Prioritizing Agricultural Value Chains for Reviving the Food System in Yemen

Input for an Agricultural Strategy Update

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Overview of the economic impact of the conflict in Yemen

In addition to the unprecedented humanitarian crisis and the creation of space for militant groups, the conflict in Yemen is also taking a heavy toll on the economy. According to estimates from the International Monetary Fund (IMF 2018) together with information on physical damages from the World Bank-led Yemen Dynamic Damage and Needs Assessment (World Bank et al. 2018), the accumulated impact of the conflict from 2015 to 2018 is estimated to be USD47 billion (in 2014 prices), nearly one and a half times total GDP in 2014 (Figure 1).

Figure 1: Yemeni economy: Actual and counterfactual GDP and cumulative GDP losses, 2010 to 2018

Source : Breisinger et al. 2019a.

The poverty headcount for Yemen is estimated to have increased from 49 percent in 2014 to 77 percent in 2018 (Figure 2). The results of economic recovery scenarios run within a recursive dynamic computable general equilibrium (DCGE) model of the Yemeni economy suggest that unless significant support is provided by the international community for reconstruction, poverty in

coming years, even if the conflict ends, will remain high or increase even further. Poverty outcomes of alternative post-conflict transition options range between a national poverty rate of 84 percent in the worst-case scenario of economic stagnation and 50 percent in the best-case scenario that involves the recovery of physical capital, total factor productivity (TFP) growth increases in all sectors, and significant inflows of foreign aid. Under a recovery scenario with lower foreign aid, the poverty headcount is projected to fall, but only modestly. Only under a recovery scenario with high aid inflows are poverty levels projected to be below pre-conflict levels by 2025.

Figure 2: Yemen: Impact on poverty to 2025 of alternative post-conflict reconstruction scenarios

Source: Breisinger et al. 2019a.

The agricultural sector has also suffered due to the conflict resulting a reduction in output. This has been driven by sharp reductions in returns on land, reflecting a situation in which the lack of inputs, such as water, adversely influences production. However, agriculture has been the most resilient economic sector with the lowest rate of contraction throughout the conflict. As such, agriculture and the agri-food system is playing an important role in the Yemeni economy and for the welfare of Yemen's citizens during the conflict. The agricultural sector is expected to play a leading role during post-conflict recovery and reconstruction.

The Role of Agriculture and the Agri-Food System in Yemen

The agri-food system can be divided into direct production, input production, and trade and services components. Direct production includes primary production of agricultural products as well as agro-processed goods, e.g., wheat and grain milling. The input production category includes all goods and services that are used as intermediate inputs for the production of primary agricultural products and for agroprocessing. These include, for example, fertilizer and seed for agriculture and energy and packaging materials for agro-processing. Trade and transport includes all services that are related to trading, transporting, and marketing of agricultural productions and agro-processed goods (Breisinger et al, 2019b).

Figure 3: Yemen's agri-food system, by share of total output and employment

Source: IFPRI AIDA model, pre-conflict base

Table 1: Yemen's agriculture GDP, by sub-sector, 2014

Agricultural sub-sector	Agriculture GDP share (%)	GDP per worker (USD)
Agriculture	100.0	244
Cereals	6.4	9,049
Root crops	4.9	9,757
Coffee	2.5	17,858
Wheat	0.8	8,988
Pulses	0.0	10,214
Oilseeds	0.6	9,543
Potatoes	4.9	9,757
Vegetables	15.3	10,023
Qat	8.8	51,786
Cotton	0.0	7,555
Fruits, nuts	8.9	39,863
Cattle, milk	7.4	74
Poultry, eggs	7.3	32
Small ruminants	7.6	98
Forestry	0.4	5,557
Fishing	8.5	4,883
Other crops	15.7	20,777

The agri-food system makes up more than one quarter of Yemen's pre-conflict output and about one third of the jobs (Figure 3). Agricultural production alone accounted for 14 percent of output and 22 percent of jobs. Agro-processing accounts for 7.0 percent of GDP, but only 2.3 percent of employment, indicating the relatively high capital intensity and low labor intensity of the sector. By contrast, input production, trade and transport, and food services contribute relatively more to employment than to GDP. Within agriculture, vegetables, fruits, qat, and fishing are the largest sub-sectors in terms of their contribution to output. Qat, fruits, and coffee produce the highest value added per worker (Table 1).

In addition to the structure of agricultural production and the agri-food system, differences in household food consumption patterns also matter for value chain prioritization. Total annual average estimated household expenditure pre-conflict is USD 1,025 per capita. Rural households' per capita expenditure is lower at USD 839 compared to USD 1,468 for urban households. Rural households spend 66.7 percent of total expenditures on food compared to 57.6 percent for urban households. Within food categories, spending on vegetables; milk and dairy; and meat, fish, and eggs make up relatively large shares of households' spending. For rural poor households, spending on food accounts for almost three quarters of household expenditure, whereas about a quarter of food spending goes to vegetables, followed by cereals and milk and dairy with around 15 percent each (IFPRI AIDA model).

Prioritizing Agricultural Value Chains for Reconstructing and Development in Yemen

In order to quantify how the development of different agricultural value chains in Yemen can contribute to economic growth, employment, poverty reduction, and nutrition, we use the Agriculture

Investment for Development Analyzer (AIDA) for Yemen. This model captures key transmission channels that determine the economy-wide impacts of promoting various agricultural value chains as an important part of reconstruction. These channels include forward and backward economic linkages, price responses, and net employment effects. As such, the model provides forward-looking estimates of expected economy-wide impacts of interventions in Yemen's agri-food system; captures the role of agri-food in the Yemeni economy; and shows trade-offs between different development goals (for more details, see Appendix 1).

