



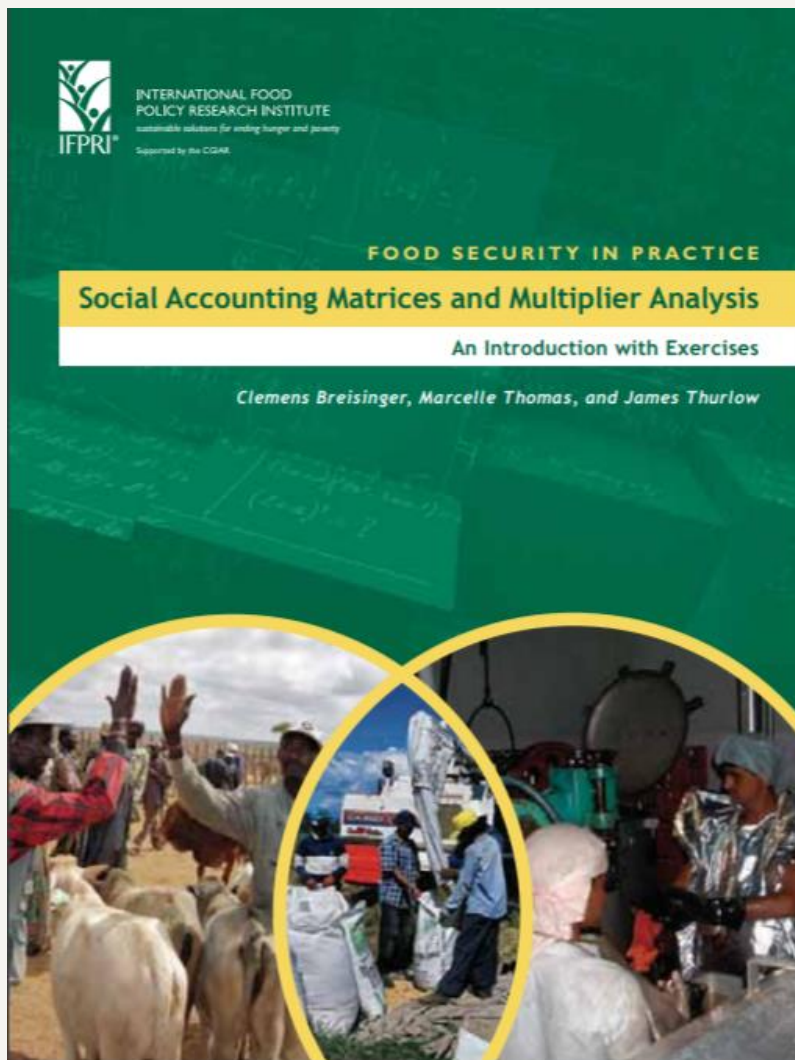
# **IFPRI's experience and innovations in CGE modeling with the example of the AIDA project**

Workshop on Impact Analysis Toolkit  
Organized by UN-ESCWA, May 8, 2018

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With inputs from James Thurlow, Yumna Kassim, Sikandra Kurdi, Tewodaj Mogues, Mai Mahmoud, Askar Mukashov, Josee Randriamamonjy, Mariam Raouf, and Manfred Wiebelt

