

MIND
STEP



MIND STEP Policy Brief

**Enhancing
Agricultural
Policies through
Individual
Decision Modelling:
Insights from the
MIND STEP Project**



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Highlights

- This policy brief summarises the key achievements and policy recommendations derived from the EU Horizon MIND STEP project (September 2018 to January 2024)
- MIND STEP addresses the integration of individual farmer behavior into the formulation and assessment of agricultural policies
- Including farm level decision making models and farm variables (such as age, income, knowledge and risk behavior of the farmer) into the macro-micro modeling chain frequently used by the European Commission, helps to identify successful policy measures and increase their adoption by farmers
- Farm heterogeneity mean that mitigation policies can only be cost efficient if they are differentiated by farm type
- A gradual implementation of emissions taxes, that gives farmers and markets time to adapt and invest, seems the most cost-effective measure to mitigate climate change and reduce mineral Nitrogen input
- Reinvesting tax revenues into mitigation technologies can mitigate fluctuations in income and prices and further reduces net global emissions
- Regular re-evaluation of farm specific GHG emission levels can ensure that taxation and subsidy strategies are phased out once reduction potentials are achieved



How MIND STEP supports the European Union's Green Deal

The European Green Deal, initiated in 2019, provides a comprehensive policy framework integrating environmental, economic, and social dimensions to combat environmental degradation and promote a sustainable Europe. Key objectives include transforming Europe into the world's first climate-neutral continent by 2050, as mandated by the European Climate Law (EU Regulation, 2021). The Farm to Fork (F2F) strategy, a pillar of the Green Deal, focuses on sustainable food systems by promoting organic farming, reducing pesticide and fertilizer use, and enhancing animal welfare.

The Horizon 2020 MIND STEP (Modelling INdividual Decisions to Support The European Policies related to Agriculture) project aims to support the environmental and social objectives of the European Union within the framework of the European Green Deal. In particular, it addresses the need for the Common Agricultural Policy to better assess the environmental outcomes of policy measures, thus supporting farm-specific measures and greater target-orientation.

How? Between September 2018 and January 2024, MIND STEP has contributed to:

- Allowing a better representation of farm heterogeneity in models
- Improving the representation of individual decision making at farm level in model based policy analyses
- Modeling interactions between farms, while taking advantage of meta-modelling and machine learning approaches
- Improving interfaces between data and models at different scales (farm, regional, national, EU)
- Ensuring transparency of methods, sustainable software development, and model validation



What does MIND STEP recommends to policy makers?

Targeted measures and incentives, differentiated by farm type are crucial for enhancing the adoption of climate mitigation technologies: From a case study investigating the adoption of GHG mitigation measures on Dutch dairy farms it was found that farmers under 45 with bachelor's or master's degrees in agriculture and those operating farms with high livestock density are more likely to have already adopted mitigation measures. Policy makers may find it beneficial to specifically target this demographic for the promotion of additional mitigation measures. Conversely, farmers over 45 with practical farming experience and farms with low livestock density may be better suited for initiatives aimed at encouraging the initial uptake of climate mitigation measures. Policy makers and the dairy sector can cooperate to evaluate the advantages and disadvantages of certain climate mitigation measures, promote long-term benefits of mitigating GHG emissions and organize farm extension services. Fostering learning from peers and developing smart applications to calculate mitigation potential and trade-offs with other farming goals can further encourage adoption. Additionally, compensating short-term costs associated with these measures can make them more appealing to farmers. Given the heterogeneity between farm characteristics, cost efficient policies require that policy measures are differentiated by farm type e.g. different GHG emission reduction targets.

Economic incentives can effectively drive sustainable agricultural practices: In the realm of crop management, economic incentives play a pivotal role. Crop farmers in Italy and France, in particular, respond positively to such incentives, indicating that economic policy instruments could effectively achieve the objectives of the EU Green Deal.

Improved risk communication and support for multi-year contracts can increase crop insurance uptake: Risk assessment studies within MIND STEP shed light on the low uptake of crop insurance, influenced by risk behavior and loss aversion. To enhance insurance adoption among farmers in Germany and Italy, it is crucial to improve the communication of risks, reframe probabilities, and support multi-year contracts.

Farmer demographics significantly impact farm exit decisions, necessitating targeted retention policies: When examining structural changes, the age of the farmer emerges as a



critical factor in farm exit decisions. Policies aimed at retaining farmers should consider the impact of farmer demographics and farm characteristics more significantly than regional factors.

Promoting collective action and strategic framing can enhance participation in Agri-Environmental Schemes (AES): The adoption of Agri-Environmental Schemes (AES) is another area where farmer behavior plays a pivotal role. The project finds that collective action in ecosystem services, such as the use of flower strips, can provide long-term benefits and increase participation. Framing AES economically and ecologically can influence farmers' decisions, and collective payment schemes, where higher participation leads to better environmental outcomes, tend to be more effective than fixed payment schemes.

Coordination among producers can strengthen bargaining positions and improve farm incomes: In supply chain dynamics, the coordination among pig producers in Germany and Italy can significantly strengthen their bargaining position, improving farm prices and incomes. This coordination can be facilitated through producer organizations (POs), which enhance collective negotiating power.

