7
Main crop yield	101.6	125.4	23.8	23.4
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	*RRiND*	*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	0.0
Crop water consumption	4170.5	2995.2	-1175.3	-28.2
Kerosene fuel million tons	1400.7	1080.7	-319.9	-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	14.9
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) RRiND model (2020)

deficit irrigation (Zwart and Bastiaanssen, 2004) or with the aid of thinking that water lost in canal systems may be more productive elsewhere (Seckler et al., 2003). The second path is composed of improving the irrigation supply chain management in order to boom its economic value, both at the farm and marketing levels. Four alternatives may be considered: Firstly, various measures are possible to enhance the attractiveness of the irrigation supply chain with admire to other plants or sub-sectors: price techniques for agricultural inputs and commodities, contracts imparting sure protection to numerous parties, credit facilities, technical support, and provision of inputs. Secondly, guaranties can be furnished to farmers

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

Winter cultivation in old land of Egypt				
	Mean	*RRiND*	*Change*	*%*
Irrigated area of crop in old land	5117.3	5282.0	164.8	3.2
Main crop yield	101.6	125.4	23.8	23.4
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Crop production cost	26235.4	40629.1	14393.7	54.9
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	*RRiND*	*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	14.9
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	0.0
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) RRiND model (2020)

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

Winter cultivation in old land of Egypt				
	Mean	*RRiND*	*Change*	*%*
NO_x	1.59	1.26	-0.33	-20.58
SO_2	7.66	6.09	-1.58	-20.58
CO_2	7704.23	6118.49	-1585.74	-20.58
SO_3	nugatory	nugatory	nugatory	nugatory
CO	2.45	1.94	-0.50	-20.58
CH	nugatory	nugatory	nugatory	nugatory
SPM	nugatory	nugatory	nugatory	nugatory
Winter cultivation in new land of Egypt				
	Mean	*RRiND*	*Change*	*%*
NO_x	0.70	0.54	-0.16	-22.84
SO_2	3.37	2.60	-0.77	-22.84
CO_2	3383.45	2610.66	-772.78	-22.84
SO_3	nugatory	nugatory	nugatory	nugatory
CO	1.08	0.83	-0.25	-22.84
CH	nugatory	nugatory	nugatory	nugatory
SPM	nugatory	nugatory	nugatory	nugatory

Data source: (1) MALR (2020) (2) RRiND model (2020)

regarding the purchase of their productions, for this reason encouraging them to produce greater and to supply preferentially to the marketplace. Thirdly, the deliveries during the year might be regulated to higher in match the consumers' demand, as an instance via differentiated price mechanisms. Fourthly, measures could be applied to boom the excellent of raw productions which leads to better valued processed outputs. In that respect the interviews achieved with the stakeholders and the general discussion conducted confirmed that the productions supply chain is currently facing three strategic issues: 1) a way to boom the crop manufacturing by using enhancing the productiveness of farms, 2) a way to reduce the seasonality, three) the way to enhance the hygienic in addition to the intrinsic quality of the crop supply to the marketplace?

Assessing the water productiveness is complex due to the numerous parameters affecting its calculation and value. The ways irrigated agricultural products are processed and promoted play a great function in contributing to this productiveness, affecting directly farmers' income in line with a cubic meter of water used. As such, improving the technical, monetary and organizational performances of agro-food supply chains located on irrigated schemes seems a valuable direction to follow. It means (1) pinpointing the vital supply chains driving the water consumption at the scheme level, (2) analyzing their potential capacity for improvement and (3) running with the numerous stakeholders concerned in those chains. The scheme manager may additionally endorse this strategy, as this can enhance water productivity as shown. Although these stakeholders occupy a distinguished position within the water supply chain, they've to remember the farmers' orientations. These farmers might choose to market fodder or to supply meat in place of crop depending on their relative prices (or even switch to different crops). Besides, milk and meat production fill complementary functions inside the farm, as milk gives cash-flow (payment every two weeks), while meat allows saving up for future investments or vital expenses (water bill, social expenses). The strategic stability between productions will depend fundamentally on the farm kind - at the same time as both operational and tactical decisions can be made according to the context farmers are currently facing. All those decisions will directly impact the water productiveness via the numerous production functions (water to fodder, fodder to milk or meat). Moreover, indirect parameters may also play an essential function as well. The manufacturing of manure contributing to soil fertility is another component taken into account by farmers. A supply chain perspective will focus on linking the milk price to the expenses of other agricultural outputs within the region, consisting of meat and fodder. But the chain strategy and in the long run its pricing machine may additionally vary, must it search for with the exception of non-competitive breeders with dissuasive price levels due to their low productiveness or their poor milk satisfactory, or for attracting new suppliers. In that case, prices want to be attractive, as several supply chains operate inside the irrigation scheme and they fiercely compete for scarce water, land, labor and capital sources.

CONCLUSION

Risk reduction in Nile delta (RRiND) may be a model that should be used. To use production and technical risk management it can be reallocated to increase farm income; the model was adjusted regardless of the change in the land to accompany changes in soil and water type after laser leveling of the land in the old and new lands of Egypt. The model structure for optimum cultivation based on the appropriate soil type and water in Lower Egypt is shown. Moreover, it shows the economic assessments of optimal cultivation based on Risk reduction in Nile delta (RRiND) and laser leveling of land in the old and new lands of Egypt and was compared with the current situation in Egypt. It illustrates changes in water efficiency in cultivation within the region and winter season from average 2014/2015-2016/2017 to RRiND in the old and new lands of Egypt. The results showed that the total water consumption for optimum cultivation decreased by 28.159 and 28.181% in the old and new lands of Egypt and that the total area of crops would be 931749.034 and 319914.983 hectares planted in the old and new lands of Egypt, as well as the expected model, provides a higher net benefit than the current model. The total net profit of the heterogeneous case was 186530.800 and 69395.275 million EP higher than the total of the homogeneous case (166259.954 and 20074.227 million EP) after applying the model as well as the total cost of crops in heterogeneous case 40629.067 and 13102.565 million EP that did not reach the total homogeneous case (34968.102 and 8436.099 million EP). This result may indicate that the difference between the heterogeneous cases had a significant impact on the optimal solution. For this reason, the RRiND model of the heterogeneous character of the land area is applicable to cultivation based on production and managing technical risks after laser land leveling in the old and new lands of Egypt.

A classification of agro-climatic adaptation (per crop) ought to be established within a suitable type to match crops with climate and soil resources and the cost of crop production specified for every soil and geographical region, convenient to evaluate whether yields exceed expenses or now not. According to financial and economic analyzes, the internal annual rate of return (IRR) became better than the current model of the zone and increased by way of 14.98 and 118.32% in the old and new lands of Egypt. The absolute risk of optimal cultivation is decreased by 23.31 and 65.61%. The proposed model provided less greenhouse gasoline emissions than the present model for all agricultural operations. Pollutants cause harm to the ecosystem, structures, and people's health. The social cost per ton of greenhouse gas emissions and air pollution was calculated to obtain data at the optimum use of water in antique and new lands in Egypt. Finally, farmers must level the land by laser because it is the best solution to the Egyptian question, as it is low-cost (261.904 EP) per hectare in Egypt.

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