

Prin 2022

ECOWHEATALY

"Evaluation of policies for enhancing sustainable wheat production in Italy"

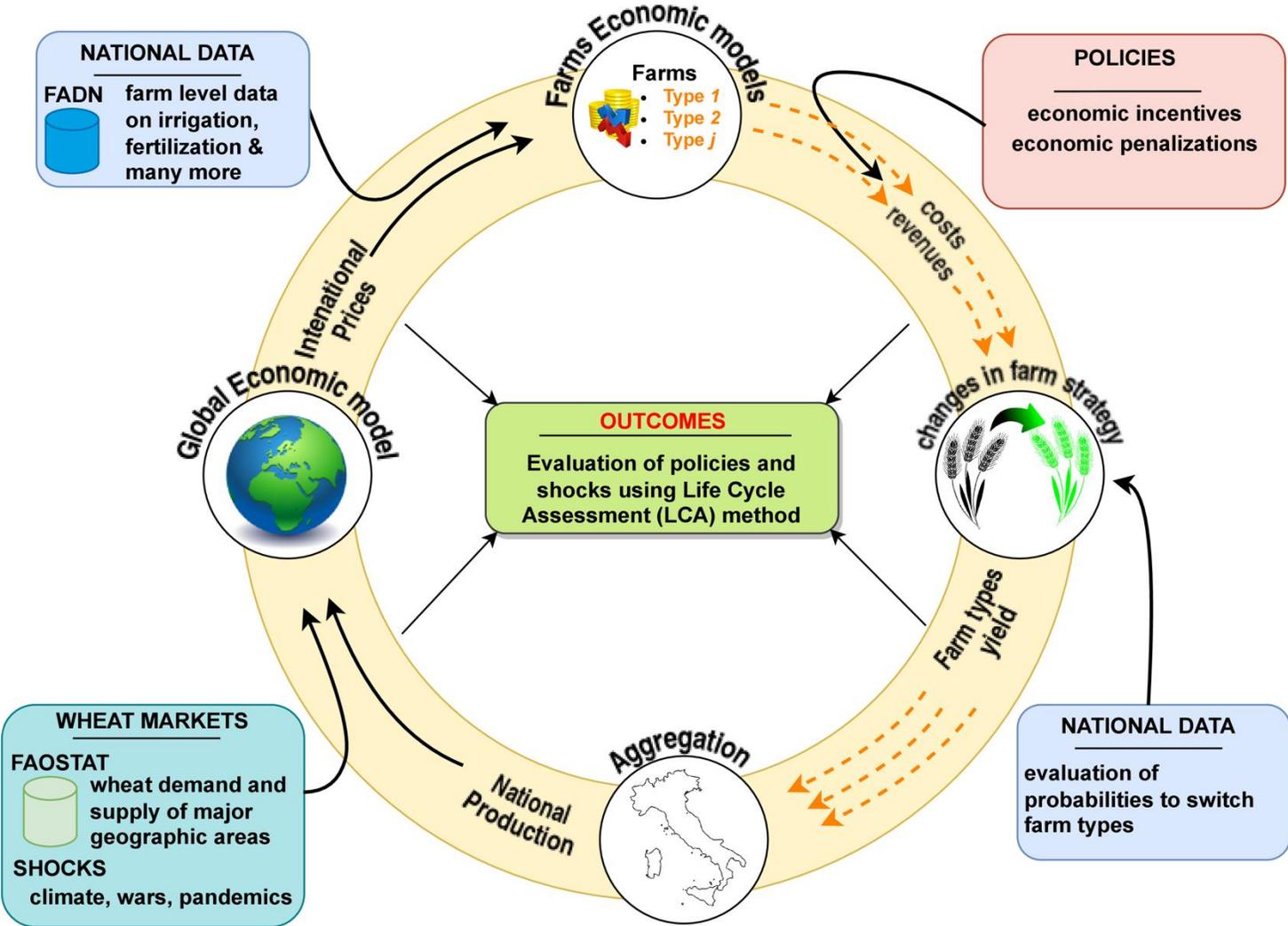


 National Research Council of Italy
Institute of BioEconomy

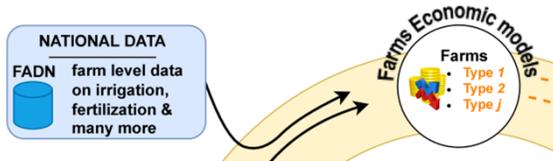
OUTLINES

- Description of the Project “Ecowheatly” (30 min)
- Introduction of Participants (10 min)
- Comfort break (10 min)
- Tasks discussion and assignment (1h)
- Work scheduling (10 min)

