MIDDLE EAST AND NORTH AFRICA

This project is co-funded by the European Union

RESEARCH PROGRAM ON Policies, Institutions, and Markets Led by IFPRI

REGIONAL PROGRAM POLICY NOTE 19 FEBRUARY 2022

Investing in dates, poultry, olive, and medicinal and aromatic plants value chains in Egypt

Assessing the economy-wide impacts

M. El-Kersh, M. Atef, A. Ali, L. Farghaly, Z. Abderabuh, F. Abdelradi, K. Abdou, E. Abdelaziz, V. Faris, S. Nasr, Y. Nassar, Z. Nassar, M. Raouf, and M. Wiebelt

This policy note summarizes an evaluation of public investment options for Egypt's agri-food system conducted by the International Food Policy Research Institute in collaboration with the Ministry of Agriculture and Land Reclamation of the Government of Egypt and Cairo University. We quantitatively assess the expected economy-wide impacts of investing in four promising agricultural value-chains: dates, poultry, olives, and medicinal and aromatic plants (MAP). As part of the analysis, a range of agriculture-related public investments along the value-chains are considered, including spending to expand farm production and promotion of downstream agri-processing and marketing.

We use two IFPRI structural models. The Rural Investment and Policy Analysis (RIAPA) economywide model is used to capture linkages between economic sectors, households, and rural-urban economies and to measure changes in economic growth, household welfare, and employment within and beyond the agri-food system. RIAPA is linked to the Agricultural Investment Data Analyzer (AIDA), the second model, which tracks investment impacts and costs over time. Inter alia, we find that:

- Investments into each of the four agricultural value chains enhance growth, create additional employment opportunities, improve household welfare, and reduce poverty.
- The MAP and poultry value chains are the most promising value chains with regard to all four evaluation criteria. However, growth generation is largest if investment is concentrated in the MAP value chain, while investment into the poultry value chain has the strongest impacts on job creation and poverty reduction.
- Investments into primary production and processing, besides having a strong direct impact on the value chain growth, generate significant indirect effects inside and outside the agri-food system. These indirect effects are largest for the MAP value chain.

The agri-food system in Egypt

Agriculture's role in Egypt's economy extends beyond the sector itself, with many industrial and service sectors forming parts of the agri-food system. Agriculture and agri-processing together account for 16 and 29 percent of GDP and employment, respectively (Thurlow et al. 2020). These sectors use domestically-produced inputs, such as fertilizer and animal feed, the production of which creates additional value-added and jobs within the agri-food system. An even larger component of the agri-food system is moving agriculture-related products between farmers, processors, and markets. Households also consume food services or meals prepared outside the home, such as at restaurants. In total, the agri-food system accounts for 27 and 38 percent of national GDP and employment, respectively. Thus, a much larger share of the economy and workforce depend on the agri-food system than the sectoral share of agriculture alone would suggest.

The agri-food system consists of a multitude of value chains. In this policy note we focus on four promising agricultural value-chains: dates, poultry, olives, and medicinal and aromatic plants (MAP):

Egypt is the world's largest producer of dates. In 2019, the country produced 1.6 million tons. This made up around 10 percent of total value of fruit production and 1.2 percent of total agriculture production in Egypt. However, despite growth in international demand, Egypt's share of the international date market is low. A major constraint for the date palm sector is marketing problems at national and international levels. However, the most significant constraint is the ineffective linkages within the date value chain between farmers, traders or collectors, and packers or processors. Investments in the value chain seek to build the capacity of these value chain actors, such as by assisting with the planting palm trees; providing extension services for date growers, traders or collectors, and packers or processors; and building cold storage stations.

The poultry industry is one of the largest industries in Egypt (FAO 2020). The volume of investment in the industry in recent years has been more than 90 billion Egyptian pounds. It employs over 3 million workers. The government considers the poultry sector as one of the key pillars for achieving food security and economic development in the country.

Olive cultivation occupies about 13 percent of all agricultural land, and that has increased considerably over the last four decades due to land expansion into the desert (Mofeed 2021). While the olive oil sector has the potential to significantly contribute to increasing Egypt's high value-added agricultural exports and remains socially and economically significant, it also faces several challenges. These include: (i) low yields and high production variability due to inefficient farming practices and adverse local climate conditions, (ii) limited alignment of local product quality with international standards, lack of enforcement of international sanitary and phytosanitary regulation, and limited domestic consumer awareness about international quality standards, and (iii) limited visibility of Egypt's olive products in international markets.