Table 2 provides a ranking as to which agricultural value-chains, if scaled-up, are most effective at reducing poverty (poverty bias), nutrition (nutrition bias), economic growth (growth bias), and employment (employment bias). The results in the second column of Table 2 are an aggregate assessment based on giving the results for all of the four dimensions for each value chain the same weight.

Table 2: Ranking of agricultural value chains by their contribution to different dimensions of economic and human development in Yemen

Rank	Equal weight aggregate assessment	Poverty bias	Nutrition bias	Growth bias	Employment bias
1	Fruits, nuts	Cattle, milk	Fruits, nuts	Cattle, milk	Coffee
2	Poultry, eggs	Poultry, eggs	Coffee	Poultry, eggs	Fruits, nuts
3	Coffee	Fruits, nuts	Poultry, eggs	Coffee	Fishing
4	Cattle, milk	Cereals	Cattle, milk	Fishing	Small ruminants
5	Fishing	Coffee	Cereals	Fruits, nuts	Cereals
6	Cereals	Fishing	Fishing	Cereals	Poultry, eggs
7	Small ruminants	Small ruminants	Small ruminants	Small ruminants	Vegetables
8	Vegetables	Root crops	Vegetables	Vegetables	Root crops
9	Root crops	Vegetables	Root crops	Root crops	Cattle, milk

Source: IFPRI AIDA CGE model results

As expected, the rankings of the agricultural value chains differ depending on what the main development targets are.

- If reducing poverty is the main development objective, then strengthening livestock (cattle and milk; poultry and eggs) and fruits and nuts should be the value chains given highest priority.
- If the main objective is to improve nutrition, then coffee, fruits and nuts, and poultry and eggs should be considered. The high rank of coffee for improving nutrition can mainly be explained its strong positive growth and employment effect, which in turn increases household incomes and allows households to diversify their diets for improved nutrition.
- If economic growth is the primary goal, then cattle and milk, poultry and eggs, and coffee should be given the highest priority.
- Whereas if employment is the top goal, efforts to strengthen the value chains for coffee, fruits and nuts, and fishing should be given precedence.

Given the specific situation of Yemen where progress across all development dimensions is urgently needed, we also consider an equal ranking for poverty, nutrition, economic growth, and employment outcomes. Given an equal priority for all four of these development outcomes, the value chains that are expected to have the most positive impact across all four dimensions are fruits and nuts; poultry and eggs; coffee; cattle and milk; and fishing.

Figure 4: Venn diagram of contribution to different economic and human development outcomes of top six priority agricultural value chains for Yemen

Source: IFPRI AIDA CGE model results

In order to synthesize these findings and also to visualize the key links between the development outcomes, we illustrate the top value chains in terms of their poverty, economic growth, nutrition, and employment impacts using a Venn diagram (Figure 4). The value chains for cattle and milk and for poultry and eggs have strong positive impacts on economic growth, rural poverty reduction, and nutrition. Fishing provides a combined positive impact on economic growth and employment. Cereals contribute to reducing poverty. Fruits and nuts are effective for reducing poverty, improving nutrition, and fostering employment. The coffee value chain ranks well for improving nutrition, contributing to economic growth, and expanding employment opportunities.

Appendix. AIDA model for Yemen

The effectiveness of agricultural value chains in generating additional growth and employment opportunities and in reducing poverty and improving nutrition is analyzed using an economy-wide regionalized dynamic computable general equilibrium model, the Agriculture Investment for Development Analyzer (AIDA) that has been developed by IFPRI in collaboration and with support from the International Fund for Agricultural Development (IFAD) and the CGIAR Research Program on Policies, Institutions, and Markets (PIM). This class of economy-wide models simulates the workings of a market-based open economy in which supply and demand of commodities and factors are determined by market-clearing flexible prices, subject to resource constraints and macroeconomic consistency (see Diao and Thurlow 2012 for a description and mathematical specification of the model together with data requirements and calibration procedure). The flow diagram in Figure A1 provides a stylized picture of the circular flow of goods and factors as well as financial transactions between economic agents – producers and consumers in different regions, government, and rest of the world – acting in national and international product markets and regional factor markets.

Figure A1: Flowchart of the Agriculture Investment for Development Analyzer (AIDA) model

Source: Own illustration.

The model is based on a detailed, pre-conflict (2014) social accounting matrix (SAM) constructed in collaboration with the Yemeni Central Statistical Organization (Raouf et al. 2019). We design several scenarios in order to determine which agricultural value-chains, if scaled-up, are most effective at: accelerating agricultural and national economic growth; raising farmers' incomes and reducing poverty; creating jobs on and off the farm; and improving nutrition by diversifying diets. We use the AIDA model to simulate the effects of expanding farm production within existing agricultural value-chains. Total factor productivity (TFP) growth in each group of agricultural products is accelerated beyond baseline growth rates, such that, in each value-chain scenario, total agricultural GDP or regional agricultural GDP is one percent higher in 2025 than it is in the baseline scenario.

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IFPRI looks forward to receiving feedback and comments on this policy note from those interested in economic studies, especially studies that may contribute to improving and building upon this body of work.

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