ECOWHEATALY Visual presentation

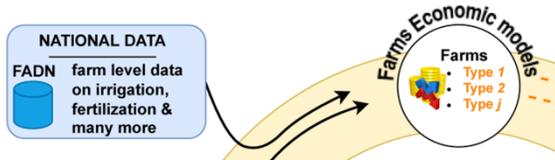


Farms types



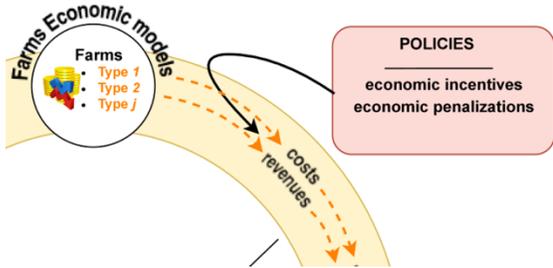
- Statistics and clustering techniques to **identify farm management types** operating in Italy
- Database:
 - Rete di Informazione Contabile Agricola (**RICA**) provides Italian data of the agriculture sector. It is maintained by the Council for Agricultural Research and Economics (**CREA**), and reports about 12000 farms per year, 1800 and more of which are classified as wheat producers.
 - RICA consists of approximately **3000 variables**. Some of them particularly interesting for the project: quantity of **fertilizers** and **pesticides**, **water use**, and **energy consumption**.
 - RICA is part of Farm Accountancy Data Network (FADN) which provides harmonized micro-economic data for farms in the European Union
- For each firm type, we **estimate revenue, cost and production functions** using data from RICA.

Computational model of the Italian production system



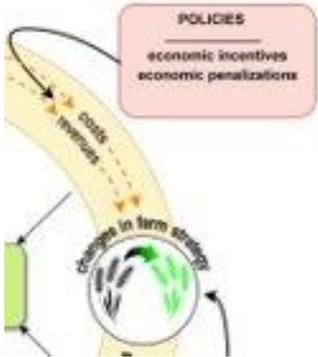
- We will build an **agent-based model** for the **Italian wheat system** able to handle several types of farming strategies
 - We plan to use the Repast suite facilities. Repast is a family of advanced, free, and open source agent-based modeling and simulation platforms that have been under continuous development for over 20 years
 - Repast for Python 1.1.3, released on 31 May 2023, is the newest member of the Repast Suite of ABM toolkits.
- The model will be calibrated and validated using real data
- An additional module to perform LCA using the model output will be developed.

Policies identification



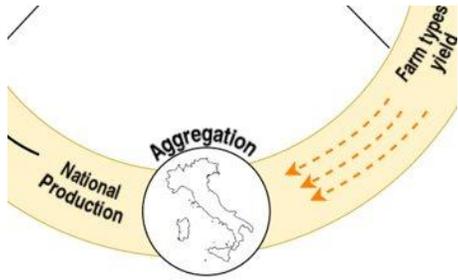
- The **possible environmental policies** that could be implemented by the Italian institutions within the EU framework **will be identified and classified**.
- Policies incentives and penalizations will allow to estimate the **effect of each policy on revenues and costs** of each type of farm.
- This gives a measure of the **economic convenience of each farm type** relative to the other **under a policy**.

Changes in firms strategy



- Economic conveniences of each firm type will be used to evaluate **switching probabilities**.
 - discrete choice theory
 - Multinomial logit
- This allows to **evaluate how a policy modifies the wheat production system**
- **environmental pressures** will be quantified for the production systems generated by our simulations using LCA

Aggregation phase

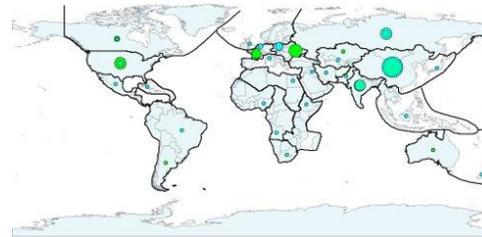


- In an agent-based computational model each farm implements its economic decision.
- This is a **complex process** based on interactions among many farms each one able to evolve its strategy according to exogenous and endogenous variables.
- Aggregation is performed using a **bottom-up** approach
- will allow to trace the expected **time evolution** of **indicators** of **economic** and **environmental performance** of each policy at the national scale.

Global model



- The Computational model for the **Italian Wheat System** will be interfaced with an existing **global model** for wheat markets.

