STAPLES

Stable food Access and Prices and Lower Exposure to shocks

OEET

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CCA

11th OEET Workshop
Global Trade Shocks and Geopolitical Uncertainty: Implications for food security in Emerging Economies

STAPLES Roundtable

12-13 December, 2025

PRIMA

PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

This project is part of the PRIMA programme supported by the European Union. Under grant agreement n°2333.

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Food Security: Definition and Measurement

Prof. Donatella Saccone

University of Pollenzo and OEET

STAPLES' Principal Investigator (WP2 leader)

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Definition of Food Security

"*Food security exists when **all people**, at **all times**, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life*" (1996 World Summit in Food Security).

"*The four pillars of food security are **availability**, **access**, **utilization**, and **stability***" (2009 World Summit in Food Security). In order to achieve food security, all four dimensions must be fulfilled simultaneously.

More recently: Agency and Sustainability (FAO HLPE-FSN).

Measuring the 4 Dimensions of Food Security

1. **AVAILABILITY**: physical availability of food. Food availability addresses the **supply side** of food security and is determined by the levels of food **production**, **stocks** and net **trade**.

Examples of indicators: average value of food production; share of dietary energy supply derived from cereals, roots and tubers; average protein supply; average supply of protein of animal origin.

Source: FAO Suite of Food Security Indicators (SDG 2)

Measuring the 4 Dimensions of Food Security

2. **ACCESS**: economic and physical access to food. **Economic access** is determined by disposable income, food prices and the provision of and access to social support. **Physical access** is determined by the availability and quality of infrastructure and other installations that facilitate the functioning of markets.

Examples of indicators: GDP per capita in PPP; domestic food/cereal price index; percentage of paved roads over total roads; road density; rail lines density; prevalence of undernourishment (% of pop.).

Source: FAO Suite of Food Security Indicators (SDG 2)

Measuring the 4 Dimensions of Food Security

3. **UTILIZATION**: the way in which the body uses the various nutrients in food. Individuals achieve sufficient energy and nutrient intake through **good care and feeding practices**, **food preparation**, and **diet diversity**. Combined with biological utilization of the food consumed, **energy and nutrient intake** determine the nutrition status of individuals.

   Examples of indicators: percentage of children under 5 years of age affected by wasting* and stunting*; prevalence of anemia among women in reproductive age; percentage of population using safely managed drinking water services.

* Stunting (low height for age) results from chronic undernutrition, which retards linear growth, whereas wasting (low weight for height) results from inadequate nutrition over a shorter period.

Source: FAO Suite of Food Security Indicators (SDG 2)

Measuring the 4 Dimensions of Food Security

4. **STABILITY**: **the stability of the other three dimensions over time**. Even if individuals' food intake is adequate today, they are still considered food insecure if periodically they have inadequate access to food, risking deterioration of their nutrition status. Adverse weather conditions, political instability or economic factors (unemployment, volatility in food prices) may have an impact on individuals' food security status.

Examples of indicators: cereal import dependency ratio (cereal imp/(cereal production+imp-exp)); political stability and absence of violence/terrorism; domestic food price volatility; per capita food supply variability.

Source: FAO Suite of Food Security Indicators (SDG 2)

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Food Security proxies adopted and network analysis