# From SAM construction to static and dynamic CGEs

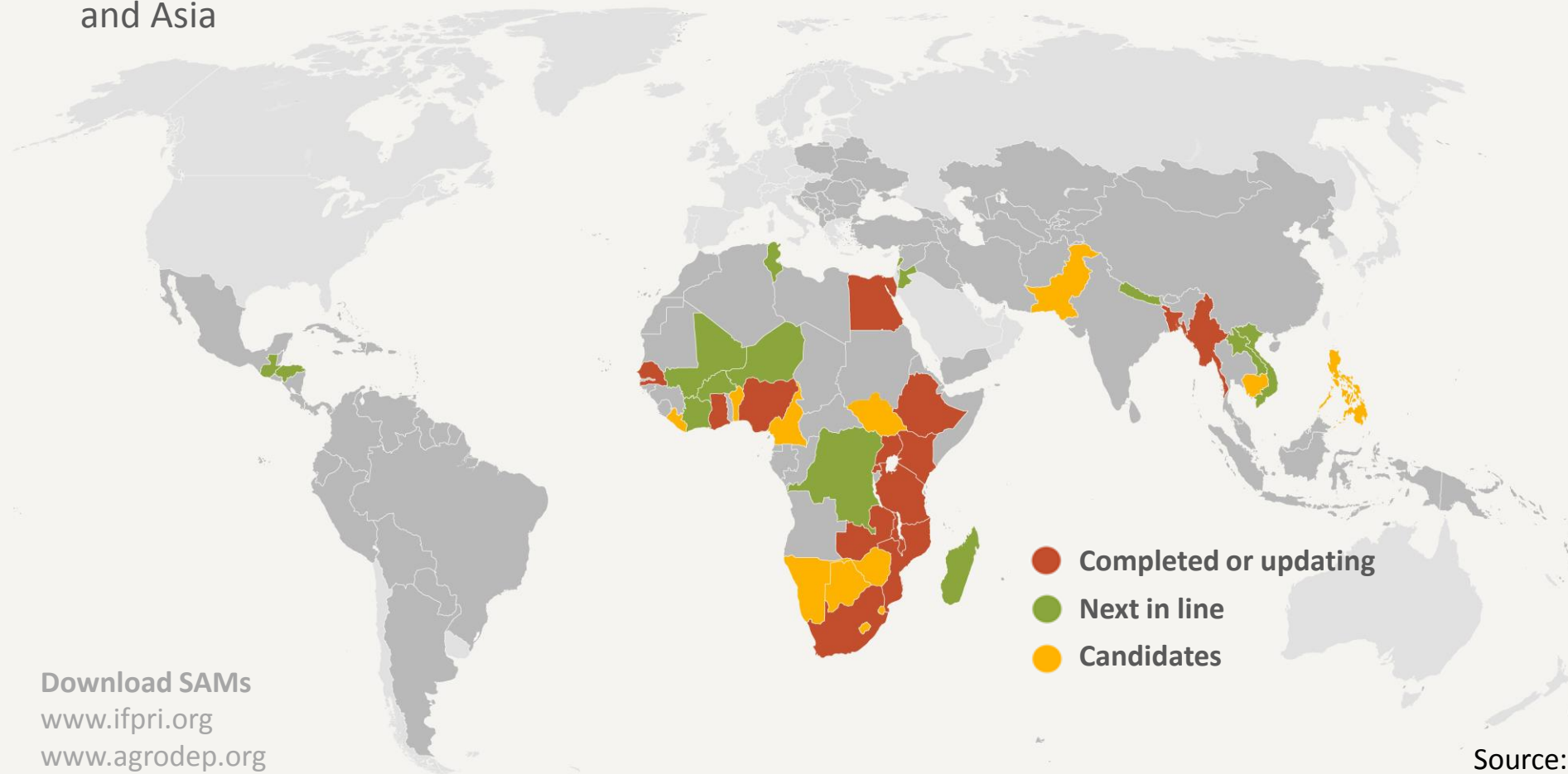


# From diverse to standardized SAMs



## Establishing common data standards

- Transitioning IFPRI SAMs to Nexus framework
- Focus on late-transforming countries in Africa, MENA and Asia



Source: Thurlow, 2018

# From aggregated to very detailed SAMs



## Agricultural Sectors & Products

**35** Maize | Sorghum + millet | Rice | Wheat + barley | Other cereals | Pulses | Groundnuts | Other oilseeds | Cassava | Irish potatoes | Sweet potatoes | Other roots | Leafy vegetables | Other vegetables | Sugarcane | Tobacco | Cotton + fibers | Nuts | Bananas + plantains | Other fruits | Tea | Coffee | Cocoa | Cut flowers | Rubber | Other crops | Cattle | Raw milk | Poultry | Eggs | Sheep + goats | Other livestock | Forestry | Aquaculture | Capture fisheries

## Industrial Sectors & Products

**39** Coal | Crude oil | Natural gas | Other mining | Meat | Fish + seafood | Dairy | Fruits + vegetables | Fats + oils | Maize milling | Sorghum + millet milling | Rice milling | Wheat + barley milling | Other grain milling | Sugar refining | Coffee processing | Tea processing | Other foods | Animal feed | Beverages | Tobacco | Cotton yarn | Textiles | Clothing | Leather + footwear | Wood | Paper | Petroleum | Chemicals | Non-metal minerals | Metals + metal products | Machinery | Equipment | Vehicles | Other manufacturing | Electricity + gas | Water supply + sewage | Construction

## Service Sectors & Products

**12** Wholesale + retail trade | Transportation + storage | Accommodation | Food services | Information + communication | Finance + insurance | Real estate activities | Business services | Public administration | Education | Health + social work | Other services