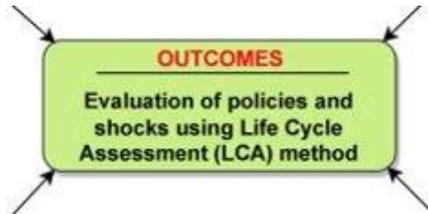


- The **aggregate Italian production** computed from the Italian Wheat System model will be an **input for the global model**.
- The **global model** will **provide international wheat prices**, that, in turn, **affect Italian farmers decisions**.
- **Global shock** (war, pandemics, macroeconomic policies, etc.) considered in the global model will feedback into the Italian model.

Tools for stakeholder

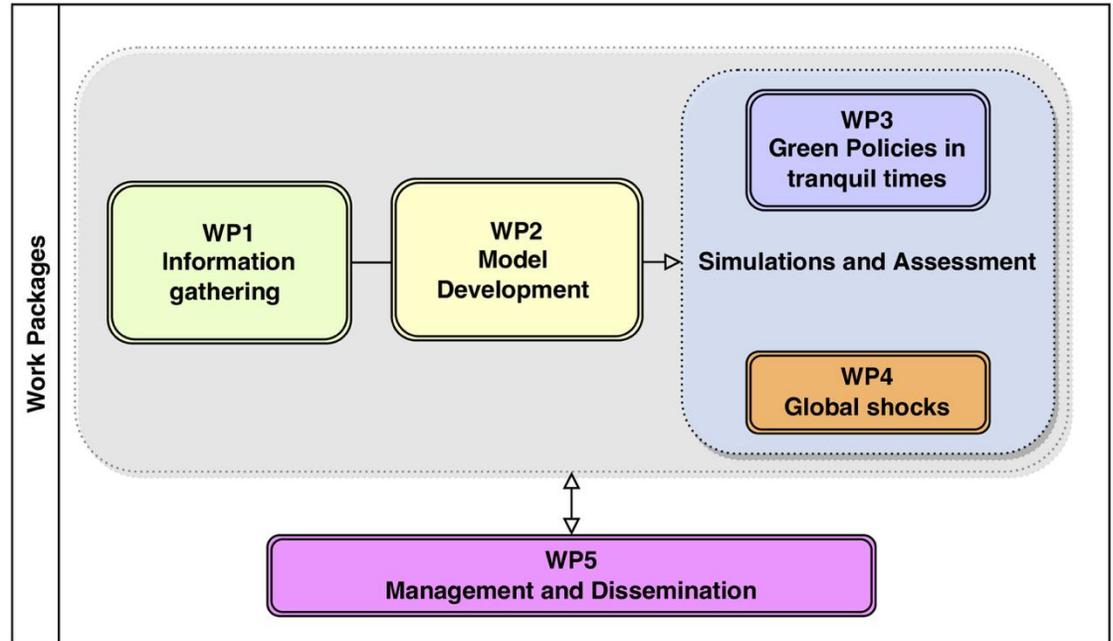
- We will build interactive web tools where stakeholders can setup scenarios they are interest in.
- Clicking on a button the set of developed models run.
- Results are deliveres to the user.

Outcomes



- 1) to build an **agent-based model** for the Italian wheat system
 - ✓ handling several types of farming strategies and the possibility of switching among types
 - ✓ Interfacing the output with a global model
- 2) to assess the effects of economic policies (**green**)
 - ✓ which measures could be put in place by policymakers to “greening” the agriculture sector and favoring the implementation of mitigation and adaptation strategies while preserving sustainability priorities
- 3) to evaluate the effects of **global shocks** on the sustainability of Italian wheat production
 - ✓ tools to measure the effects of different government orientations against recession, increasing national debt, pandemics, war
- 4) to build a **framework** to be used for further investigation after the project ends
 - ✓ handling the bidirectional effect of a country’s production on international prices
 - ✓ open-source and easily obtainable code

- **WP1:**
 - ❖ **Wheat** data and information at both local (FADN, Incentive bonus) and global (FAOSTAT) levels
- **WP2:**
 - ❖ Implementation of an **Agent-Based** model for the Italian wheat production system
 - ❖ Extension of a **Computational** Global Economic Model
 - ❖ **Integration**
- **WP3:**
 - ❖ **Simulations** in tranquil times in which traditional policies are progressively replaced by green policies
 - ❖ Evaluation of the explored **green policies** on both the environment and the national wheat production for policymakers
- **WP4:**
 - ❖ **Simulations** with global shocks (global warming, pandemics, or wars in specific areas)
 - ❖ Evaluation of negative effects on **sustainability of wheat production** if there is a change in government priorities because of global shocks
- **WP5:**
 - ❖ made public on **Open Science platforms** and dedicated web pages the data produced and methodological improvements



