METHODOLOGICAL GUIDELINES

D2.3

DECEMBER 2024

Funded by
the European Union

Tools4CAP has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No. 101086311 . Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

METHODOLOGICAL GUIDELINES

Project name	Tools4CAP: Innovative Toolbox empowering effective CAP governance towards EU ambitions
Website	https://www.tools4cap.eu/
Document type	Report
Status	Submitted
Dissemination level	Public
Authors	Leading authors: Ana Gonzalez-Martinez (WUR); Roel Jongeneel (WUR); Marcel van Asseldonk (WUR) Contributing authors: Peter Witzke (EuroCare); Guna Salputra (EuroCare); Petr Havlik (IIASA); Juliana Arbelaez-Gaviria (IIASA); Trevor Donellan (Teagasc); Emil Erjavec (UL)
Work Package Leader	WUR (Wageningen University and Research)
Project coordinator	Ecorys Belgium

Acronyms

AECM	Agri-Environmental Climate Measure
AECMt	Agri-Environment-Climate Measures ‘transition of practices’
AGMEMOD	AGricultural MEmber states MODelling
CAP	Common Agricultural Policy
CSP	CAP Strategic Plan
CAPRI	Common Agricultural Policy Regional Impact Analysis
DCE	Discrete Choice Experiment
DID	Difference in differences
EARD	European agricultural fund for rural development
EC	European Commission
EFA	Ecological Focus Area
EGD	European Green Deal
EU	European Union
FADN	Farm Accountancy Data Network
FARMDYN	FARM DYNamic optimisation model
GLOBIOM	Global Biosphere Management Model
MAGNET	Modular Applied GeNeral Equilibrium Tool
MS	Member States
NDM	New Delivery Model
Tools4CAP	Innovative Toolbox empowering effective CAP governance towards EU ambitions
RCT	Randomised Controlled Trial
WTA	Willingness To Accept

Table of contents

List of figures

List of tables

Report on methodological guidelines on the use of modelling tools

FOCUS

- **Raise awareness** on the potential role that modelling tools can play in supporting the strategic planning of the CAP.
- Illustrate how modelling tools can be used for the design of the CSPs, listing the **steps** that end users would need to follow and highlighting the potential **challenges.**

METHODOLOGY

- **Literature review**
- **Consultation** with modelling teams and ministry officials

CONCEPT

- Modelling tools are mathematical/econometric models and methodologies for analysis to carry out **ex-ante and ex-post evaluations of the CAP**.
- Modelling tools generate **quantitative evidence based** on statistical data.

EXAMPLE OF MODELLING TOOLS INCLUDED

- **Joint models: eco-scheme simulation tool-FARMDYN-AGMEMOD**
- **CAPRI**
- **GLOBIOM**

HOW CAN MODELLING TOOLS SUPPORT THE POLICY-MAKING PROCESS?

Ex-ante analysis

- Tools are employed before policy implementation and are instrumental in **evaluating potential outcomes, benefits, and risks** associated with various policy options.
- Tools are used for **evaluating and comparing past experiences or similar experiences** from other contexts and assess outcomes under various policies and policy mixes.

KEY MESSAGES

1. Using appropriate modelling tools provides robust and transparent insights for a **solid strategic planning** of the CAP.
2. The use of modelling tools improves the **legitimacy**, **accountability**, and **relevance** of CSPs.
3. Modelling tools enable adaptive management, allowing Member States to **anticipate expected trends and impacts** of policies and other shocks, extending the time frame in which policy-makers can **adjust/fine-tune policies**.

Funded by the European Union

Tools4CAP has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No. 101086311 . Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

2. Executive summary

Deliverable 2.3 aims at encouraging end users to apply modelling tools during the design and implementation of the CAP Strategic Plans (CSPs). More specifically, the concept 'modelling tools' refers to a set of mathematical/econometric models and methodologies for analysis to carry out ex-ante and ex-post evaluations of the CAP, generating quantitative evidence based on statistical data. Ex-ante analysis refers to those cases in which tools are employed before policy implementation and are instrumental in evaluating potential outcomes, benefits, and risks associated with various policy options. In contrast, ex-post analysis tools are used for evaluating and comparing past experiences or similar experiences from other contexts and assess outcomes under various policies and policy mixes. These methodological guidelines capture the general (and practical) aspects to keep in mind when considering their use for policy assessment.

This deliverable has been prepared in the context of Work Package 2 (WP2) – 'Screening and development of innovative quantitative tools'. Among others, WP2 has set-up the selected modelling tools for implementation in the case studies carried out in Work Package 5 (WP5) – 'Replication lab: demonstration, support to adaptation and uptake'.

From a methodological point of view, this deliverable assesses the selected modelling tools and presents in a visual way a summary of the type of inputs, assumptions and background information that each tool needs in order to generate quantitative results. More specifically, the tools covered in this deliverable are: (i) Joint model, including eco-scheme simulation tool, FARMDYN, AGMEMOD; (ii) CAPRI and (iii) GLOBIOM. These tools are used to conduct some case studies in the Netherlands, Hungary and Czech Republic respectively. In addition, other practical aspects such as the steps to be followed when replicating/translating the exercise to another Member State (MS), as well as the challenges encountered during the process are described. The outcomes of this deliverable take as starting point the findings of Task 2.1 – 'Assessment of needs and potential of existing and new models'. In Taks 2.1 a gap analysis was carried out in order to identify those aspects of the current CAP that can already be modelled (and which ones are missing) with the existing tools.

In a nutshell, using appropriate modelling tools play a critical role in ensuring the effectiveness and inclusiveness of CAP Strategic Planning and aligning plans with the demands of the New Delivery Model, creating robust, adaptable, and transparent CSPs aligned with EU-wide objectives. These tools ensure that CAP interventions are performance-driven and evidence-based, shifting the focus from compliance with prescriptive rules to achieving measurable outcomes and empowering MSs and their constituencies in formulating plans that better meet local needs. They enhance policy coherence by systematically linking interventions to CAP objectives and provide structured frameworks for balancing economic, environmental, and social goals. By fostering the use of models, these tools improve the legitimacy, accountability, and relevance of CSPs. Moreover, modelling tools enable adaptive management, allowing MSs to anticipate expected trends and impacts of policies and other shocks, extending the time frame in which policy-makers can adjust/fine-tune policies.