Dr. Iacopo Maria Taddei

Collegio Carlo Alberto (CCA) and OEET

Prof. Alessia Amighini

University of Piemonte Orientale, CCA and OEET

STAPLES' Senior researcher

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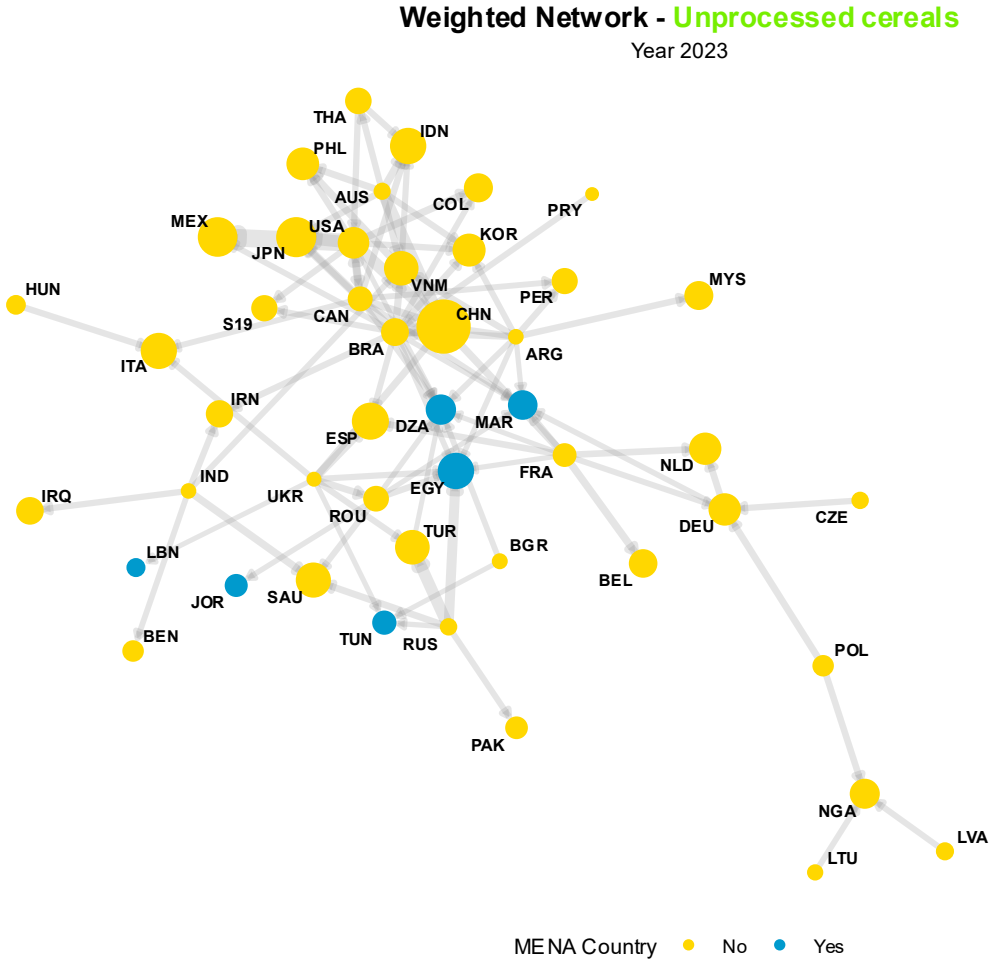
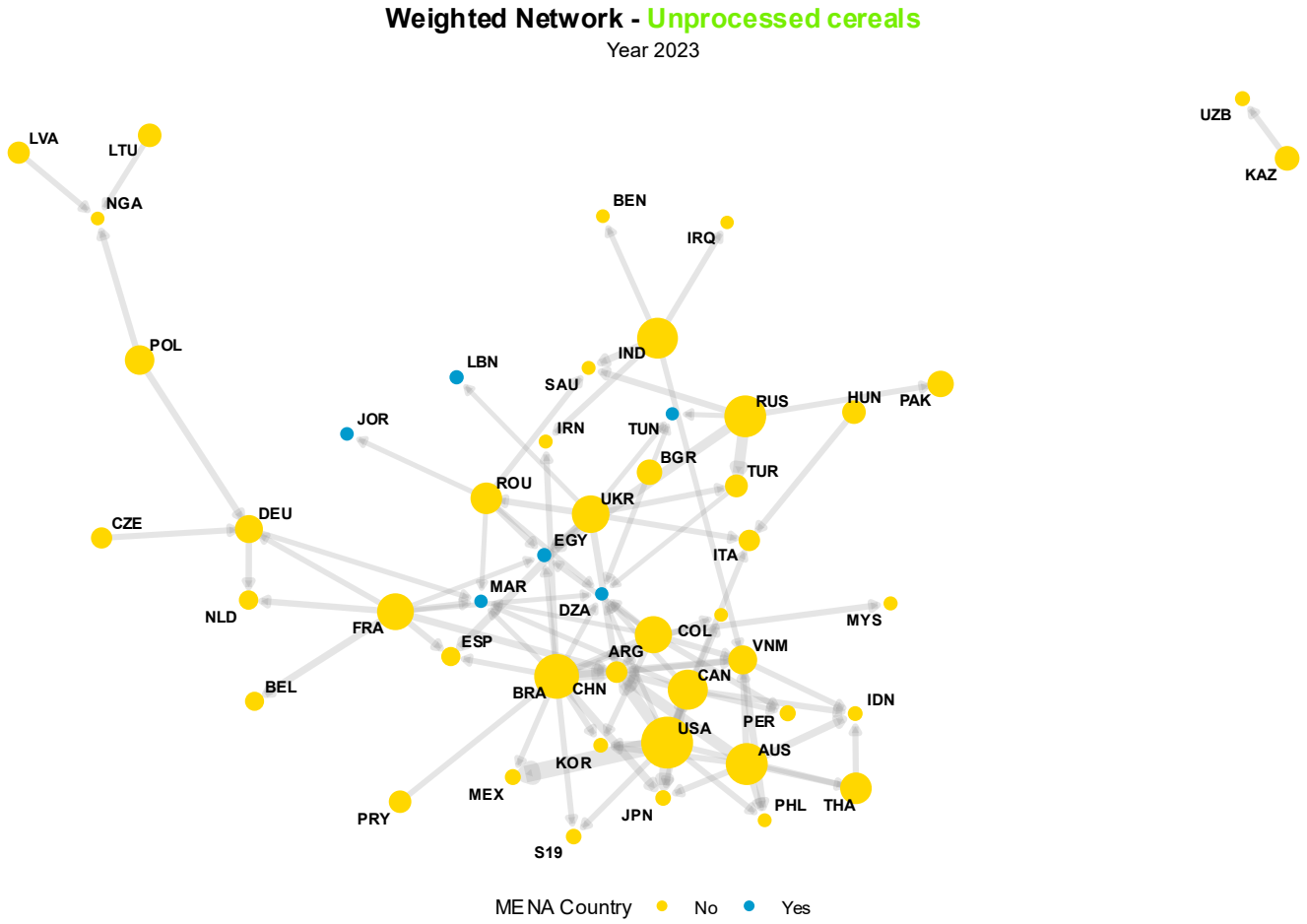
Network Analysis Representations for 2023



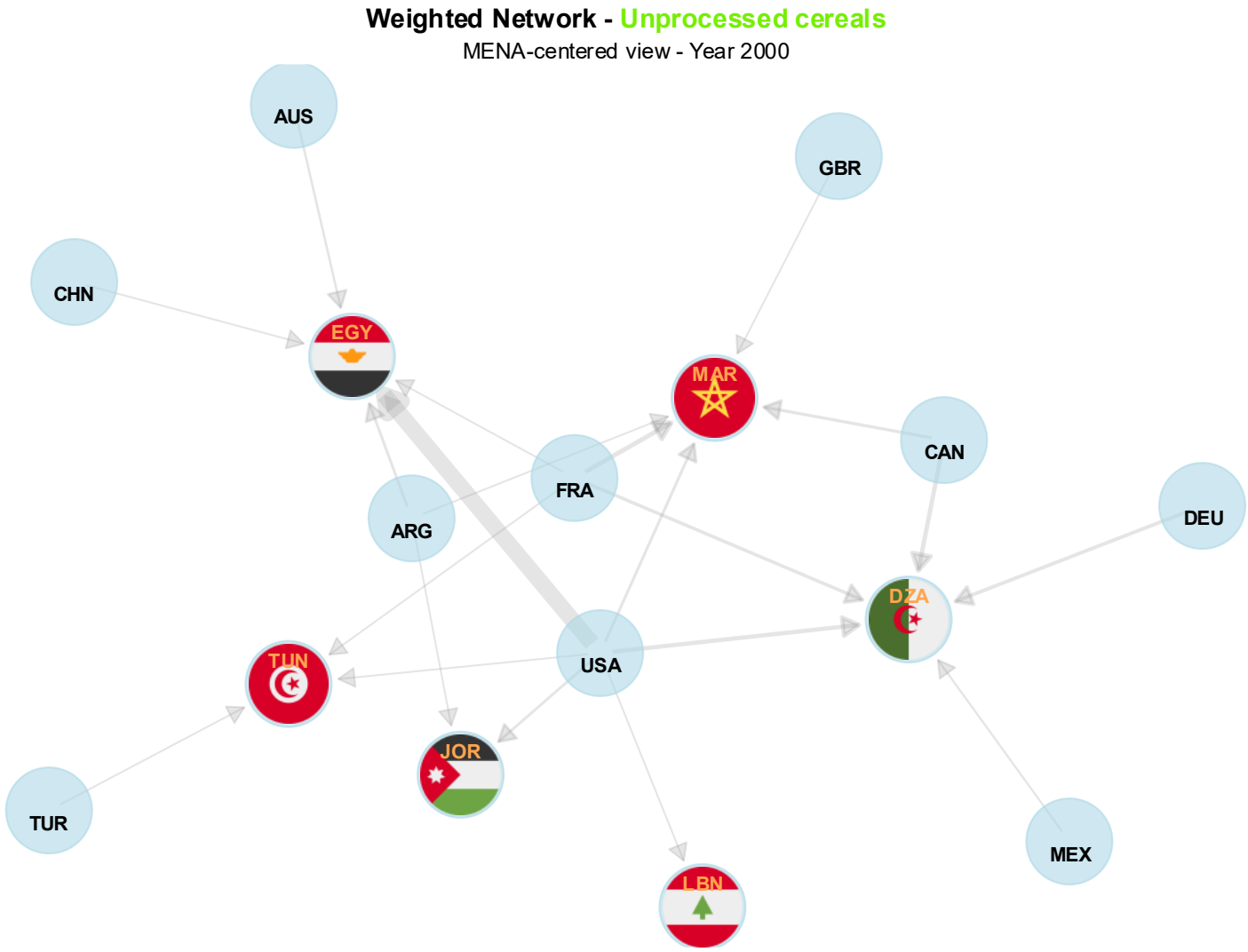
Top-5 Unprocessed Cereals Importers	
China	87213.726
Japan	37059.265
Mexico	35849.522
Spain	29148.362
Egypt	27552.926