Egypt is a well-known supplier of conventional and organic medicinal and aromatic plants to Europe, USA, and within the region, e.g., to Turkey and the Gulf States (Abdelradi 2019). According to the Chamber of Food Industry, fennel, marjoram, chamomile, peppermint, coriander, and calendula are the main MAPs exported. MAPs are high value export crops – more than 80 percent are exported, generating annual revenues of approximately USD 100 million, which represents about 10 percent of total processed food exports from Egypt. Up to 20 percent of national MAP production is sold domestically, for an estimated annual value of USD 25 million. Over 80 percent of MAP production is

located in Upper Egypt. MAP production is labor intensive, employing around 140,000 or about 2 percent of Egyptian agricultural workers (MDF Training & Consultancy 2011). The MAP value chain is characterized by a scattered and poorly organized upstream base of producers, with better organized and more formally structured downstream processors and exporters. The value chain operates with little vertical integration and almost no horizontal collaboration, despite the presence of MAP producer organizations (North South Consultants Exchange 2015).

Assessing value chain investments

Methodology

The Rural Investment and Policy Analysis (RIAPA) model is a computable general equilibrium (CGE) model that simulates the functioning of a market economy, including markets for products and factors, i.e., land, labor, and capital. RIAPA measures how economic impacts are mediated through changing prices and resource reallocations. The model ensures that resource and macroeconomic constraints are respected, such as when inputs or foreign exchange are limited. RIAPA provides a consistent "simulation laboratory" for quantitatively examining the policy impacts at national, sub-national, and household levels (Thurlow et al. 2018). For our use here, the RIAPA model is used first to establish a baseline scenario for the period 2015 to 2030 using projected GDP growth rates from the Economic Outlook (January 2020) of the International Monetary Fund combined with observed patterns of demographic change and economic growth in Egypt since 2012.

The Agricultural Investment and Data Analysis (AIDA) model is an accounting system that estimates how public spending affects productivity levels in different sectors of the economy. AIDA converts annual expenditures into a stream of investment outcomes using information on unit costs, maintenance needs, and depreciations rates. Investment outcomes are linked to productivity levels using estimated elasticities or impact coefficients. For example, investments in irrigation infrastructure are converted into irrigated land area based on the average cost of irrigating one feddan of land. The productivity gains from new irrigation investments are then calculated based on the estimated yield gains from using the newly irrigated land. AIDA tracks the share of farmers with and without new irrigation infrastructure and calculates a weighted average annual productivity level for each crop (Raouf et al. 2018). A similar approach is used in assessing how public spending affects productivity levels in other sectors and sub-sectors of the economy.

Using IFPRI's RIAPA model, we quantitatively assess the expected economy-wide impacts of investing in a range of agriculture-related public investments along the four value-chains considered. These investments are increased spending to expand farm production and promoting increased downstream agri-processing and marketing. We use information on past impacts and costs and on future spending projections, combining this information with data from a range of sources, including surveys and monitoring and evaluation studies, to estimate the direct impacts of these investments (see "Methodology" text box).

To compare the expected impacts of investing in various value chains, we constructed stylized investment packages assuming identical investment volumes of USD 40 million for primary production, USD 7.5 million for processing, and USD 2.5 million for marketing for each of the

individual agricultural value chains over the period 2020 to 2026. We also employ identical changes in total factor productivity of 15, 10, and 5 percent for the three segments of value chains, respectively, but use different coverage rates. These stylized scenarios highlight the strength of linkages within commodity and factor markets, the importance of the tradability of the commodities, and factor intensities in primary and secondary production. In addition, we have constructed a combined investment scenario in which a total of $200 million ($160 million in primary production, $30 million in agri-processing and $10 million in marketing) is invested for the benefit of all four value chains. This scenario highlights the impact of resource competition for factors of production on investment outcomes.

Comparing the economic impact of investments in the four value chains

Table 1 reports the agri-food system economic growth effects of investing in the four individual agricultural value-chains as well as their combined growth effects. Investment in the agricultural value chains expands agricultural (AGR+) and agri-processing (PRC+) output. The combined investment of USD 200 million into the four value chains rises agricultural GDP by USD 469 million over the period 2020 to 2026 relative to the baseline, while processing GDP rises by USD 55 million.