## Factors of Production

**13** Crop land | Crop, livestock, mining and nonagricultural capital | Rural and urban labor by education category

## Household groups

**15** Rural farm and nonfarm households and urban households by national per capita expenditure quintiles

# Example: Focus on Agri-Food Systems in Nexus SAMs

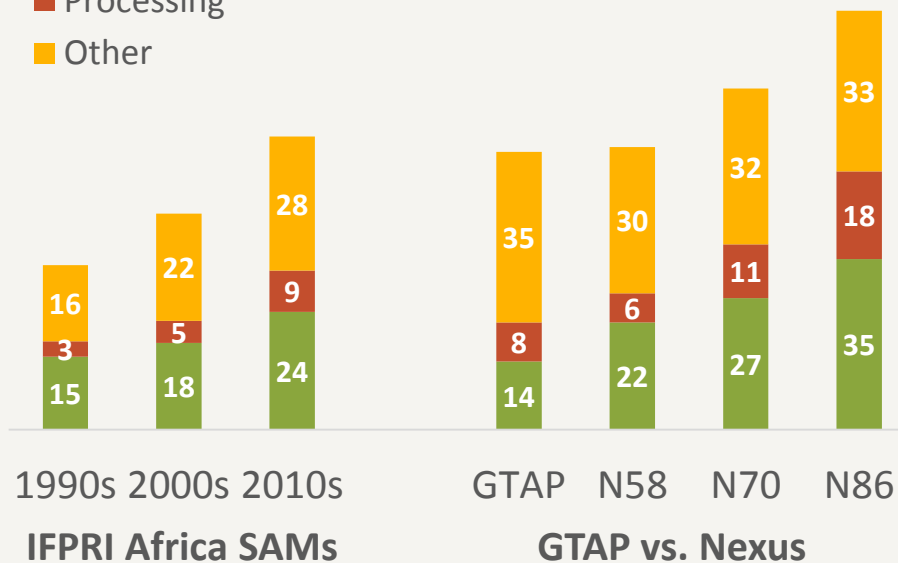


## Detailed agricultural processing

- Important for tracking agricultural transformation and dietary change

### Average number of SAM sectors

■ Agriculture  
■ Processing  
■ Other



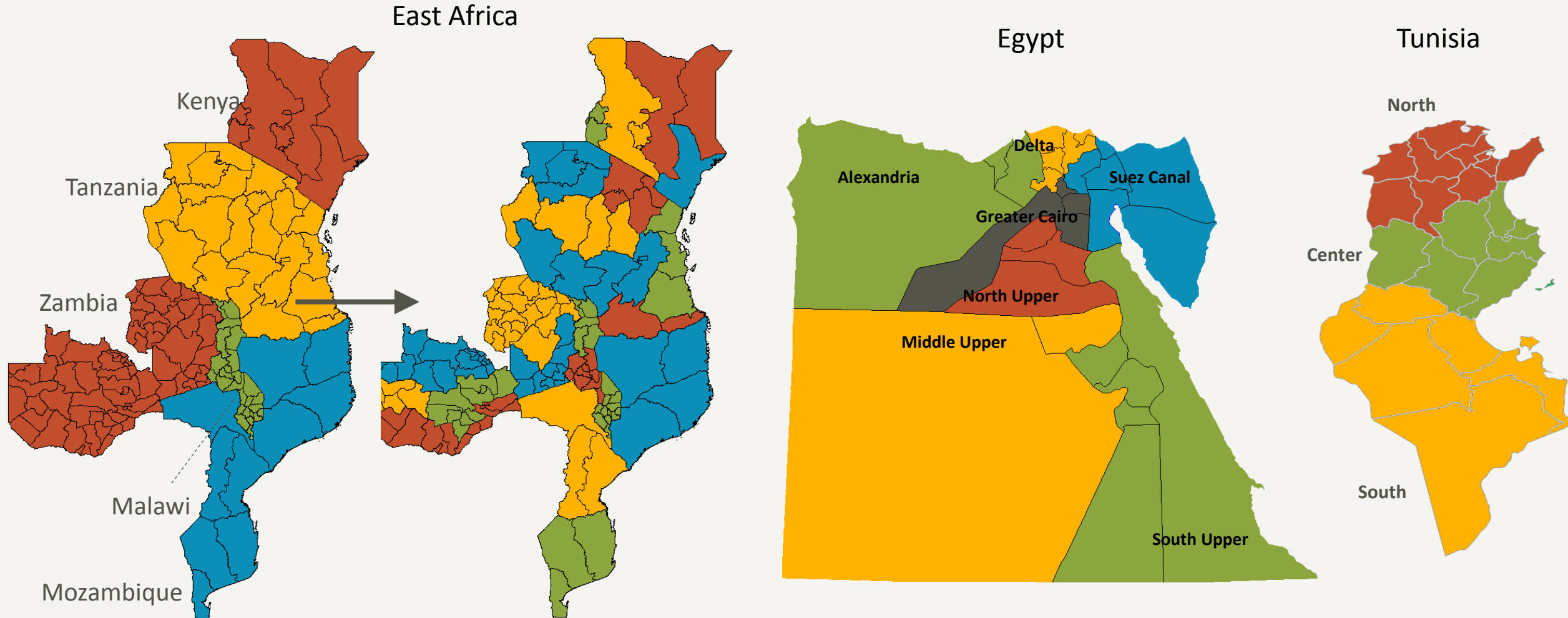
## Measuring Agri-Food Systems

■ Meals outside the home  
■ Trade & Transport  
■ Input production  
■ Processing  
■ Agriculture



# From national to sub-national SAMs

Disaggregate: Sectoral production | Factor markets | Household groups





# From GAMS only to Excel-Based Interfaces

- **CGE models increasingly use Excel Interface**

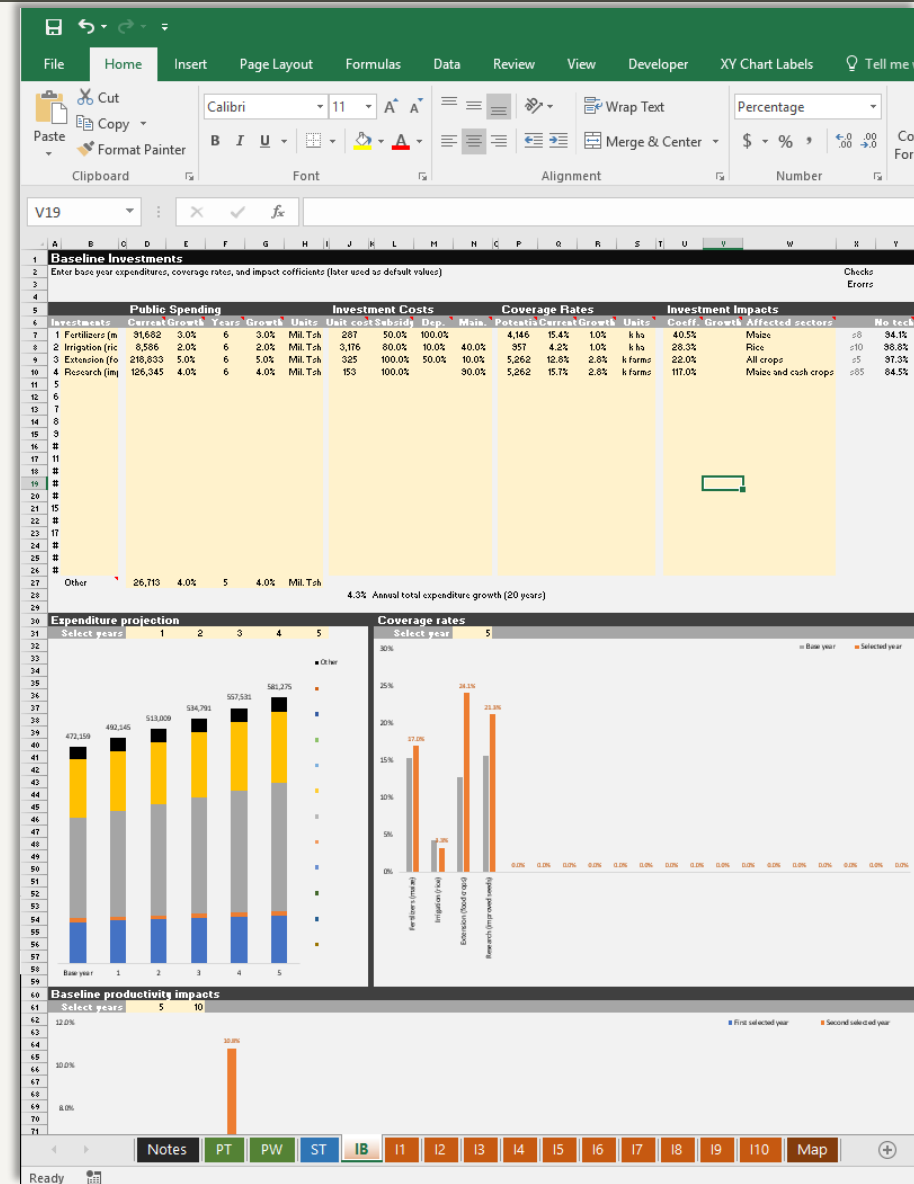
- Scenarios designed in Excel
- Results viewed in Excel