Network Analysis Representations for 2023



Top-5 Unprocessed Cereals Exporters	
United States	116564.850
Brazil	77467.262
Australia	64301.376
Russia	63823.093
India	59453.254

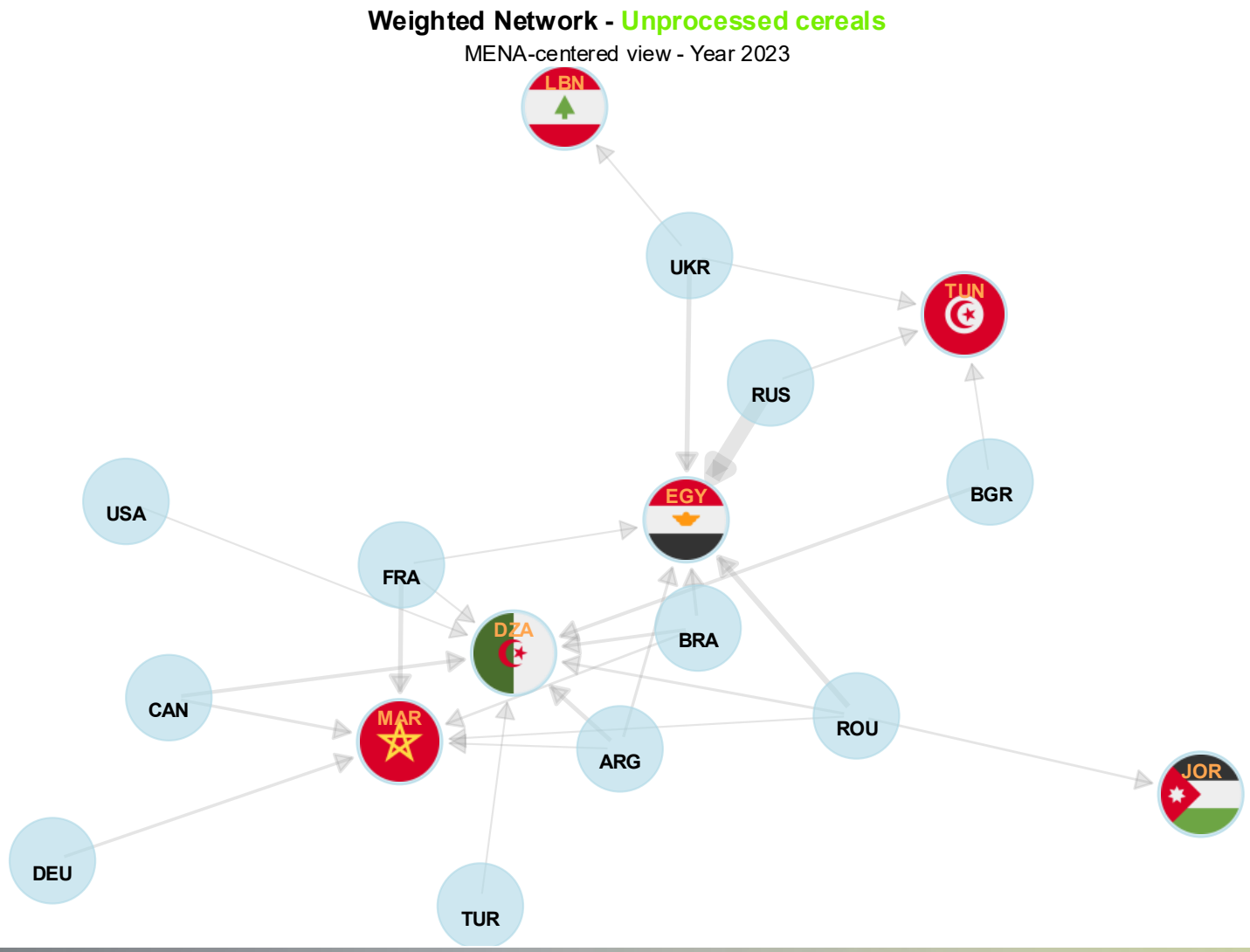
Network Analysis Representations: MENA countries, 2000



Top 10 share of exporting cereals countries to Egypt (2010-2023), share of total imports.

Egypt				
Imports of cereals	**2010**	**2015**	**2020**	**2023**
Tot. Value, thousands of USD	5,013,338	5,053,494	8,221,226	5,867,936
10-Year Variation (%)	.	0.80	62.68	-28.62
Share of Top 10 exporting countries (%)				
Russian Federation	29.41	16.80	45.59	43.53
Romania	0.28	11.24	4.94	13.88
Ukraine	10.76	23.78	22.87	11.84
Brazil	1.57	6.83	6.58	7.35
Argentina	4.70	5.65	7.81	6.56
France	11.45	10.15	5.07	4.08
Bulgaria	0.23	0.57	0.50	1.87
India	0.16	0.57	0.41	1.78
China	0.04	0.05	0.42	1.49
USA	23.66	7.92	0.80	1.49