Table 1. GDP gains from agricultural value-chains investments, 2020 to 2026, USD millions

	Combined	Dates	Poultry	Olives	Medicinal & aromatic plants
Total economy GDP (TOT+)	713	138	357	57	535
Agri-food system GDP (AFS+)	793	159	485	64	602
Combined agricultural & agri-processing GDP (DIR+)	524	116	287	49	313
Agricultural sector GDP (AGR+)	469	104	288	35	173
Agri-processing GDP (PRC+)	55	12	-1	14	140
Off-farm downstream processing GDP (OFF+)	324	55	197	29	428
Investment costs (COST)	200	50	50	50	50
Benefit-to-cost ratio, combined agricultural & agri-processing (BCR)	2.6	2.3	5.7	1.0	6.3

Source: Egypt RIAPA-AIDA model.

The direct impact of combined investment in all four agricultural value chains on agriculture and agri-processing (DIR+) is smaller than the summed up impact of individual investments (USD million 524 < USD million 765), because of resource and market competition. For the same reason, the growth effects in the agri-food system (AFS+) exceed the economy-wide growth effects (TOT+), both for investments in individual agricultural value chains, e.g., dates (USD million 159 > USD million 138),

and for their combined impact (USD million 793 > USD million 713), because sectors outside the agri-food system decline slightly as more workers engage in agricultural value chains.

The direct impact on agricultural growth is largest in the poultry value chain (USD million 288) followed by the MAP value chain (USD million 173), while agricultural transformation, i.e., the shift from agriculture towards downstream processing (OFF+), is strongest in the MAP value chain (USD million 428 > USD million 173). There are GDP losses in poultry processing (USD million 1) which result from a restructuring of poultry processing towards primary poultry production.

Investing simultaneously into all four value chains would increase employment by more than 17,000 jobs (Table 2), with most of the jobs created by investment into primary production and marketing. Investments into processing activities lower employment relative to the baseline over the period 2020 to 2026. As is the case for GDP growth, the impact on employment of the combined investments into all four value chains is smaller than the sum of the individual value chain investments. This is because the four value chains compete for labor, thereby increasing real producer wages and lowering labor demand overall.

Job creation is largest for investment in the poultry value chain. With poultry generally being non-tradable, any investment that raises total factor productivity in poultry production will lead to lower prices, higher real producer wages, and, finally, a reduction in labor demand in the poultry sector with lower economy-wide wages for all types of labor. This will benefit other labor-intensive agricultural, manufacturing, and services sectors.

Table 2. Job creation by value chain segment and labor category, 2021 to 2026, thousands of workers

Value chain	Value chain segment	Labor category				Total for value chain
		No formal education	Primary education	Secondary education	Tertiary education	
	Base year 2015	8,801	4,243	8,333	5,430	26,807
Combined	Production	976	2,670	5,710	3,877	
	Processing	45	-85	-183	-90	17,139
	Marketing	313	851	1,820	1,235	
Dates	Production	815	499	944	630	
	Processing	55	11	13	13	3,896
	Marketing	259	158	300	200	
Poultry	Production	1,349	3,241	5,129	3,328	
	Processing	-54	-66	-126	-72	16,998
	Marketing	470	1,052	1,669	1,079	
Olives	Production	276	211	440	291	
	Processing	-70	-89	-173	-95	1,180
	Marketing	89	67	140	93	
Medicinal & aromatic plants	Production	-4,018	484	2,884	2,134	
	Processing	1,850	372	423	416	5,024
	Marketing	-1,282	155	923	682	

Source: Egypt RIAPA-AIDA model.

In contrast, job creation is lowest for investments in the olives value chain. The fats and oils market in Egypt is characterized by high import dependence in primary production, including of olives, and a strong export orientation for processed oils and fats, on the one hand, and a high share of intermediate demand for olives – about 95 percent of domestic olive production is processed – and a high share of household demand for fats and oils. Together, these structural characteristics imply that total factor productivity changes resulting from investments in the olives value chain will have no significant impact on the domestic olive prices and on wages of workers in the olives sector, leaving employment almost unaffected.