- **Advantages:**

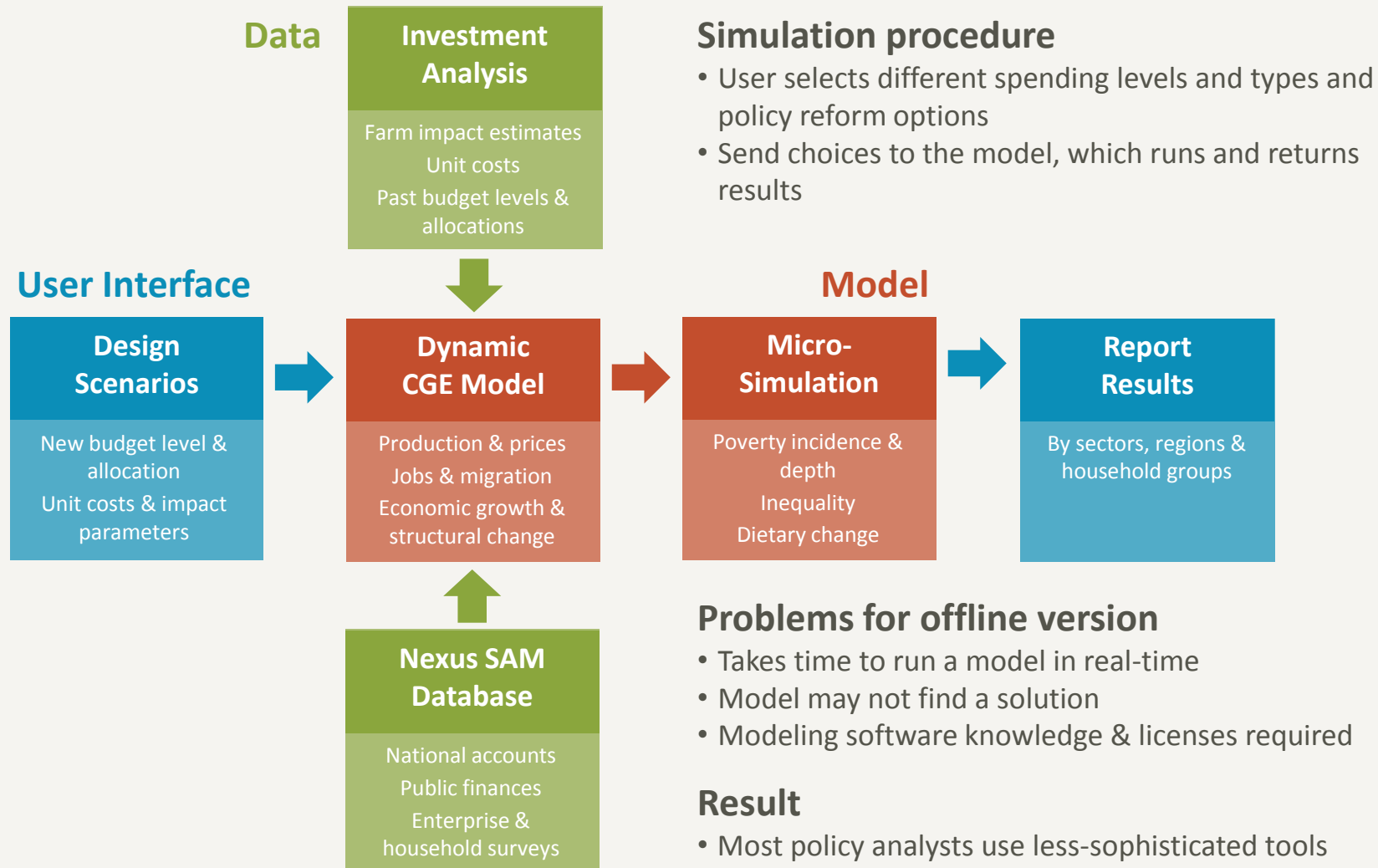
- Makes modeling easier to do
- Keeps user focused on investment choices rather than complex modeling
- Reduces cost for modeling analysis
- Ministries can avoid having expensive dedicated modeling units