Network Analysis Representations: MENA countries, 2023



MENA Network Analysis Representations: Entire Evolution

dynamic_mena_unprocessed_cereals_network.html

Network Topological Measures

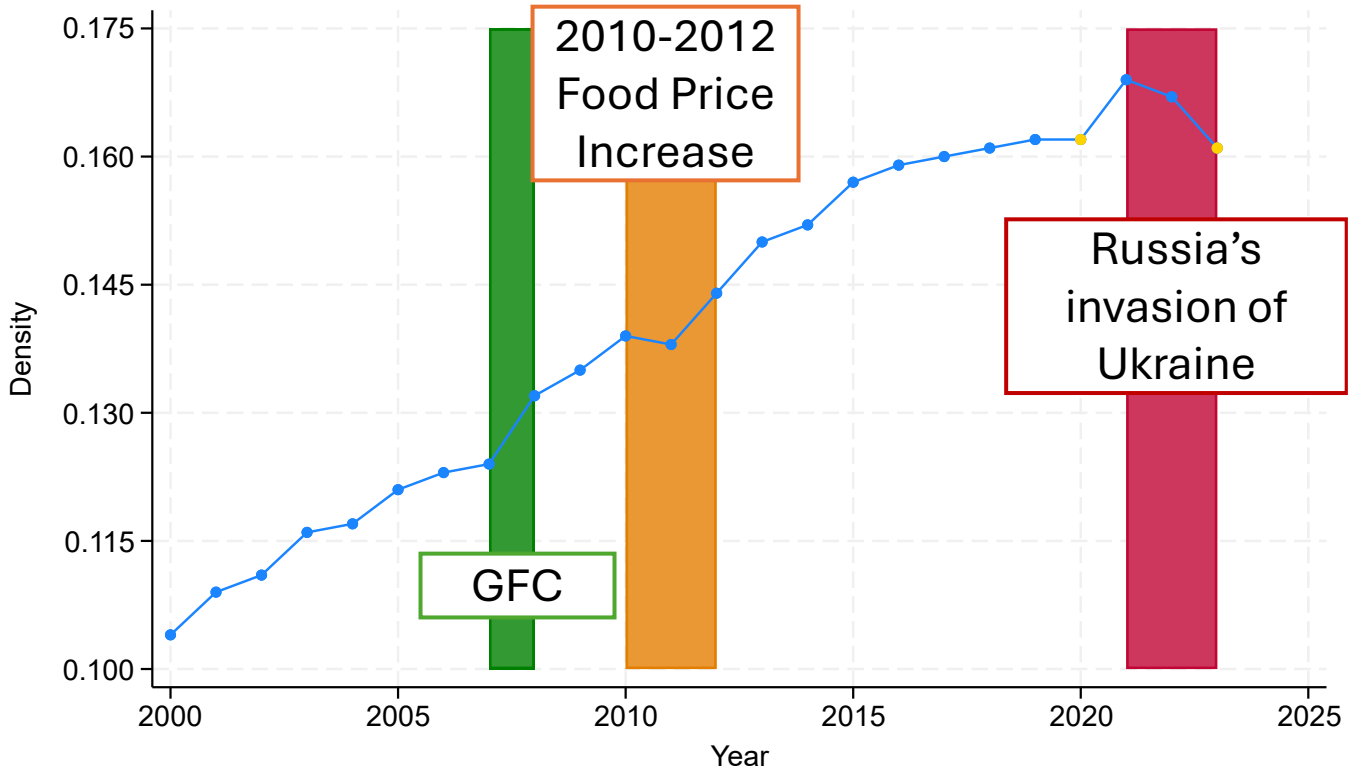
Density measures **the degree of connection** of the network**:** the likelihood that two countries are connected through cross-border fertiliser trade flows.

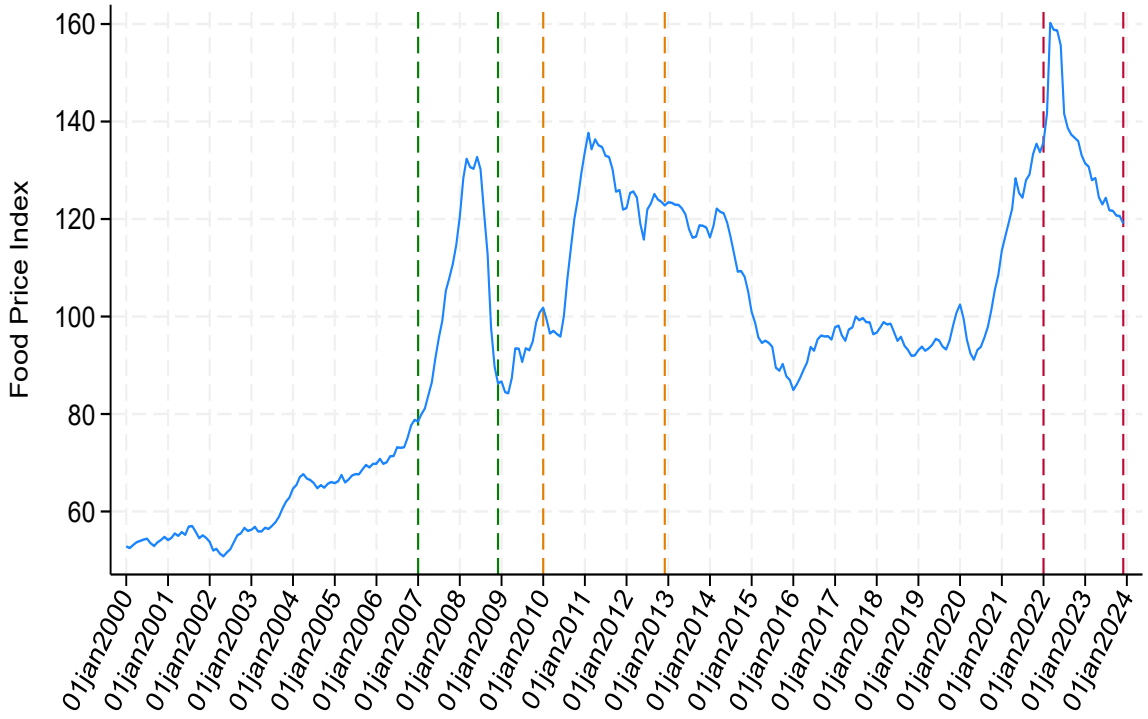
Average path length: the shortest distance between two countries measures **the efficiency** of the network. It can also be measured by **the global network efficiency**.

Betweenness centrality: key hubs/exporters when a major exporter faces a shock, its betweenness may fall sharply.