The impact on household welfare and poverty, as measured by real consumption spending, depends on various factors, including whether households engage in the value chain as a primary activity and earn higher farm revenues; whether poorer workers are employed in downstream processing and upward input production and trading and earn higher wages; or whether poorer households consume the primary or final product at lower prices: The more that an increase in production comes about as a result of productivity-driven growth in a sub-sector and the less tradable is the sector, the greater the reduction in the price for the specific agricultural good. Consequently, the more a certain household consumes that commodity or a related processed item that benefits from the lower input price, the higher the positive impact on the household's welfare.

Table 3 reports the per capita welfare gains of the four agricultural value chain investments at national level and for different household types. If the total available investment sum of USD million 200 is invested into all four value chains, this will increase by USD 4.90 the value of consumption in 2026 for each of the then 106 million Egyptians. The per-capita change of spending USD 50 million in each of the four agricultural value chains ranges from USD 0.50 for olives to USD 3.00 for MAP.

Table 3. Annual welfare gains in 2026, by value chain and household type, USD per capita

	Households				
Value chains	**All**	**Rural**	**Urban**	**Poor**	**Non-poor**
Combined	4.9	2.0	8.6	2.7	6.4
Dates	1.0	0.6	1.5	0.5	1.3
Poultry	2.9	0.6	5.9	3.4	2.6
Olives	0.5	0.4	0.6	0.3	0.6
Medicinal & aromatic plants	3.0	0.5	6.2	1.1	4.4

Source: Egypt RIAPA-AIDA model.

Welfare gains are generally larger for urban and non-poor households than for rural and poor households in almost all value chains. The exception is poultry, the expansion of which increases poor households' per-capita consumption by more than those of non-poor households. Almost two third of the welfare gains generated by investments into the four agricultural value chains go to urban households, largely via lower prices for weakly tradable farm products. In addition, urban households earn some of the rental incomes from farming, but not vice versa.

Conclusion

Egypt will continue to rely heavily on the agricultural sector to ensure employment for the rural poor and food security for its growing population and to meet the development challenges brought on by climate change and spikes in global food prices. Improving efficiencies in agricultural value chains is central to addressing these challenges. Increasing productivity in agricultural value chains is also critical to reducing poverty. Greater productivity can boost farmers' income, especially for smallholder farmers, who have limited resources to leverage in producing and marketing their crops and livestock. Yet, creating more efficient agricultural value chains also requires engaging many stakeholders – from farmers growing crops and raising livestock to input suppliers to processors and to distributors. In this context, investing in digital extension services is essential to the current government agricultural plan, to provide the farmers with timely and accurate knowledge, helping them to adapt to climate change conditions. In this regard, the government has developed several digital applications for providing extension services to Egyptian farmers, such as "ازرع صح" "Cultivate Well" and "Hodhod".

This policy note compares the impact on economic output, employment, and household welfare of similar levels of investments in four promising agricultural value chains: dates, poultry, olives, and medicinal and aromatic plants. Our results suggest that investments into all four enhance growth, create additional employment opportunities, and improve household welfare and reduce poverty. Moreover, investing into agricultural value chains helps transform Egypt's agri-food system: Almost one half of the GDP gains from the investments in these value chains happens in off-farm sectors – in the MAP value chain, off-farm gains even exceed direct gains from investments in primary production and processing. Generally most of these off-farm gains are in trading sectors. Comparing across the four value chains, investments into the MAP value chain are most effective at achieving growth, while investments in the poultry value chain contribute most to jobs generation and poverty reduction.

The production of MAPs would not be limited to existing areas but could be expanded in the new cultivated lands as well, such as in Noubareya, in Northern Egypt, to benefit from its proximity to export markets, hence reducing transportation and transaction costs. The Noubareya area is also near to the industrial zone, Borg El Arab, that is characterized by its highly developed infrastructure facilities, hence, providing a potential for MAPs processing, and consequently generating higher value- added activities. Agricultural policies should also aim to tackle the challenge that is related to the expected large increase in the supply of dates, via targeting new export markets and/ or investing in dates processing activities. Developing new production techniques for poultry, by implementing closed or semi-closed systems of production instead of open systems may help to stabilize the production rate of 'day old chick' and reduce its mortality rates. However, this would require huge amount of investments. Supporting private centers for poultry slaughtering to avoid the trading of live poultry, to ensure better food safety across the whole country and permanent access to markets abroad is another policy option for the poultry value chain.