This document aims at raising awareness on the type of insights that modelling tools can deliver, as well as providing the reader with a general understanding of the steps that end users would need to follow when using them. A final remark regarding the use of these methodological guidelines is that given the nature of the modelling tools considered, which often involves computing skills of a certain degree, licensing of the tool, etc., this document is not intended as a user manual to operate tools such as AGMEMOD, CAPRI, FARMDYN or GLOBIOM.

3. Introduction

3.1. Why Tools4CAP?

In the context of a changing Common Agricultural Policy (CAP), the New Delivery Model (NDM) established in Regulation EU 2115/2021[1] introduces national Strategic Plans (SPs) and new monitoring, review and evaluation requirements. In 2019, the European Commission (EC) launched the European Green Deal (EGD) including the Biodiversity Strategy, the Farm to Fork strategy, the Soil and Forest Strategy and the Climate Adaptation plan and established sustainability targets to be achieved mostly by 2030, also through the CAP. The new CAP comes with more responsibility on Member States (MSs), a performance-oriented rather than compliance-based approach, more responsibilities and flexibility for MSs for the design of the SPs and the monitoring framework, as well as a new policy cycle entailing exchange and coordination with the EC.

MSs must acquire new capabilities and set up proper methodological tools to ensure: i) alignment to CAP, GD and SDGs objectives and international commitments; ii) increased sustainability ambition compared to the previous programming period; iii) internal and external coherence of the intervention strategy; iv) consistency from regional to national levels; v) accountability through SMART targets and reflected in funding allocation; vi) reliance on ex-ante evaluations; vii) wide stakeholder engagement and coordination with regional bodies, socio-economic partners, and environmental and climate authorities; viii) process quality, simplification, and modernisation; and ix) cost-effectiveness of the adopted systems.

The Tools4CAP (Innovative Toolbox empowering effective CAP governance towards EU ambitions) project, therefore, in set in the context of a changing CAP and aims to provide CAP decision-makers with suitable tools for a more evidence-based policy making, ultimately improving the capacity to design next generation strategic SPs, and to perform monitoring tasks. To realise its ambitions, the project pursues five specific objectives:

- **Objective 1**. To provide a shared knowledge base and an evaluation of methods and tools used for the design and implementation of the SP.
- **Objective 2**. To identify and adapt innovative methods and tools for the design and implementation of the SP, by taking stock of relevant and replicable solutions developed in recent and ongoing research projects and other EU initiatives.
- **Objective 3**. To empower end users to adopt innovative solutions for the design and implementation of the SP, by providing them with methodological guidance on choosing the best solutions, their operationalisation, and associated good practices.
- **Objective 4**. To establish a replication lab supporting the practical demonstration and uptake of innovative solutions for the design and implementation of the SP, by operationalising and testing methods and tools across case studies.
- **Objective 5**. To set up a capacity building hub to mobilise knowledge and transfer operational capabilities to end users for the design and implementation of the SP, by enabling mutual learning, participation, and science-policy dialogue.

This deliverable especially contributes to objective 3 (see more details below).

3.2. Defining 'modelling tools' in the context of Tools4CAP

The label 'modelling tools' refers to a set of mathematical/econometric models and methodologies for analysis to carry out ex-ante and ex-post evaluations of the CAP, generating quantitative evidence based on statistical data. Ex-ante analysis refers to those cases in which tools are employed before policy implementation and are instrumental in evaluating potential outcomes, benefits, and risks associated with various policy options. Their role is to provide a forward-looking assessment to help policymakers understand potential impacts, thus enabling them to make more informed policy decisions which can bring about more desirable outcomes or avoid less desirable

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R2115.

outcomes. In contrast, ex-post analysis tools are used for evaluating and comparing past experiences or similar experiences from other contexts and assess outcomes under various policies and policy mixes. This retrospective examination provides valuable insights into the effectiveness and impacts of implemented policies, enabling improvements.

More specifically, the list of modelling tools that have been included in the Tools4CAP project are introduced and briefly described in Table 1.[2]

Table 1. Overview of selected tools

Broad category	Tools
Large-scale modelling tools *This type of tool refers to quantitative models that primarily focus on simulating scenarios, interventions, or impacts. In the context of Tools4CAP, 'large-scale' refers to models which are multi-country (EU-wide, world-wide).*	▪ AGMEMOD ▪ CAPRI ▪ GLOBIOM ▪ MAGNET ▪ MITERRA-Europe
Small-scale modelling tools *This category includes a very heterogenous set of tools. On the one hand, it includes simulation models but in this case their geographical scope is more limited than in the previous case – only one country is represented. These tools also have higher level of granularity, i.e. they can include regions and/or farm types. On the other hand, this category include some modelling tools which have a more simple structure, e.g. MS excel-based 'calculators' in which no mathematical optimisation is included to compute indicators.*	▪ Eco-Scheme Farm simulation tool (NL) ▪ Farm income FADN-based calculation tool (NL) ▪ FARMDYN ▪ FAPRI Ireland Model ▪ FARMIS (DE) ▪ IMF-CAP ▪ KOBALAMI (NL) ▪ SiTFarm tool (SI)
Experimental economics *This methodology allows us to generate data in a controlled setting in order to analyse relationships between the intervention of interest and people's actual behaviour or stated intentions.*	▪ Laboratory (lab) experiments, ▪ Contextualised field experiments, ▪ Randomised controlled trial (RCT), ▪ Discrete choice experiment (DCE), etc.

Source: Tools4CAP 2024

3.3. Modelling tools in support of CAP strategic planning

In CAP national SPs, **modelling tools** play a crucial role, particularly in conducting ex-ante assessments of the potential impact of alternative policy measures (scenario analysis). Also for (ex-durante) midterm evaluations and (ex-post) evaluations modelling tools can be of help, for example in order to isolate the policy impact from the impact of (changing) confounding variables. The challenge of making agriculture more sustainable requires an integrated policy approach, while at the same time it raises many trade-offs and other interaction effects, into which policy makers need to have proper insight (e.g. Hermans et al., 2020). An integrated approach is crucial to avoid inefficiencies caused by for example sunk cost and fixed asset problems. As such there is an increasing need for studies, addressing trade-offs (dilemmas) and providing quantitative assessments with respect to economic, environmental, and social indicators (Bos et al., 2023). This poses important and varied challenges for the policy modelling community (Gonzalez Martinez et al., 2022).