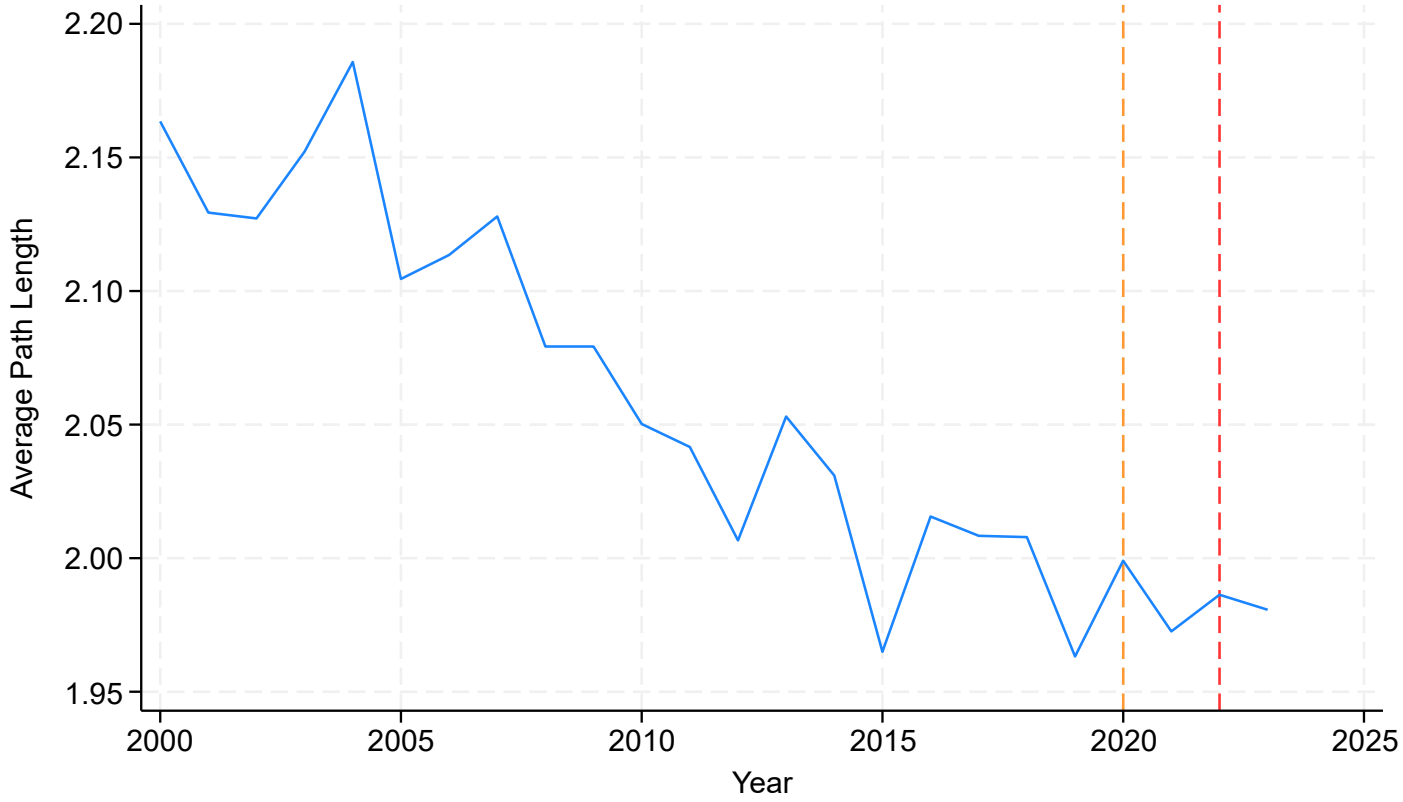
Closeness centrality: Import-dependent countries may become **more peripheral** or experience **longer effective "distances"** to alternative suppliers.

Network Topological Measures: Density

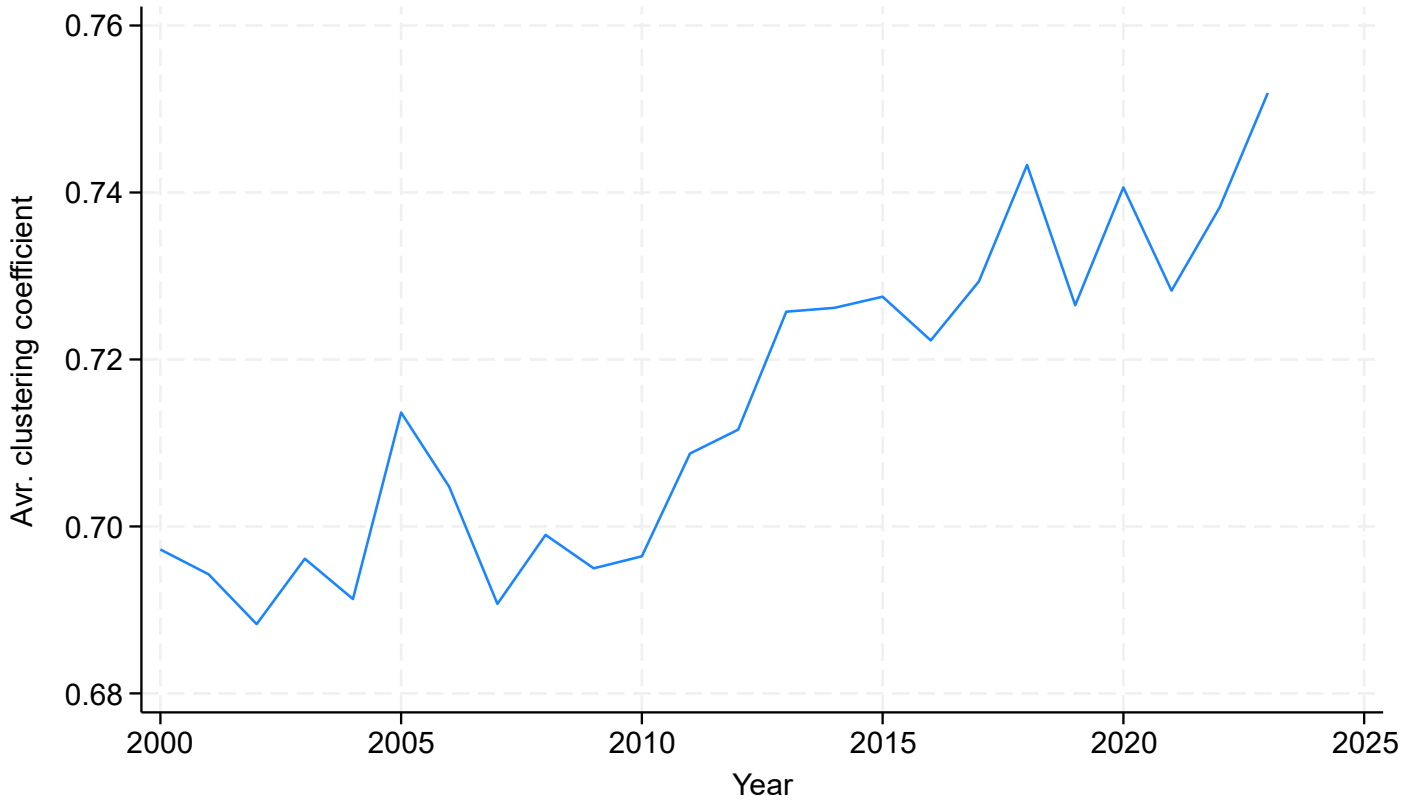




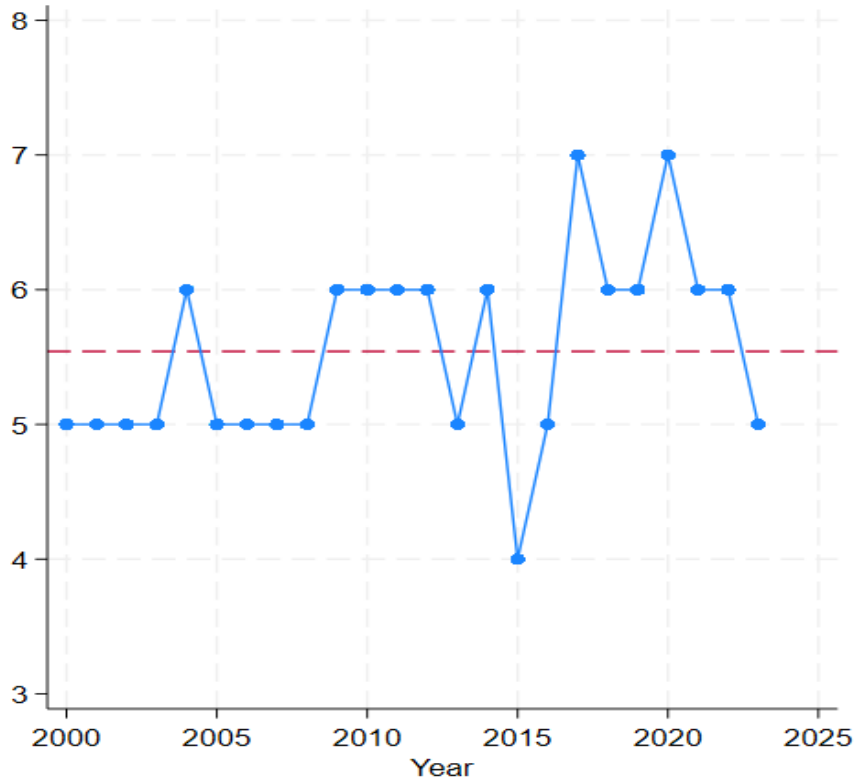
Network Topological Measures: Average Path Length