Combined taxation and subsidies are effective strategies for balancing environmental goals and income stability: At a broader policy level, the MIND STEP model toolbox provides critical insights into climate mitigation and the reduction of mineral nitrogen fertilizer use (see textbox). For both climate mitigation and reduction of mineral nitrogen fertilizer use, a gradual implementation of combined approaches of taxation and subsidies (of specific technologies) emerges as a potential strategy to balance income stability and environmental objectives. Gradual implementation of these measures allows farmers and markets time to adjust, balancing income stability with environmental goals. Regular re-evaluation of farm specific GHG emission levels can ensure that taxation and subsidy strategies are phased out once reduction potentials are achieved. Particularly relevant is the role that evolving technology may have in achieving sustainable agricultural practices. Reinvesting tax revenues into mitigation technologies further reduces net global emissions.

Tailored support mechanisms are necessary to mitigate the economic impact of environmental policies on farmers: Specialised crop farms are most affected by a tax on mineral nitrogen fertilizer. Smaller farms, on average, face more significant income impacts, underscoring again the need for tailored support mechanisms.

Model toolbox

The MIND STEP toolbox covers individual decision making (IDM) models at farm level, as well as models that operate at market- or sector level. The latter include the general equilibrium model MAGNET and the partial equilibrium models CAPRI and GLOBIOM. These three models permit the simulation of economy-wide (MAGNET) or sectoral (CAPRI, GLOBIOM) effects of policies or technological change on markets, resource allocation, or agricultural incomes, aggregated at a global or EU level. The addition of the farm-level optimization models FarmDyn, IFM-CAP and the econometric simulation INRAE-MC model in the MIND STEP toolbox allows deeper insights into the adjustment processes that take place, either on representative farms (FarmDyn), or on individual farms (IFM-CAP, INRAE-MC). The advantage of IDM models is that they include heterogeneity between farms and can identify which type of farms would take up a new technology or benefit from a certain policy.

Scenarios

Two policy scenarios in line with Green Deal objectives on GHG mitigation and nutrient loss reduction were implemented and results on individual farms and the farming sector as a whole were compared. The first scenario addressed GHG emission reduction from agriculture under a variety of policy instruments like taxation of emissions or subsidization of emission reduction. In the most extreme variant, GHG emissions were taxed by 130 Euro per ton of CO₂ equivalent (CO₂eq). The second scenario addressed the reduction of nitrogen loss, also under a variety of policy instruments. The impacts of a tax on mineral fertilizers are assessed with and without re-investing tax revenues as subsidy on mitigation technologies. In the most extreme variant, price of nitrogen fertilizers would increase with 132% (corresponding to a tax on mineral fertilizers of 200 Euro per ton of CO₂eq).

References

Links to extended summaries of most policy relevant public deliverables
([Resources](#) | [MIND-STEP](#))

[D1.1 Summary- Key policy questions for ex-ante Impact Assessment of EU Agricultural and Rural Policies](#)

[D1.2 Indicator framework for measuring the impact of policies/global drivers on IDM units in agriculture](#)

[D1.3 Summary- Conceptual Framework fo the MIND STEP Project](#)

[D3.2 Development of a Modular and Customisable Suit of Models Focussing on the Idm Farming Unit](#)

[D3.2 Development of a Modular and Customisable Suit of Models Focussing on the Idm Farming Unit](#)

[Deliverable 3.3: Report on modelling greenhouse gas emission including adoption behaviour of farmers regarding mitigation strategies and interfaces to the MIND STEP model toolbox](#)

[D3.4 Summary - Report on Modelling Crop Management Practices and Implementation in Mind Step Model Toolbox](#)

[D3.5 Report on modelling risk management and interfaces to the MIND STEP model toolbox](#)

[D4.2 Summary- Report on Modelling Structural Change and Farm Interaction on Land Markets and Interfaces With the Mind Step Model Toolbox](#)
[D4.4 Summary- Report to model the supply chain mechanisms and the bargaining position of farmers along the chain and interfaces with the MIND STEP model toolbox](#)

[D4.3 Summary - Experimental findings on willingness to participate in agri-environmental schemes](#)

[D4.5 Report on Integration of Complex IDMS in ABMS and Interfaces with the MIND STEP Model Toolbox](#)

[D5.2 Report on improvements to the current EU and global models](#)

[D6.2 Summary- Report on the validation of the MIND STEP toolbox and the proof of concept](#)

[D6.3 Summary- Stakeholder workshop on transferability, usability and functionality of the MIND STEP toolbox](#)

[D6.4 Policy Evaluation](#)

Relevant policy documents:

European Commission (2019). Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. The European Green Deal, COM 640.

European Union (2021). Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law')

European Commission (2020a). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A Farm to Fork Strategy: For a Fair, Healthy and Environmentally Food System, COM 381.

European Commission (2021a). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil', COM 400.

European Commission (2021b). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. EU Soil Strategy for 2030. Reaping the benefits of healthy soils for people, food, nature and climate, COM 699.

European Commission (2020b). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. EU Biodiversity Strategy for 2030: Bringing nature back into our lives, COM 380.

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