- **Online AIDA is even easier!**

- But fewer policy options available



# Excel-based Modeling Framework





# Examples of how CGE-based results help governments in decision making



- IFPRI's CGE models are used to assist countries' to evaluate and prioritize their agricultural investments and policies as part of the African Union's Comprehensive African Agricultural Development Program (CAADP).
  - In **Malawi, Uganda, Ghana and Rwanda** modelling analysis was used to facilitate a **debate between Ministries of Agriculture and Finance** and international donors on the role of agriculture in the country's national development plan.
  - IFPRI's models was explicitly cited by the government when choosing to revoke **Tanzania's recent maize export ban**.
  - IFPRI's economywide evaluation of **Malawi's input subsidy** program formed part of a IFPRI-facilitated dialogue on subsidy
- IFPRI's CGE models are routinely used in a number of government policy units to design national development strategies, including identifying the contribution of agriculture to broader development processes.
  - In **Ethiopia**, IFPRI worked with government-appointed policy analysts to provide the **macroeconomic framework to the Second Growth and Transformation Plan**, which included setting targets and investment priorities for the agricultural sector.
  - In **South Africa**, IFPRI's models are used on a regular basis to evaluate **energy investment strategies, water resource management, climate change risks, and policies to reduce poverty and unemployment**.
  - In **Yemen**, IFPRI's CGE model and its findings on trade-offs and cost/benefits across various food security sectors and investments was the basis for the formulation of Yemen's **National Food Security Strategy**.
  - In **Egypt**, IFPRI worked with CAPMAS, MOPMAR and the World Bank to analyse the **impacts energy subsidy reforms**
- IFPRI's CGE economywide models and analysis are routinely used by international development organizations to support their policy dialogue with national governments. Two current examples illustrate this trend.
  - **World Bank** is using model-based analysis to encourage governments in Africa and Asia to consider rural-urban linkages
  - **FAO** is expanding its CGE modeling capabilities, with IFPRI support, to inform their policy engagement
  - **IFAD** is working with IFPRI to inform country strategic plans and support countries in investment prioritization (RIAPA-AIDA)

# From offline to online CGE modeling: the case of AIDA and agricultural investment analysis



- **AIDA Arab Investment for Development Analyzer (AIDA)** is an evidence-based tool for prioritizing agricultural policies and investments. It can assess “packages” of interventions and captures the whole of agriculture-food system and national economy

**The project has 3 components:**

**1. Component 1: Prioritizing Rural Investments and Policies**

- ✓ Overview and Rationale
- ✓ Investment and Policy
- ✓ Economy-wide analysis

**2. Component 2: Advocacy and Policy Engagement**

**3. Component 3: Community of Practice**



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# **AIDA: Policy and Investment Analysis From “offline” to online CGE models**

Additional support from IFAD “Rural Investment and Policy Analysis (RIAPA) Model”; CGIAR Research Program on “Policies, Institutions and Markets” (PIM); BMGF Project “Prioritizing Policies for Driving Inclusive Agricultural Transformation”

# Policy Challenge



- **Designing agricultural policies and investment plans is challenging**
  - Allocate scarce resources across both interventions and locations
  - Consider both investments and policy reforms
  - Track downstream spillovers and trade-offs (i.e., systems approach)
  - Link agricultural spending to growth, job creation, and household poverty