Network Topological Measures: Clustering Coefficient



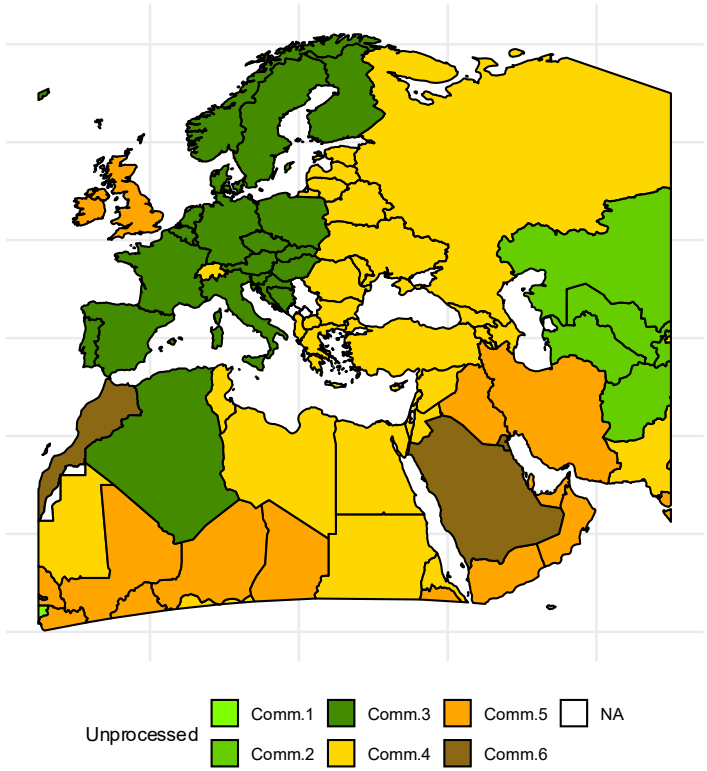
Network Topological Measures: Clustering Coefficient



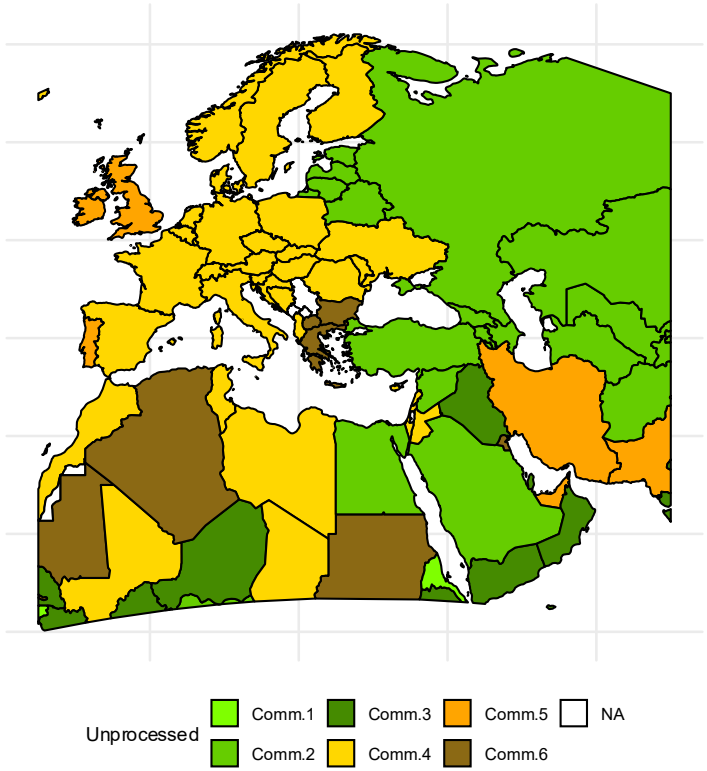
Newman-Girvan modularity (Newman, 2006)

Network Topological Measures: Community Detection

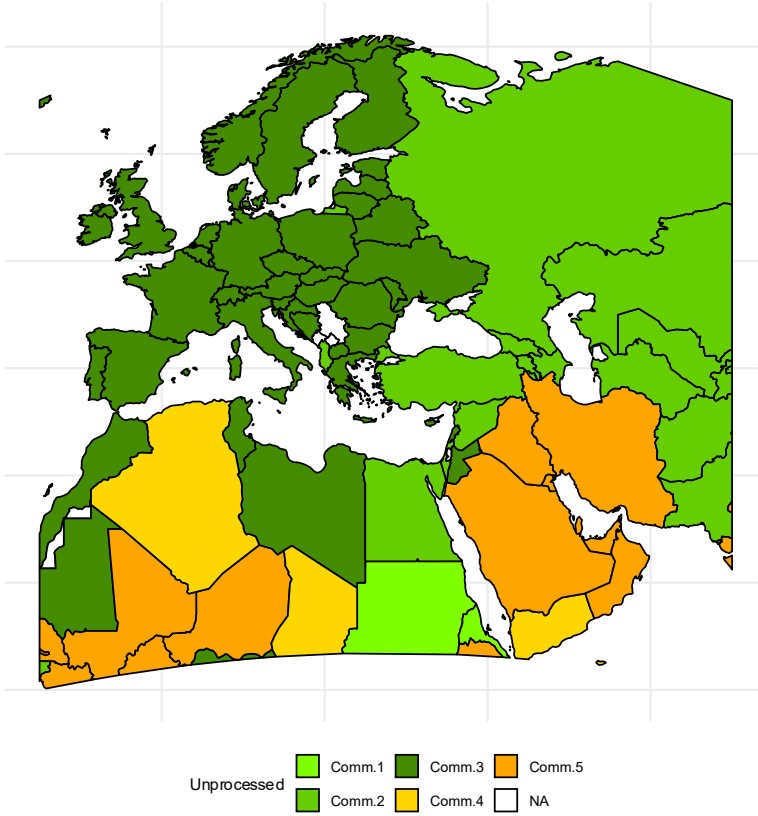
2021 - Pre Russian aggression of Ukraine



2022 - Outbreak of the Russia -Ukraine war



2023 - A year after the Russian aggression of Ukraine



Empirical Analysis: Data Sources (1)

Structural Country Characteristics:

- Arable land: World Development Indicators (WDI)
- Real GDP per capita: WDI
- Rural population share: WDI

Domestic Macroeconomic Policy Quality:

- Inflation rate: WDI (as a proxy for macroeconomic stability)
- FDI net inflows on GDP: WDI

Agriculture and Demographic Development:

- Annual Population Growth Rate: WDI
- Cereal Yield: FAOSTAT (as a proxy for agriculture productivity)
- Growth rate of GDP per capita

Quality of Institutions:

- Rule of Law;
- Corruption.