[2] Further details on modelling tools are provided in the Tools4CAP Benchmarking factsheet N° 9. Available at: https://www.tools4cap.eu/wp-content/uploads/2024/03/FT9-EU-level-modelling-tools-for-policy-analysis-supporting-the-design-of-CAP-Strategic-Plans.pdf.

As such the modelling tools should (individually or in combination) satisfy a number of key properties, including:

- **Adequate policy representation**: quantitative assessment or modelling tools should have an adequate and refined representation of the relevant policy instruments that need to be assessed. As the point where policies have their impact can differ, be in at the level of commodity markets, primary agriculture, or upstream and downstream supply chain stages, the models need to properly account for that. Also, the distinctive nature of different policy instruments (e.g. incentives, regulations, investments) needs to be accounted for (Sok et al., 2020; OECD, 2021).
- **Take farmer and other actor behaviour into account:** behaviour of farmers and other actors in response to changing market conditions (prices, taxes, subsidies, levies) need to be addressed in a coherent way. This includes responses to non-monetary policy signals and issues such as compliance behaviour (Herzfeld and Jongeneel, 2011; OECD, 2021). It also includes farmer uptake behaviour of management measures or specific agri-environmental and eco-scheme measures.
- **Account for market dynamics**: response to price signals and impacts on variables at sectoral level such as input use, yields, supply, demand for various uses, imports, exports and stock holding behaviour. Coherence should be ensured by requiring the models to have consistent balance conditions.
- **Account for supply chain stages and their interlinkages:** the modelling tools need to embody sufficient knowledge about the structure (e.g. farm and firm size distribution) of each represented sector and its linkages with up- and downstream sectors.
- **Provide an adequate representation of the agronomy and environmental and climate aspects of agriculture:** agricultural production is characterized by agronomic relationships and processes (e.g. relevance of soil conditions and crop fertilization and protection issues) and by jointness between its regular output (crops, milk, meats) and environmental and climate emissions. The modelling tools need to sufficiently capture these aspects, because all these aspects are subject to policy approaches and ambitions (e.g. the 9 specific objectives and the cross-cutting horizontal objective of the CAP).
- **Take the relevant context into account:** the modelling tools should be able to take into account the relevant broad(er) context (e.g. world market impacts, macro-economic conditions, such as GDP-growth, inflation, exchange rate, energy prices, and other contextual variables such as population growth, age-distribution) in which EU and national policies will be implemented (see, also, socio-economic context analysis in Chapter 3, Figure 1).

If, and to the extent that, the quantitative modelling tools, be it on their own or in combination, satisfy these properties, they can be used by policy makers to analyse policy options and the trade-offs and side effects that may be generated by such options, which can be helpful for intervention setting (see, also, Chapter 3, Figure 1). An advantage of quantitative modelling tools is that when there are factors that are counteracting each other (and where qualitative reasoning maybe insufficient to come to a conclusion on the net effect) these tools still can come with quantitative results.

With the latest CAP reform a new delivery model (NDM) has been chosen, which emphasizes the performance aspects of policies. Key aspects of the NDM are:

- **Performance monitoring**: under the NDM, Member States are required to monitor and report on their progress using a **Performance Monitoring and Evaluation Framework (**PMEF**).** This framework includes indicators (output, result, and impact indicators) that track the achievements of CSP objectives.
- **Enhanced flexibility for Member States**: the NDM allows Member States to design CSPs based on their own agricultural, environmental, and socio-economic contexts. This flexibility enables tailored approaches that address specific national or regional needs, while aligning with broader CAP goals.
- **Annual performance reporting**: each MS must submit annual performance reports to the EC, detailing progress towards meeting the targets set out in their CSPs. This replaces previous compliance checks, focusing instead on whether objectives are met rather than on how resources are used.

- **Focus on results and accountability**: by shifting the emphasis to measurable results, the NDM aims to improve the CAP's accountability. MS are now accountable for achieving agreed-upon outcomes, which helps justify CAP funding allocations based on demonstrable impacts.

The NDM thus fundamentally redefines the CAP's governance by promoting a results-oriented approach that respects MS' unique contexts while ensuring alignment with EU-level objectives. However, in order to ensure that a MS' CSP truly matches its needs, a sound evidence base must be ensured, which can and should partly be achieved through the use of quantitative assessment methods and tools that support needs-based planning, transparency, adaptive management, prioritization of interventions, and accountability. The use of these tools can support policy makers in creating CSPs that are effective, transparent, robust and efficient. Chapter 3 provides an overview of the elements (policy tasks) of the NDM that are particularly suited to be addressed using quantitative modelling tools.

Regulation (EU) 2021/2115 also calls for alignment between CSPs and the (EGD) objectives, particularly those of the Farm to Fork and Biodiversity strategies, to foster the use of sustainable farming practices and make agriculture more resilient to climate and environmental changes. The Commission staff working document 'Analysis of links between CAP Reform and Green Deal' (EC, 2020) provides an overview of the links between the reform and EGD objectives. Quantitative policy impact assessment tools (e.g. bio-economic and environmental models) can significantly contribute to achieving these **objectives** by providing policy scenarios impact assessments that can be used as input into the CAP Strategic Planning (CSP) process by providing evidence about the results that may be expected. They can:

- **Support the transition to sustainable agricultural practices**: quantitative modelling tools can provide impact assessments that include a wide range of economic (e.g. market and price impacts, impacts on farm income), environmental (e.g. ammonia and greenhouse gas emissions), biodiversity and social (e.g. employment) impacts, which are crucial to be considered in an NDM-policy approach. This is even more so when the modelling tools have well-established linkages with respect to output, result and impact indicators, as these are part of the CAPs monitoring and evaluation framework.

- **Strengthen the evidence-based justification of policy choices**: Quantitative modelling tools include a detailed representation of the mechanisms and behavioural changes induced by policy changes, that can rely on an adequate empirical basis. By that these tools can contribute to strengthen the evidence-based nature of policy making. Moreover, specific tools (e.g. experimental economics) can be very useful for (ex-post or ex-durante) policy impact evaluation, identifying and 'isolating' the real effectiveness of specific policy interventions.