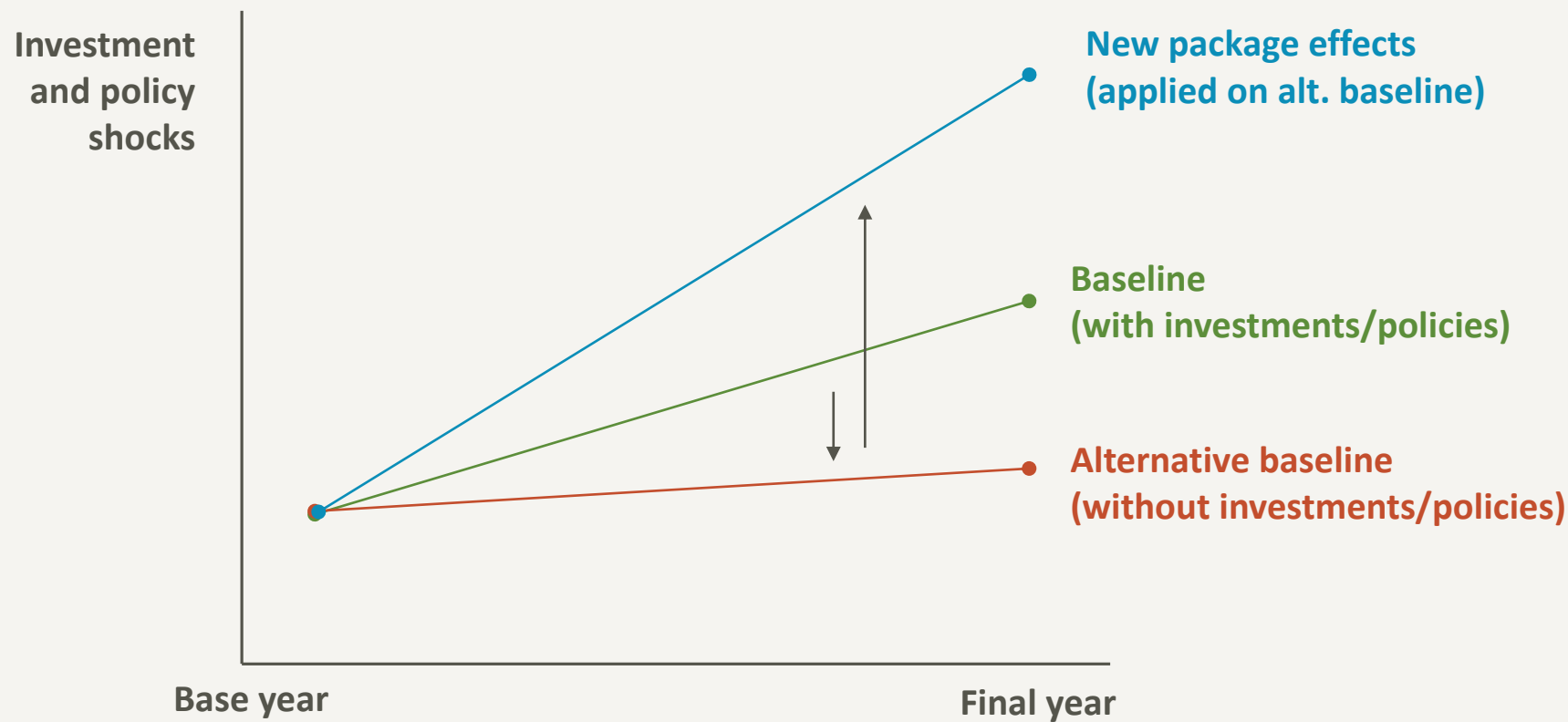
## Three dimensions of decision-making

Where to invest?

Which crops or activities to invest in?

What interventions to prioritize?

# Evaluating Investments and Policies against a “Baseline”



# Example: Economywide Approach to Prioritization



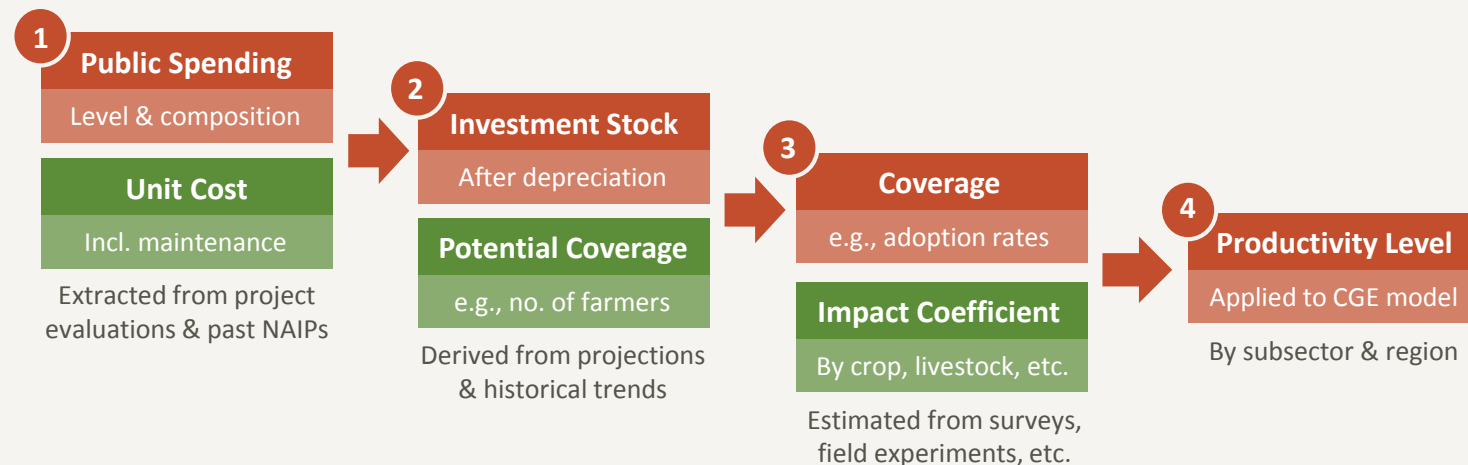
- **Evaluate national development strategy**
  - Within & beyond agriculture (i.e., food system)
  - Across ministries and public-private sectors
- **Cover full range of policies and investments**
  - **Investments** affect productivity or behavior through direct spending (e.g., irrigation, inputs)
  - **Policies** affect resource allocations via relative price changes & monetary transfers (e.g., grain procurement, exchange rates, safety nets)
  - **Regulations** set quality standards and directly restrict quantities (e.g., export bans)

National Strategy	
Policies	
Trade & prices	
Social transfers	
Macroeconomic	
Investments	
On-farm	
Off-farm	
Economywide	
Regulations	

# Projecting Investment Impacts



- Convert public spending projections into sectoral and spatial productivity changes using unit cost data and impact “coefficients”
  - Separate recurrent spending (subsidies) from capital spending (infrastructure)
  - Account for capital depreciation (both infrastructure and knowledge)
  - Track current & potential coverage rates (e.g., farmers receiving extension visits )
  - Derive impact coefficients from ex post household/firm data (e.g., LSMS-ISA)