Trade:

- Centrality measures: in-degree, in-strength, authority.

Empirical Analysis: Data Sources (2)

Stressors:

- **Conflict:**
  - Number of Reported Fatalities (by country and year): ACLED Number of reported fatalities by country-year | ACLED
  - Number of Political Violence Event: ACLED Number of political violence events by country-year | ACLED
  - Political Violence: **The Polity IV** INSCR Data Page Data available **from 1946 to 2018**. However, we can only know whether they occurred or not but not the intensity. (An indicator equal to one if the country has experienced a civil or interstate conflict since 1960 to control for disasters).
  - Alternative data source for conflict: Uppsala Conflict Data Program UCDP - Uppsala Conflict Data Program
- **Climate Shock:**
  - Temperature Changes: IMF Macroeconomic Climate Indicators.
  - Number of Natural Disasters: EM-DAT The international disaster database
- **Trade Stressors:**
  - Non-tariff measures: WTO
  - Tariff measures: WTO

Thank you!

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Marta Marson

OEET Workshop 2025

13th December 2025

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General overview

- **Acronym**: STAPLES
- **Title**: STable food Access and Prices and Lower Exposure to Shocks
- **Total budget**: € 2,692,925
- **Duration**: 01 May 2024 – 30 April 2027 (36 months)
- **Coordinator**: Politenico di Milano
- **Fieldwork:** Egypt, Morocco and Spain
- **Products' focus:** barley, maize, rice, wheat
- **Countries' focus:** Algeria, Egypt, Jordan, Libano, Morocco,Tunisia

Consortium

10 partners from **4 countries:**
Italy, Egypt, Morocco, Spain

- 3 Universities
- 3 Research centres
- 2 Multi country business networks/confederation
- 2 Private actors

POLITECNICO MILANO 1863

FONDAZIONE POLITECNICO DI MILANO

Research Education Outreach CCA

Università di Scienze Gastronomiche di Pollenzo
University of Gastronomic Sciences of Pollenzo

EURO-MEDITERRANEAN ECONOMISTS ASSOCIATION

STAPLES

ECONOMIC RESEARCH FORUM

UNIVERSITÉ IBN ZOHR

ascame
Association des Chambres de Commerce et d'Industrie de la Méditerranée
Association of the Mediterranean Chambers of Commerce and Industry

CIETA' AGROALIMENTARE ED OINDUSTRIALE DEL BRADANO

ceeba
The Confederation of Egyptian European Business Associations

Challenges

→ MENA countries **heavily rely on cereal imports** to meet their population's dietary needs.

→ Imports dependency makes MENA food systems **vulnerable to global market fluctuations and economic shocks,** increasing the risks of instability in food availability, accessibility, and affordability.

Why is MENA Region Highly Dependent on Cereals Imports?

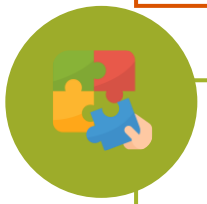
- **Dietary habits**: central role of grains in daily consumption habits
- **Environmental factors**: scarcity of water and of arable land
- **Growing population**: regional rate are above the global average

Low production vs High demand

Objectives

UNDERSTAND

Gain insight into local systems' **vulnerability to trade dynamics and global value chain shocks** that threaten local cereal supply chain and food security.



DEVELOP

Develop **innovative solutions and evidence-based recommendations** → strategies, action plans and best practices that governments and economic actors of the MENA food systems along the cereal value chain can use to enhance the resilience of the food systems and ensure food security.

DESIGN

Design **IT tools** for a comprehensive **monitoring, analysis and management of cereal production and trade** in MENA countries → improve preparedness of governments and economic actors along the cereal value chain and in the food system to anticipate and cope with external stressors and shocks.

Expected results/outputs

- Indicators toolkit for resilience assessment
- Resilience-enhancing trade policies
- Recommendations for public procurement and private storage
- Design of a new multipurpose agricultural machinery for marginal land
- Strategy for the promotion and rediscovery of traditional drought-resistant cereals
- Virtual water analysis of competing crops

Dashboard and decision support system for stakeholders of the cereals value chain

Scope and delimitation: Countries

Criteria for selection: WB MENA countries vs PRIMA

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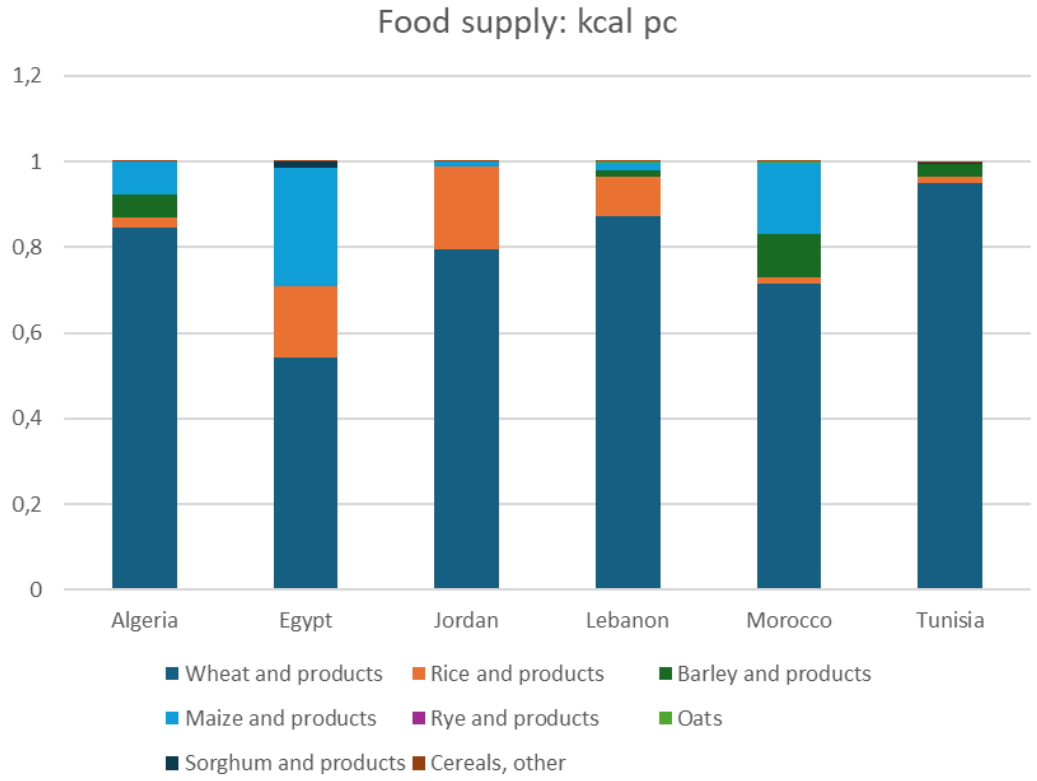
Scope and delimitation: Countries