- **Contribute to determining the joint-effort of a plethora of implemented policy measures:** As policy interventions usually do not stand on their own, but are implemented as being part of a set of measures (policy measure packages) determining their joint impact with respect to key policy performance indicators is crucial. Quantitative modelling tools are strong on delivering such insights, while taking into account positive and negative interaction effects between measures. This is important for policy makers at regional, national and EU level in understanding the joint-effort of implemented policies.

By integrating participatory tools into the CAP, MSs can effectively address CAP, Farm-to-Fork, EGD and other objectives, making agricultural practices more sustainable, climate-resilient, and transparent.

3.4. Purpose and audience of these guidelines

These methodological guidelines aims at encouraging end users to apply modelling tools during the design and implementation of the CAP national CSPs. It relies on insights from the following Tools4CAP deliverables:

1. **Tools4CAP – Conceptual Framework (D1.2):** This deliverable outlines the CAP's shift towards a performance-based approach under the NDM. It provides a comprehensive conceptual picture of the design and monitoring of the CSPs, examining the tools and methodologies selected by MSs and the factors influencing these choices.

2. **Tools4CAP – Evaluation and Benchmarking of Methods and Tools (D1.3):** This document evaluates the methods and tools used by EU MSs for designing and monitoring their CSPs, highlighting strengths, weaknesses, and potential improvements to facilitate their future replication. It includes benchmarking factsheets, evaluation criteria, and key findings for each tool category, providing MSs with a detailed understanding of available tools and practices to support informed selection and adaptation for future CSPs.
3. **Tools4CAP – Assessment of the potential of existing and innovative modelling tools (D2.1):** This report provides an assessment of the potential of selected modelling tools against their actual application along the governance of the CSPs in order to identify operational needs at MS and EU level. This document also elaborates on the potential of combining modelling tools, as well as using other approaches such as experimental economics.

These methodological guidelines targets all stakeholders involved in agriculture, rural development and environmental governance within the EU. More specifically, the following audiences could benefit from the present report:

- **National CAP Managing Authorities (MS level):** as the primary implementers of CAP Strategic Plans, these authorities can benefit from guidance on effectively integrating modelling tools into CSP design and evaluation. This document aims at inspiring them to understand better how modelling tools can deliver quantitative (and forward-looking) insights that can be used to design/fine-tune agricultural policy.
- **Regional and local government bodies:** local and regional authorities are key actors for the implementation of the CAP 'in the field'. Benefits in this case are two-sided. On the one hand, these stakeholders can take more informed decisions regarding upcoming policies that are being considered. On the other hand, modelling teams can at the same time further improve the quality of their tools by getting insights at local level, e.g. additional data, feedback on model responses, etc. These improvements eventually also have implications for the CAP end users who have access to improved tools for analysis.
- **EU institutions and CAP oversight bodies:** it can be useful for bodies like the European Commission's Directorate-General for Agriculture and Rural Development (DG AGRI) to be provided with quantitative insights that helps them to anticipate the potential consequences of EU-wide policies. This type of insights can be useful in order to design or fine-tune policies, establishing targets, informing and guiding stakeholder consultations, etc.
- **CAP networks and Monitoring committees:** Mandatory bodies at the MS level tasked with improving the design, implementation and monitoring of CSPs, can also use modelling tools to support their work, by making use of 'transparent' quantitative insights.
- **Agricultural advisory services:** support CAP authorities by offering expertise in policy design and especially implementation. Methodological guidelines on modelling tools can offer some assistance on how to generate quantitative insights that can inform the discussion with stakeholders. This is particularly useful where there are conflicting interests//trade-offs between the different groups involved.
- **Stakeholder groups and civil society organizations (NGOs):** farming associations, environmental NGOs and rural development groups are essential contributors to CAP planning and monitoring. As in the case of agricultural advisory services, these guidelines have an illustrative purpose to show them some examples of quantitative insights that they could have access to by 'employing' modelling tools. These insights could be useful to support and enrich the discussions regarding the CSP as indicated above.

3.5. How to use these guidelines

In order to help (or inspire) end users to make use of modelling tools when designing or assessing the potential impacts of the CAP, these guidelines have been prepared by paying special attention to the practical aspects of their use. First of all, a general overview on the principles supporting the utilisation of modelling tools for evidence-based policy making is provided. Subsequently, four applications of the selected modelling tools included in Tools4CAP are elaborated on. These applications are used to illustrate the potential contribution of modelling tools to the policy-making process. Therefore, the focus is not on the specific modelling outcomes, instead, the focus is on sharing the key lessons that could help other end users when thinking of conducting a similar type of analysis. Other practical aspects such as the steps that need to be followed when replicating/translating the exercise to another MS, as well as the challenges encountered during the process are presented. A detailed description of the selected modelling tools is beyond the scope of the document. However, links to the relevant model documentation are provided where relevant.

A final remark regarding the use of these methodological guidelines is required. This document aims at raising awareness on the type of insights that modelling tools can deliver, as well as providing the reader with a general understanding of the steps that end users would need to follow when using them. Given the nature of the modelling tools considered, which often involves computing skills of a certain degree, licensing of the tool, etc., this document is not intended as a user manual to operate tools such as AGMEMOD, CAPRI, FARMDYN or GLOBIOM.

3.6. Structure

After this introduction, the layout of this report is as follows:

- Chapter 3 elaborates of the policy challenges and related policy needs.
- Chapter 4 presents the methodological guidelines for conducting an assessment by means of a selection of models that are jointly used. This example focuses on a case study carried out in the Netherlands.
- Chapter 5 describes the methodological guidelines to be used when thinking of applying the CAPRI model for CAP assessment. Hungary is the country selected for this case study.
- Chapter 6 provides the relevant methodological guidelines to carry out an assessment of different aspects of the CAP by means of the GLOBIOM model. In this case, Czechia has been selected for conducting the case study.
- Chapter 7 presents the methodological guidelines for conducting an assessment by applying experimental economics. This example focuses on the case study carried out in France.
- Chapter 8 presents key concluding remarks and summarises the lessons learnt.

4. Policy challenges (and related needs)

4.1. Guiding principles of the CSP policymaking processes and options for integrating modelling tools

Integrating modelling tools into the CSP policymaking process requires a structured and strategic approach. The structured use of these tools, guided by principles of the NDM, will empower Member States to build CSPs that are both impactful and resilient by enhancing transparency, inclusivity, accountability, and evidence-based decision-making. This section outlines the principles essential for incorporating modelling tools effectively in the CSP processes, aligned with the NDM. Furthermore, examples of tools serving the principle are provided.