# Types of Questions that AIDA can answer:

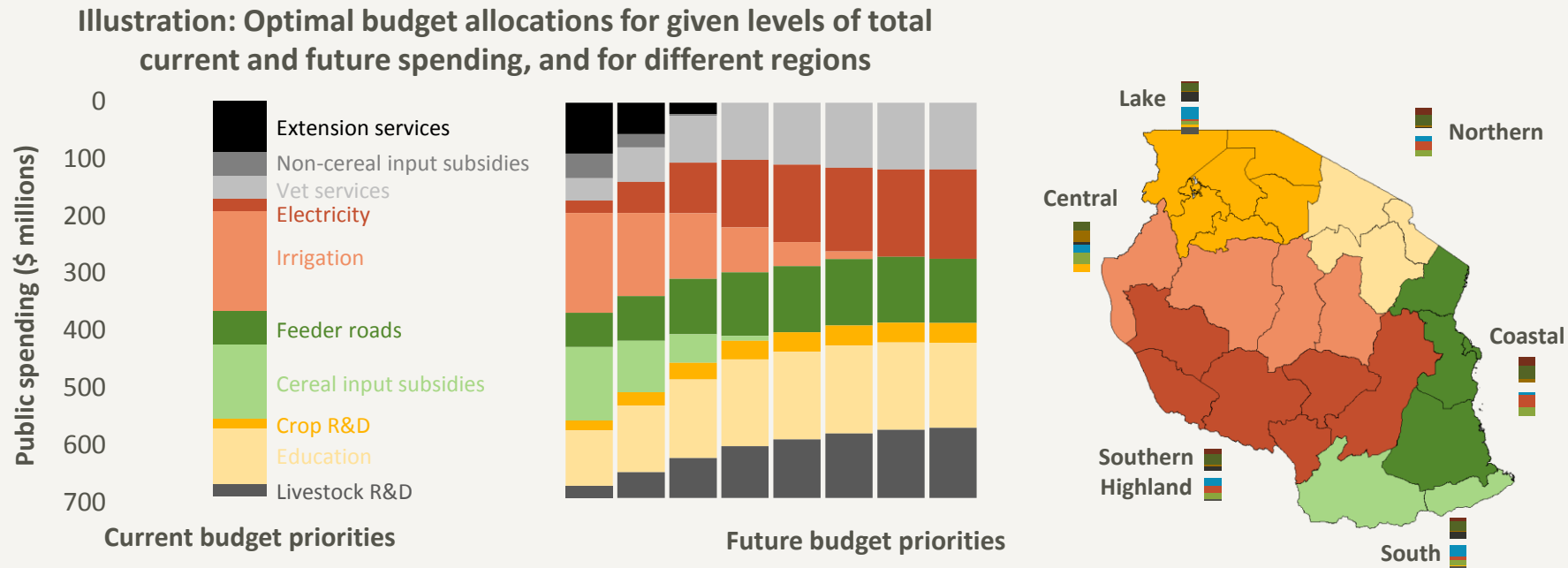


- **What is the economywide impact of different packages of investments and policies?**
  - On-farm vs. downstream value-addition
  - Number of jobs created and people lifted out of poverty
- **What are the spatial and temporal trade-offs of different packages?**
  - Growth in high-return areas vs. poverty reduction in lagging regions
  - Short vs. long-run (e.g., fertilizer subsidies vs. irrigation infrastructure)
- **What are the implications of different financing options?**

e.g., raising taxes, foreign borrowing, reducing spending elsewhere
- **Are my policy expectations reasonable?**
  - How would a change in policy affect the impact of the new investment package?
  - Increasing expenditures vs. improving investment efficiency

# Example results: “Rightsizing” Government Budgets

- **Optimize public budget allocation given available fiscal resources**
  - Use marginal cost-effectiveness estimates (change over time with spending)
  - Prioritize government interventions across regions and time periods
  - Measure combined outcomes for a given budget allocation or policy portfolio



# Towards the Online Modeling Framework

## Innovative simulation procedure

- Pre-run model thousands of time to capture range of possible policy scenarios (generate results database)
- User makes policy choices online and these are matched as closely as possible to results database

## User Interface

### Design Scenarios Report Results

New budget level & allocation  
Unit costs & impact parameters

### Online Results Database

Match user's scenario to pre-solved results  
"Big Data" search algorithms

## Model

### Micro-Simulation

Poverty incidence & depth  
Inequality  
Dietary change

## Data

### Investment Analysis

Farm impact estimates  
Unit costs  
Past budget levels & allocations

### Dynamic CGE Model

Production & prices  
Jobs & migration  
Economic growth & structural change

### Nexus SAM Database

National accounts  
Public finances  
Enterprise & household surveys

## Advantages

- Searching a database is *much* quicker than running a model
- Solution is guaranteed since simulations are pre-solved
- No modeling software knowledge or licenses required