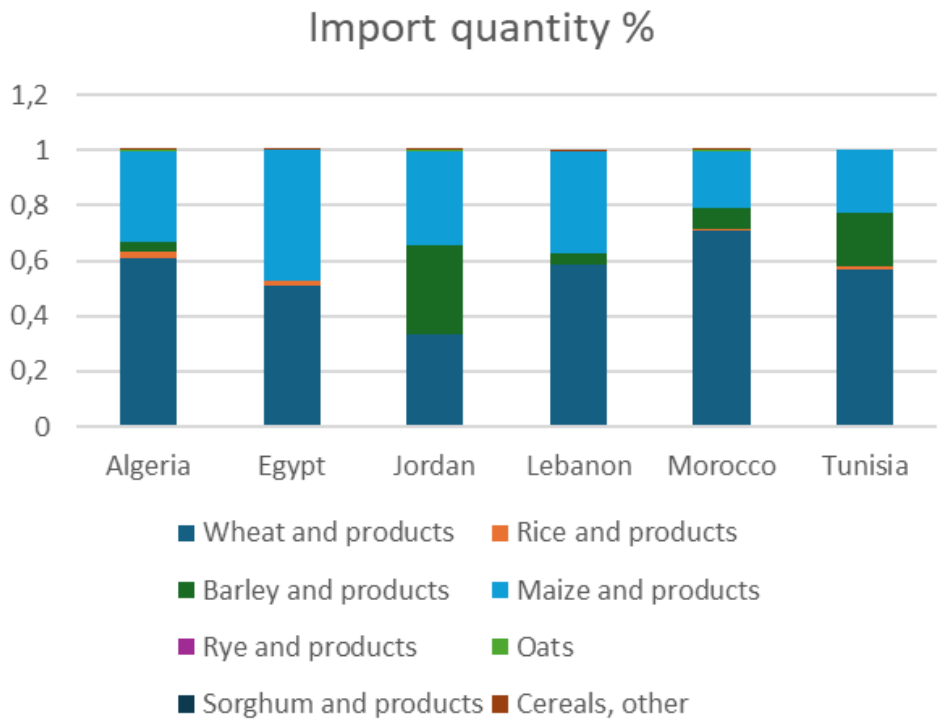
Proposal for relevant countries

- Morocco
- Algeria
- Tunisia
- Egypt
- Lebanon
- Jordan

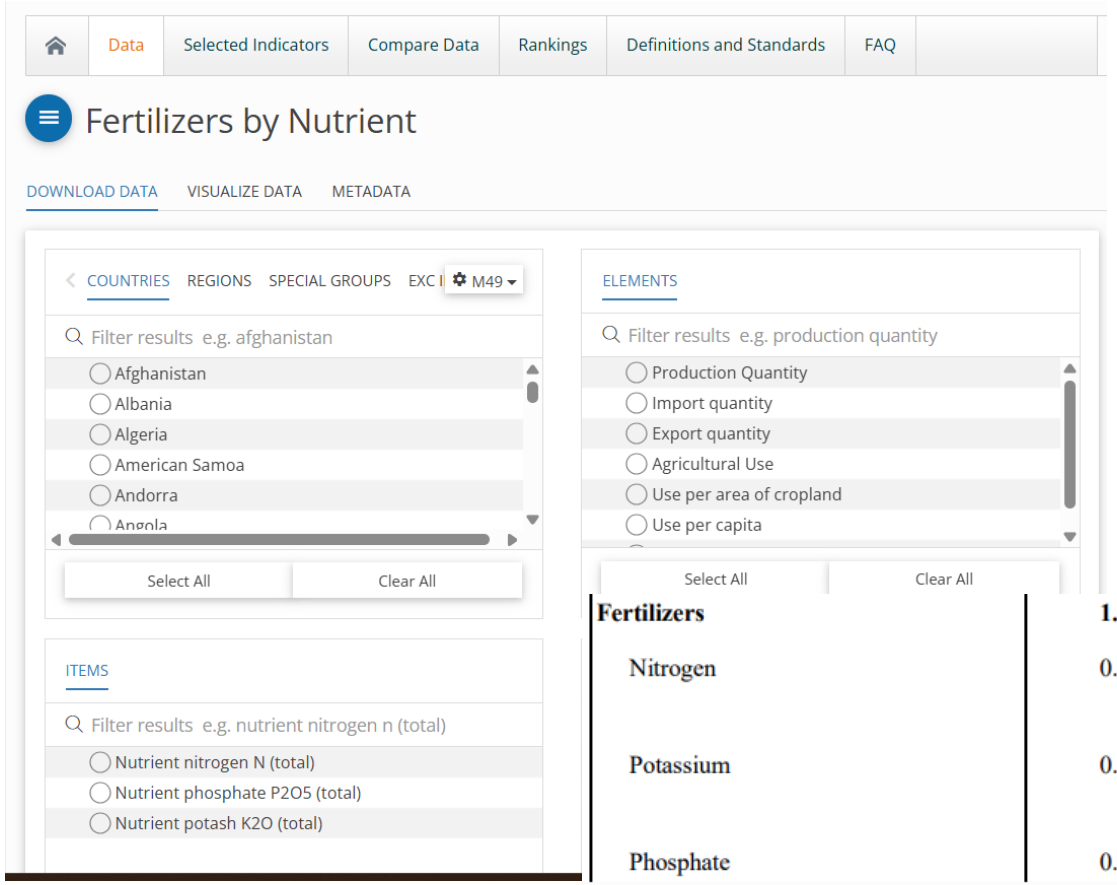
Scope and delimitation: Crops
Criteria for selection

Cereals: highest by consumption (kcal) highest by import value in selected countries





Fertilizers: FAOStat and IMF (PCPS)



Fertilizers	**1.9**	
Nitrogen	0.9	US Gulf NOLA Urea Granular Spot Price, USD/ST USDA 2/ (DataStream)
Potassium	0.5	Potassium Chloride (Muriate of Potash) Standard Grade: FOB Vancouver Spot Price, USD/metric tonne Canada Stat 3/
Phosphate	0.6	US Gulf NOLA DAP Export Spot Price per mt, USD/metric tonne