Evidence-based policymaking

- *Objective:* Base policy decisions on empirical data, research, and rigorous analysis.
- *Description:* Evidence-based policymaking relies on collecting and analysing quantitative and qualitative data to guide decisions and evaluate potential impacts. The NDM's performance-based focus requires tools that integrate data into every phase of the policy cycle, from design to monitoring.
- *Outcomes:* Improved policy coherence, consistency, and effectiveness, as policy interventions are founded on concrete data and realistic projections.
- Example tools:
    - **Large-scale model:** This type of tool relies on a large set of statistical data that has been processed to map a conceptual framework, ensuring consistency in the system. These tools usually provides a well-designed (validated) baseline. By comparing scenarios to a given baseline, policy makers can quantify potential impacts of policies and shocks, and therefore, design proper strategies to mitigate risks/impacts.
    - **Small-scale model:** Similarly, small scale models rely on statistical data that can be gathered and processed to fit a conceptual framework. The complexity of this framework can substantially differ among tools, as can the type of outcomes that they deliver (some tools can deliver forward-looking outcomes going to 2030 or beyond, while others have a static nature based on more simple calculation tools.

Transparency in decision-making

- *Objective*: Enhance trust and accountability by making decision-making processes open, visible and understandable.
- *Description*: Transparency ensures that decisions are well-documented, accessible, and communicated to stakeholders in a timely and comprehensible manner, enabling stakeholder contributions where appropriate. Given the CAP's rather complex governance structure, transparency reduces potential misunderstandings and fosters a collaborative environment.
- *Outcomes*: Increased stakeholder trust, accountability, and support for CAP measures through clearer understanding of the decision-making process.
- Example tools:
    - **Large-scale model:** The use of quantitative insights that are generated by means of transparent calculation rules, in a consistent manner and based on robust statistical data can certainly contribute objective insights to inform the decision-making process.
    - **Small-scale model:** The same remarks as in the case of large-scale modelling tools are applicable for this type of tools.

Inclusive stakeholder engagement

- *Objective*: Ensure diverse stakeholder involvement throughout CAP planning and implementation.
- *Description*: The inclusion of stakeholders — from farmers, environmental NGOs, and local authorities to researchers and the general public — is fundamental to the broad societal acceptance of CAP measures. This involvement builds legitimacy, captures ground-level insights, and ensures policies are grounded in the reality of those who are impacted by them.
- *Outcomes*: A stronger sense of ownership, social cohesion, and commitment to policy objectives among stakeholders.
- Example tools:
- **Experimental economics:** This tool can effectively help when trying to identify stakeholders' priorities and needs (mostly farmers), as well as their behaviour or position with respect to the adoption of measures or new practices.
    - **Large-scale and small-scale models:** A key element to improve stakeholder engagement is to ensure that modelling results are 'easy' to understand by non-modellers. Therefore, models which offer intuitive results for non-economist are can make a good contribution. An example of this, is the AGMEMOD model whose baseline projections are generated also taking into account market expert feedback in an iterative process.

Flexibility and adaptability

- *Objective*: Allow for policy adjustments in response to changing circumstances or new insights.
- *Description*: Given the dynamic nature of agriculture, climate, and rural development needs, as well as a shifting external policy environment, flexibility is essential in CAP policymaking. Policymakers must be able to adjust strategies as a response to policy shocks such as wars, as new data relevant to policy implementation emerges, or as feedback from monitoring processes indicates a need for change.
- Outcomes: Policies that remain relevant and effective over time, with an improved capacity to respond to unforeseen challenges and evolving stakeholder needs.
- Example tools:
    - **Large-scale model:** Policy-makers can benefit from conducting ex-ante assessment which delivers insights over a period of time. Having an indications of possible 'trajectories' that agriculture could follow given certain developments could give them additional 'time' to implement and adjust policies permitting them to eventually reach intended targets.
    - **Small-scale model:** When small scale models include a time dimension (dynamic) this can support end users to anticipate impacts in a similar way as large-scale models.

Accountability and monitoring

- Objective: Ensure that policies achieve their stated objectives through regular monitoring and reporting.
- Description: Accountability in CAP policymaking entails tracking the progress of interventions and evaluating their impact against predefined indicators. Ideally, the indicators should be aligned with the PMEF.
- Outcomes: Greater alignment with the CAP's objectives, ensuring that interventions are not only implemented but are also effective in achieving the desired outcomes.
- Example tools:

- **Experimental economics:** This tool is a well suited instrument to 'measure' the expected behaviour or position of key end users with respect to the policy measures or new practices (mostly farmers). When applied at different moments, policy makers can assess if there are changes in how measures are perceived, e.g., is expected participation higher than in the past? what are the driving factors of this change?

Coherence with the EGD and SDGs

- Objective: Align CSPs with overarching CAP objectives, the EGD, as well as the SDGs.
- Description: CAP policies must be coherent across EU and national levels, ensuring that national CSPs support broader EU sustainability and climate goals. This requires tools that help assess the interconnections and dependencies between various objectives, interventions, and impacts.
- Outcomes: More integrated policy frameworks that advance EU-wide ambitions while addressing unique MS needs.
- Example tools:
  - **Large-scale model:** This tool relies on a well-developed framework, often including interaction between different agricultural activities, policy measures, and in some cases the modelling of environmental indicators.
  - **Small-scale model:** When having a sufficient degree of complexity such as FARMDYN and IFM-CAP, linkages with external elements that are intersecting with the CAP are presented to a certain extend. Moreover, some social aspects which are excluded from large-scale models can be assessed with this type of tool (at least as a very basic level).