## Result

- More policy analysts with access to "frontier" tools

# Result Indicators from Online AIDA



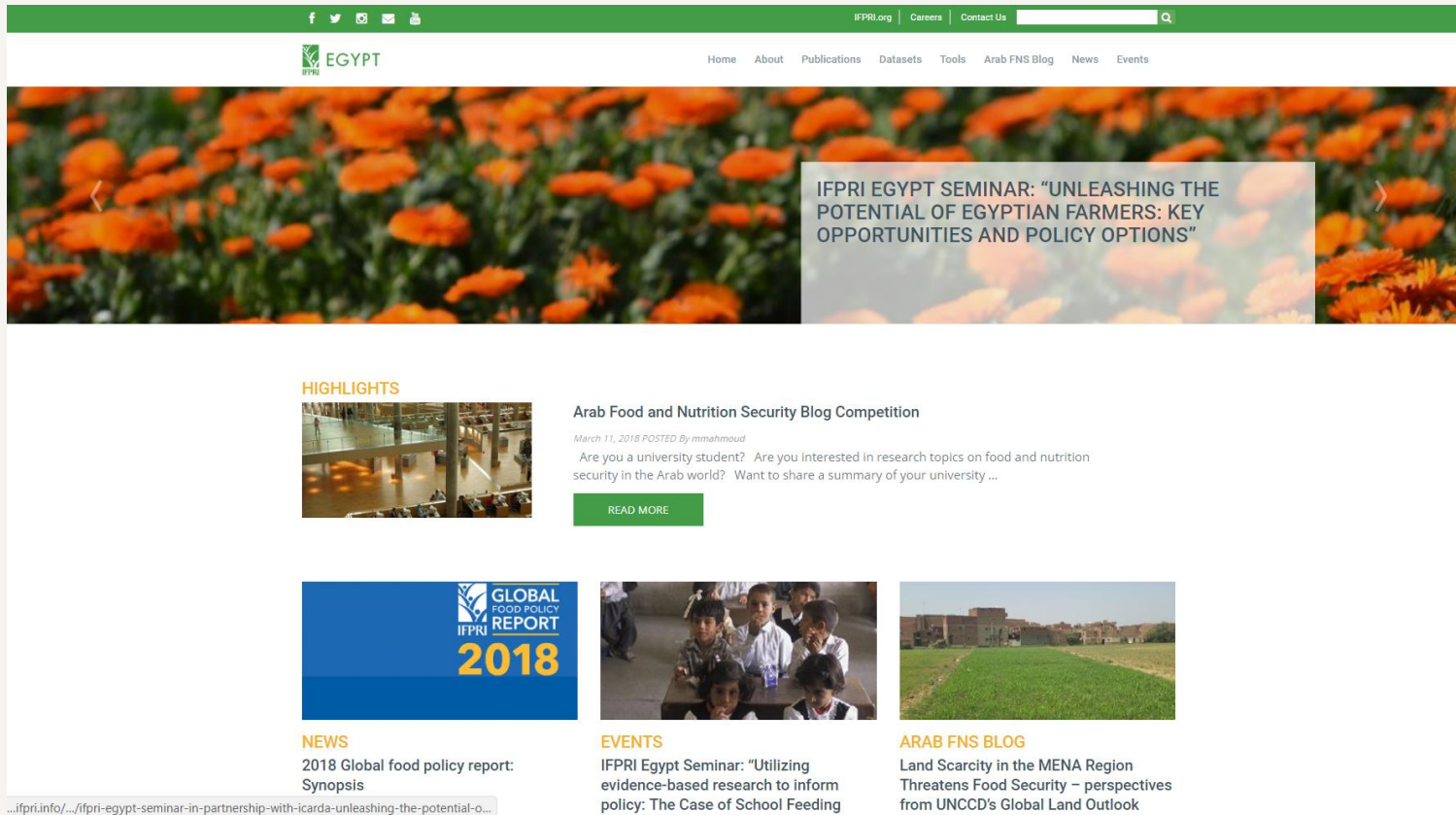
- **Typical development outcome indicators** for each investment and policy package:
  - National and agriculture-food system aggregate, e.g. GDP and employment
  - Macro distribution, e.g. investment vs consumption; private vs public demand
  - Sectoral distribution, e.g. agriculture vs non-agriculture; tradeable vs non-tradables
  - Spatial distribution, e.g. North/Bekaa/Mount Lebanon/South
  - Functional distribution, e.g. labor income vs capital income; skilled vs non-skilled labor income etc.
  - Household distribution, e.g. rural vs urban, poverty headcounts and gaps, dietary change
- Measure **rates of return** for each policy and for overall package
  - e.g., AFS GDP gain per dollar spent on investments or revenues lost from policy change
  - e.g., Number of people lifted above the poverty line per dollar spent

# Summary and Next Steps for AIDA

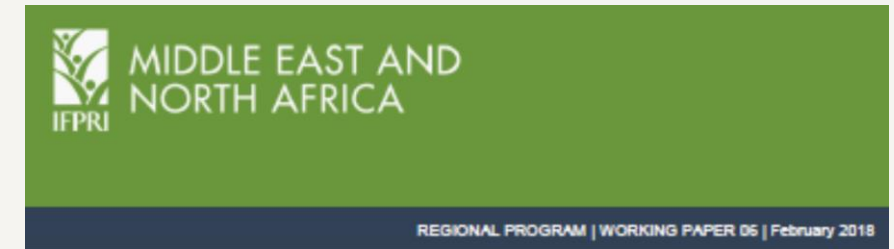


- CGE models have gone through a substantial evolution
- Online CGE models are expected to broaden access to “non CGE expert” economists and increase the use by governments and policy analysts
- Ongoing and next steps for AIDA model:
  - Close collaboration with country partners, especially statistical bureaus (for SAM), Ministries of Planning (for “housing” CGE models) and line Ministries like Agriculture, Trade and Finance
  - AIDA Egypt model expected by September 2018 and AIDA Tunisia by December 2018, Lebanon and Jordan to follow in 2019. All will be available free and on the [www](#)
- For now online AIDA focuses on rural investments and policies, but there is interest to expand AIDA models to additional purposes such as developing national development plans and rapid response tasks (Egypt)

# Related AIDA Resources



✓ [IFPRI Egypt website](http://ifpri.info/.../ifpri-egypt-seminar-in-partnership-with-icarda-unleashing-the-potential-o...)



## The (Arab) Agricultural Investment for Development Analyzer (AIDA)

An Innovative Tool for Evidence-based Planning

Mariam Raouf, Yumna Kassim, Sikandra Kurdi, Tewodaj Mogues, Mai Mahmoud, Josee Randriamamonjy, James Thurlow, Manfred Wiebelt, and Clemens Breisinger

✓ [AIDA Methodology Paper](#)