TASKS DISCUSSION AND ASSIGNMENT

➤ **Task 1.1** (*Concetta + Arianna + Sara + AdR UdA + Edmondo*)

Gathering information and data about the Italian wheat production system (IWS):

- ✓ the features of the local farm management, such as the type of farms (small/big, traditional/organic) or the level of environmental sustainability
- ✓ the list of national and EU regulations in terms of external inputs usually used (when, how, how much),
- ✓ Classifying the farms reported in the FADN according to the **care they take for the environmental and natural resources** (how to inferring features from sampled farms)

➤ **Task 1.2** (*Antonella + Arianna*)

Life Cycle Assessment (LCA)

- how to set up the methodology for the wheat production system
- what computation method & software

- **Task 2.1** (*Gianfranco + Edmondo + Adr UdA + AdR CNR*)

Global Economic Model (GEM)

- ✓ building of a specific module for Italy
- ✓ exploring new market strategies (stock, speculation, ban)
- ✓ translating from Java to Python

- **Task 2.2** (*Gianfranco + AdR UdA +*)

- ✓ design and implementation of an **agent-based model** for the Italian wheat production system (IWS)

- **Task 2.3** (*All*)

Models integration

- ✓ The IWS software will feed the GEM by supplying the Italian wheat production.
- ✓ The IWS needs also to be interfaced with the software performing the LCA
- ✓ Building a script that iterates the execution of the different software representing the four nodes of the project

➤ **Task 3.1** (*Gianfranco + Adr UdA + AdR CNR*)

Simulations in tranquil times

- ✓ configure and run the ECOWHEATALY multiscale model to explore different scenarios in which traditional policies are progressively replaced by green policies in Italy

➤ **Task 3.2**

Evaluation of environmental and wheat production impacts in Italy (*Antonella + AdR UdA + Arianna*)

- ✓ implementation of LCA framework
- ✓ delineation of options for policymakers

Ecowheatly website & web graphical interfaces (*Marco + AdR CNR*)

- ✓ domain name
- ✓ how to set up the web tool for policymakers

- **Task 4.1** (*Gianfranco + Adr UdA + Massimiliano*)

Simulations with global shocks

- ✓ configure and run the ECOWHEATALY multiscale model to include global shocks, such as Global warming, global pandemics, or wars in specific areas

- **Task 4.2** (*Antonella + Arianna*)

Options for policymakers in presence of global shocks

- ✓ when global adverse shocks happen, environmental impacts could be downgraded in the government priorities and the sustainability of wheat production could be threatened

- **Task 5.1** (*Gianfranco + Edmondo*)

Project coordination and administration

- ✓ monitoring the project activities throughout the 2 years

- **Task 5.2** (*Massimiliano + Marco + All*)

Communication, dissemination, and exploitation of project results

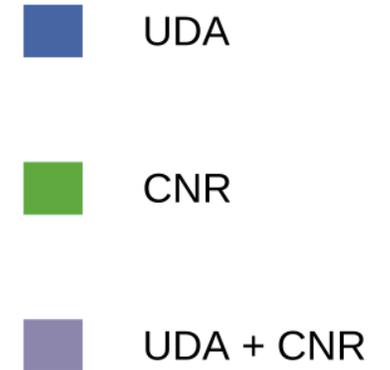
- ✓ communication, dissemination, and exploitation management plan
- ✓ promote transparency and dissemination, the data produced during the project and the methodological improvements will be made public on Open Science platforms and dedicated web pages

WORK SCHEDULE

1° meeting: 20th of Jan

Apr 2023
Task report

Task Name	Task #	Year 1	Year 2	Year 3
Identification of farm type and green policies	1.1	I11		
LCA setup	1.2	I12		
Global Economic Model adaptation	2.1	I21		
Modeling Italia wheat system	2.2		D1	
Global and Italian models integration	2.3		I23	
Simulation in tranquil times	3.1		D2	
LCA evaluation in tranquil time	3.2		D2	
Simulations with global shocks	4.1		D3	
LCA evaluation with shocks	4.2		D3	
Project coordination and amministration	5.1	GA	GA	GA
Communication, dissimination and exploitation	5.2	M1	M2	M3



Oct 2023
UdA

Oct 2024
CNR

Sept 2025