Efficiency and cost-effectiveness

- Objective: Optimize resource use to maximize policy impact.
- Description: With limited resources, CAP interventions must be designed to deliver maximum benefit relative to cost. Tools that facilitate efficient prioritization and allocation of resources can help construct CSPs whose interventions are both impactful and sustainable within budgetary constraints, ensuring prudent spending of taxpayer funds. This principle is closely related to the principle of evidence-based policymaking and is becoming increasingly important as new EU budgetary priorities emerge and taxpayers demand stronger substantiation of CAP funding.
- Outcomes: Enhanced resource efficiency, enabling CAP interventions to achieve more significant outcomes within available budgets. Broader acceptance of the policy among taxpayers.
- Example tools:
  - **Large-scale model:** This tools often include optimisation rules permitting to identify the 'best' allocation of financial resources, or the 'optimal' land use.
  - **Small-scale model:** The previous remark is also applicable for small-scale models.
  - **Experimental economics:** The use of this tool can deliver insights on how to boost adoption or participation in a measure, as well as their impact. This tool can also allow policy makers and other end users to identify priorities, which is essential when thinking of achieving targets in an effective manner.

4.2. Inclusion of tools in the design, implementation and monitoring phases of CSP

While the main focus of Tools4CAP is on the design phase for CSP, the tools described in this deliverable are in many cases useful for subsequent phases as well, especially given the fact that CSP design is not a static process and that the plans and their performance are regularly reviewed and revised both by MS themselves as a product of continuous policy learning, and by the EC as part of the Annual performance review stipulated in Articles 128 and 134 of Regulation 2021/2115, during which the Commission assesses the progress towards targets and objectives defined in the CSPs based on the output and result indicators defined in the PMEF. More specifically, modelling tools can be used for example to fine-tune the measures/instruments initially proposed in the CSP. As an illustration, we provide some evidence in the case of the Netherlands.

In principle, the yearly use of modelling tools (as well as other tools to support evidence-based policy-making) can help prevent ineffective planning that results in policy failures such as low buy-in for measures or even large-scale political turmoil, and thereby frequent modifications of plans, which entail further administrative costs. Quantitative insights, and the conceptual frameworks underlying modelling tools, can help end users to understand better the trade-offs that could emerge with the implementation of a given policy. The outcomes of modelling tools can also help end users to structure their discussions with each other, as well as rising awareness of the potential impacts that a policy can have on other end users. This certainly contributes to the inclusiveness of the policy-making process.

Design Phase

As already stated, Article 106 of Regulation 2021/2115 mandates Member States to consult economic, social, and environmental stakeholders in the CSP preparation. They must report on this consultation in one of the mandatory annexes (specifically, Annex III, detailed in Art. 115(3)). Managing authorities and other planners can incorporate modelling tools such as experimental economics in the design phase of CAP Strategic Plans (CSPs) to ensure that policies reflect the needs of agricultural and other relevant stakeholders.

Modelling tools can provide a useful instrument to identify priorities/needs and to quantify them. During the design phase it is often the case that the views of different groups of stakeholders are not aligned. Here modelling tools can help policy makers (and other relevant end users) to ‘guide’ the discussion by providing alternative pathways for the future of agriculture. These alternative pathways can give additional insights on existing trade-offs (or even lead to the identification of new ones), which can enrich the context in which decision-making happens.

Implementation Phase

During implementation, modelling tools enable end users to obtain additional insights/feedback, ensuring transparency and adaptive management. Modelling tools can help end users to learn from the experience so far and deliver quantitative insights to support policy makers to fine-tune and revise (if needed) the measures initially included in the CSPs. Sharing the insights delivered by modelling tools with relevant end users can favour the achievement of an optimal resource use as well as increasing the engagement with given policy instruments, and ultimately, with the whole CSP and relates policy cycle. An important consideration to be made when thinking of using modelling tools is the importance of building a certain degree of ‘trust’ in the exercise. In order words, end users should have information regarding the data sources that are used to ‘feed’ modelling tools, as well as any other assumptions that are adopted by the modelling tools. This could help end users to recognise the modelling outcomes easier than in those cases in which a modelling tool is perceived as a ‘black box generating numerical input’. Involving end users at an early stage during the design of the scenario can create a better understanding of the exercise carried out by means of a modelling tool. When properly designed, forward-looking scenarios generated by means of modelling tools can support end users to make well-informed decisions.

Monitoring Phase

In the monitoring phase, modelling tools also play an important role in assessing the expected (or so far) progress so far in terms of selected CAP indicators, ensuring that CSPs deliver measurable impact. The PMEF mandates ongoing tracking against predefined indicators, making tools like stakeholder feedback surveys, scenario building, and data visualization platforms highly relevant. Moreover, the CSP regulation (Article 124) demands the setting-up of a Monitoring committee in each MS, which must include both public authorities and other partners (see e.g. this document for guidelines on their effective setting up and functioning). Tools described in this document can be indirectly used by bodies such as the Monitoring committee or the National CAP network to gather and structure broader stakeholder preferences, allowing them to assess (and anticipate) interventions' effectiveness, analyse trade-offs, and engage stakeholders in transparent reporting processes, building trust in the CAP’s accountability. This is especially relevant for gathering feedback on potential implementation issues with new kinds of interventions, such as result-based agri-environmental schemes or eco-schemes (see, Chapter 4 for some evidence in the case of the Netherlands). By openly sharing results and integrating stakeholder insights in a timely manner, managing authorities not only comply with legislative requirements, but enable continuous stakeholder feedback and thus an iterative learning process, improving both current and future CSP design and increasing legitimacy.

The next section provides more detail on including the use of modelling tools into different segments of the CSP process, broken down per policy task that CSP authorities must fulfil.