Finally, the government is also interested in the "clean farming/ clean horticulture", with a special focus on investing more in the organic vegetables/crops.

REFERENCES

Abdelradi, F. 2019. "The technical efficiency of organic herbs: The case of Egypt." In A.M. Negm and N. Shareef, eds. *Waste Management In MENA Regions*. 111-128. Cham, Switzerland: Springer.

FAO (Food and Agriculture Organization of the United Nations). 2020. *The long-term future of livestock and fishery in Egypt – Production targets in the face of uncertainty*. Rome: FAO.

MDF Training & Consultancy. 2011. *Value Chain Mapping Report: Upgrading Egyptian Medicinal and Aromatic Plants Value Chain Access to Export Markets*. Report for the United Nations Industrial Development Organization (UNIDO). Ede, The Netherlands: MDF Training & Consultancy.

Mofeed, A.S. 2021. "Olives in Egypt. Current status and future strategy." *Olivae*, 127: 9-10.

North South Consultants Exchange. 2015. *Gender sensitive value chain analysis for medicinal and aromatic plants in Fayoum*. http://www.fao.org/fileadmin/user_upload/rne/docs/GSVCA_Final_Report.pdf

Raouf, M., Y. Kassim, S. Kurdi, T. Mogues, M. Mahmoud, J. Randriamamonjy, J. Thurlow, M. Wiebelt, and C. Breisinger. 2018. *The (Arab) Agricultural Investment for Development Analyzer (AIDA): An innovative tool for evidence-based planning*. IFPRI MENA Regional Program Working Paper 06. Washington, D.C. and Cairo, Egypt: International Food Policy Research Institute (IFPRI).

Thurlow, J. B. Holtemeyer, Y. Kassim, S. Kurdi, J. Randriamamonjy, M. Raouf, D. Elsabbagh, M. Wiebelt, and C. Breisinger. 2020. *Investing in the agri-food system for post-COVID-19 recovery: An economywide evaluation of public investments in Egypt*. MENA Regional Program Policy Note 07. Washington, DC: International Food Policy Research Institute (IFPRI). https://doi.org/10.2499/p15738coll2.133773.

ABOUT THE AUTHORS (Note Heading, bold 12pt, all caps)

Mohamed El-Kersh, **Mohamed Atef**, **Alaa Ali**, **Lobna Farghaly**, and **Zainab Abderabuh** are members of the economic analysis team from the Ministry of Agriculture and Land Reclamation of the Government of Egypt. **Fadi Abdelradi**, **Khaled Abdou**, **Ehab Abdelaziz**, **Victor Faris**, **Saleh Nasr, Yasmin Nassar**, and **Zaki Nassar** are members of the research team from Cairo University. **Mariam Raouf** is a Senior Research Associate with IFPRI's Egypt Strategy Support Program, based in Cairo. **Manfred Wiebelt** is a Research Fellow and Professor of Economics emeritus at the Kiel Institute for the World Economy, Kiel, Germany.

ACKNOWLEDGMENTS

The contents of this publication are the sole responsibility of the authors and do not necessarily reflect the views of the European Union. This publication was produced with the financial support of the European Union and CGIAR Research Program on Policies, Institutions, and Markets (PIM), under the "Building a Post-COVID-19 Recovery and Ag-Foresight Team in Egypt".

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
1201 Eye St, NW | Washington, DC 20005 USA
T. +1-202-862-5600 | F. +1-202-862-5606
Email: ifpri@cgiar.org | www.ifpri.org | www.ifpri.info

IFPRI-EGYPT
2 Port Said, Maadi as Sarayat Al Gharbeyah, Maadi, Cairo, Egypt
T: +20(0)22577612
http://egyptssp.ifpri.info

The Middle East and North Africa Regional Program is managed by the Egypt Strategy Support Program of the International Food Policy Research Institute (IFPRI). The research presented here was conducted as part of the CGIAR Research Program on Policies, Institutions, and Markets (PIM), which is led by IFPRI. This publication has been prepared as an output of the Egypt Strategy Support Program. It has not been independently peer reviewed. Any opinions expressed here belong to the author(s) and do not necessarily reflect those of IFPRI, PIM, or CGIAR.