4.3. Policy tasks and end-user needs in CSP design

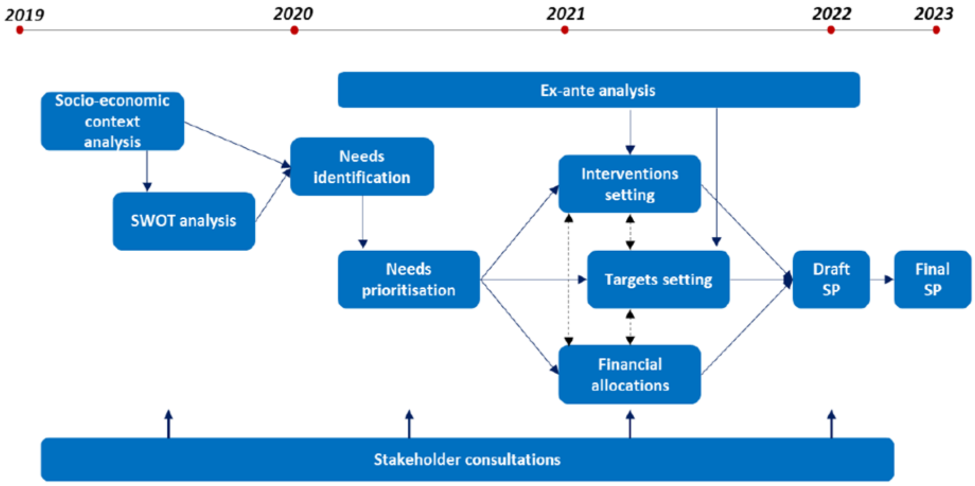
According to the NDM detailed in Regulation 2021/2115, the preparation of CSPs should rely on the involvement of all relevant national and regional authorities, as well as competent authorities for the environment and climate, and the relevant stakeholders, including economic and social partners, bodies representing civil society and bodies responsible for promoting social inclusion, fundamental rights, gender equality and non-discrimination (Article 106; see Tools4CAP Deliverable 1.2 for further detail on the NDM). In the context of the NDM, policy-makers should keep in mind the potential contribution that modelling tools can bring to the design of the CSPs. Due to its nature, i.e. modelling tools are based on statistical data, this set of tools are particularly well-suited to deliver (forward-looking) quantitative insights that can be easily tracked and generated by means of transparent calculation rules. These type of quantitative insights can be crucial when there are trade-offs or conflicting views regarding a given policy, providing a clear common ‘ground’ for all stakeholders.

For the design of the CSP, MSs are required to provide an intervention strategy (Article 109 of Regulation 2021/2115) with interventions based on a “sound intervention logic”, which should in turn be based on:

1. An assessment of the socio-economic context – see, Figure 1, socio-economic context analysis;
2. A SWOT analysis for each specific objective (SO) – see, Figure 1, SWOT analysis;
3. An assessment and prioritisation of needs for each SO, based on the SWOT analysis – see, Figure 1, needs identification and needs prioritisation;
4. Ex-ante evaluation of the CSP and Strategic environmental assessment (SEA), which assess the contribution of the CSP to achieving SOs, the internal coherence of the CSP, the consistency of the allocation of budgetary resources, and the appropriateness of the quantified target values – see, Figure 1, intervention setting, target setting, financial allocations, draft SP; and
5. Broad stakeholder consultations – are shown in Figure 1, they were taking place over the period 2019-2022.

The Tools4CAP Conceptual framework builds around these policy tasks, as shown in Figure 1.

Figure 1. Schematic example of the CAP Strategic Plan design steps



Source: Tools4CAP, Deliverable 1.2

Although modelling tools can contribute to the different stages presented in Figure 1, they are particularly well-suited to carry out ex-ante analysis. This is so since many of the modelling tools can help us to 'project' the future. Here one clarification is due. The modelling tools considered in Tools4CAP are not instruments to generate a precise 'forecast'. They are instead useful tools to anticipate key trends that agriculture (or they food system) could follow in the future given a set of existing policies and specific assumptions regarding various uncertain elements, e.g. exchange rate, population development, oil prices, normal climatic conditions.

Modelling tools can provide additional information and improve the decision-making process. More specifically, all the models presented in these methodological guidelines can play a role when conducting impact assessment since they cover different sectors and dimensions, e.g. economic, environmental, social, etc. In this regard, modelling tools can assist policy makers to better select interventions as well as helping them with their design.

The tools presented in this deliverable can make a useful contribution to multiple phases of the CSP design process. Therefore, CAP end users are encouraged (when feasible/optimal) to combine insights from several tools to enrich/complement the findings of each other.

5. Case study I: Joint models (Eco-scheme simulation tool, FARMDYN, AGMEMOD)

5.1. Description of the case study

Objective

The case study conducted in the Netherlands aims at estimating the effects of different options for the design and the hectare payments of the planned eco-schemes on the expected uptake and the required budget. Options include for example alternative specifications regarding the eligibility of fallow land as a crop and options to promote low-input grassland management.

Box 1. Illustration of key policy questions

A selection of key policy questions that can be answered by means of the eco-scheme simulator tool is provided below:

- At what level should the point requirements for the medal colours bronze, silver and gold be set in order to use the budget as effectively as possible?
- Is the adoption rate in line with the available budget?
- Is there a need for increasing the allocated budget when aiming at a 'certain' sustainability level in agriculture?
- Are the farmers who made the 'strongest' efforts the ones rewarded the most?
- Are there any differences between given farming systems in terms of sustainability indicators?
- What are the expected effects of adopting different grazing patterns in the case of livestock farming?
- What are the expected impacts of increasing organic production in terms of total production, prices and consumption per capita? Are there any changes in net trade? Are there any related impacts on farm income, budgetary allocation, etc.?
- What are the expected outcomes in terms of supply, consumption and net trade of increasing the share of protein crops in the EU? Are there any impacts on prices related to such an increase?

Selected tool

This case study combines elements at farm level, e.g. adoption of certain practices at farm level and the impact on income, with the broader (and ultimate) sustainability goal which should be achieved for primary agriculture as a whole. When aiming at analysing impacts at different levels, e.g. farm versus sectoral, it may be the case that no single tool that can effectively deliver both farm and aggregate level insights. In this case, it can be considered as a 'good practise' to 'join tools', i.e. use several modelling tools which have a different focus, e.g. one tool that covers primary agriculture (sectoral level) and another tool which considers various farm types. 'Joining tools' in this context can create a system in which there is an exchange of information between the tools in order to produce more detailed modelling outputs. For example, production (and output prices) can be calculated by means of the sectoral tool, with the farm level tool then used to translate the sectoral-level production indicator into a production indicator for the various farm types.

Drawing attention to this specific case, the 'Joint eco-scheme-farm income' model combines three quantitative farm-level models: FARMDYN, AGMEMOD, and the eco-scheme simulation tool. In the Dutch eco scheme-system, farmers can select sustainable farm activities or management practices from a menu-list of activities (containing more than 20 different eco activities). Each activity converts to eco-points with respect to five different objectives (environment, climate, water, biodiversity and landscape), which eventually are translated into hectare payments. More specifically, the focus is on showing the value added of using the outputs of the two models combined with the eco-scheme simulation tool that have been used in the Netherlands to make operational the system implemented in 2023.

In this context, FARMDYN was used as a supportive tool. Ecosystem services affect farm income, depending on the combination of measures adopted. In the FARMDYN model the eco-scheme options have been included to support the design phase (i.e., which combinations are viable options for different type of farms by means of an ex-ante analysis). As part of this integrated approach, the Dutch country model of AGMEMOD was updated to reflect the CAP Strategic Plans. This update covered financial and policy data, as well as the implementation of the eco-schemes. Subsequently, the AGMEMOD outlook (e.g. prices) is used as data input for populating the FARMDYN model.

Overall, the selected farm-level and sectoral models provides support to both farmers (in selecting eco-schemes) and policy-makers (in calibrating interventions and financial allocations). It is especially useful where score systems are employed to determine eco-scheme payments levels.

Relevant policy design and monitoring tasks

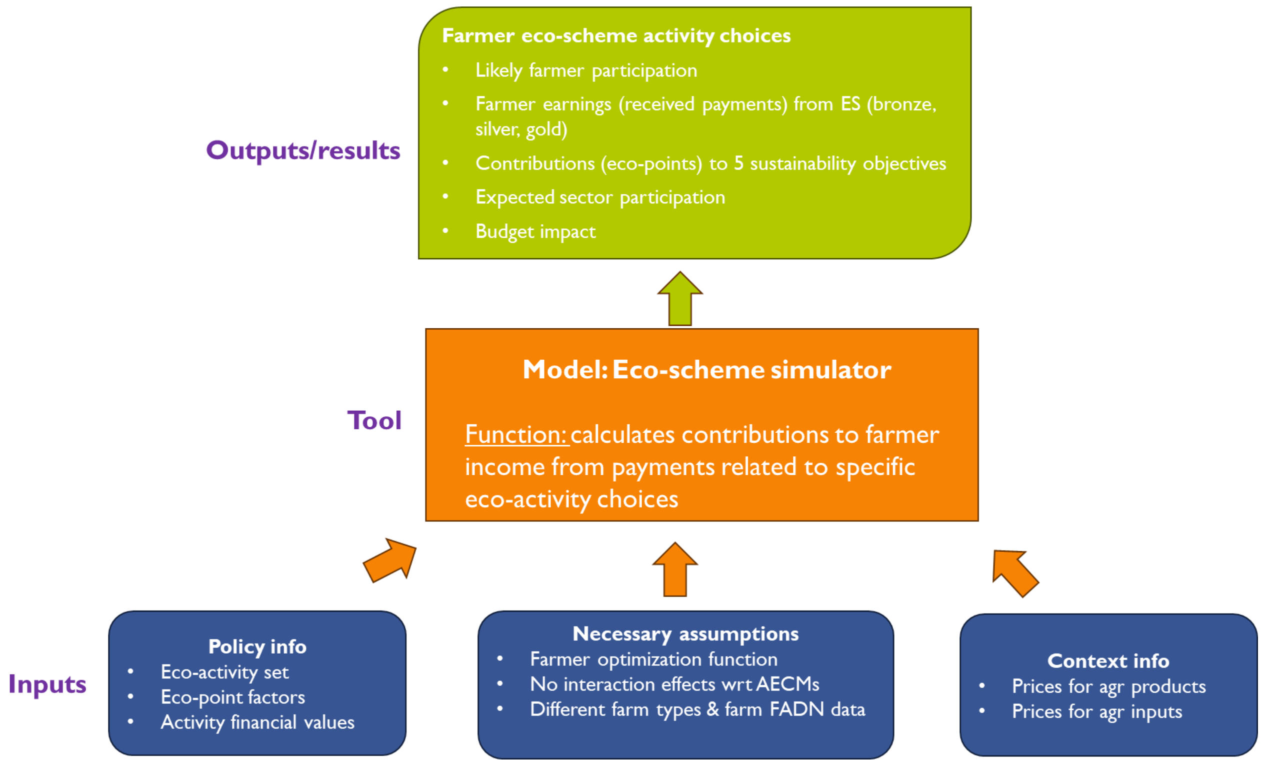
The integrated tool that has been developed for this specific case could be reused in the future to carry out ex-ante analysis in terms of the potential impacts of different financial allocations (system of payments) on farm income in the Netherlands.

5.2. Description of the tool

5.2.1. Eco-scheme simulator

The eco-scheme simulator tool (Jongeneel and Daatselaar, 2024) was developed to support the Ministry of Agriculture, Fisheries, Food Security and Nature (LVVN) and the paying agency (RVO) in the recalibration of the eco-scheme system introduced in the Netherlands in 2023 (Jongeneel and Gonzalez-Martinez, 2023). This system rewards farmers based on their effort (bronze, silver, gold) and the eco-points they obtained when implementing certain measures. The strong adoption of measures in the course of 2023 has created a need for adjusting and refining the system in other to use the allocated budget in the most effective manner possible.

Figure 2. Eco-scheme simulator tool



Source: Tools4CAP 2024

In this specific context, a team of researchers from Wageningen University and Research (WUR) has developed a calculation tool (Figure 2) which captures the trade-offs faced by farmers when participating in the eco-scheme. This tool contains the key parameters of the eco-regulation (especially point requirements) that can be easily adjusted in order to simulate various scenarios. Based on the outcomes of several scenarios, the relevant end users were provided with a proposal to introduce medal-specific thresholds as a tool to strengthen the sustainability contribution that can be achieved through the eco-scheme and at the same time somewhat reduce the likelihood of 'too easily' achieving very high value scores (gold).

An schematic description of the eco-scheme simulator tool is presented in Figure 2. As already introduced, the main objective of this tool is to calculate the contributions to farmer income from payments related to the implementation of specific eco-activities. Focusing on of the indicators that the tool can deliver, when running several scenarios, end users will be able to get insights regarding the likelihood of participation in the scheme and the potential earnings that farmers could receive depending of their score in the medal system (bronze, silver, gold). Additional indicators that the tool can deliver is the contribution of the selected activities to the five sustainability objectives,[3] the expected sector participation and the related impacts on the overall budget.

Drawing attention to the input requirements that needs to be satisfied when running the eco-scheme simulator, three building blocks can be distinguished: (i) policy information; (ii) necessary assumptions; and (iii) contextual information. To begin with, end users need to describe the policy under consideration by indicating for example the menu of eco-activities, the level of eco-points that can be achieved when selecting/implementing a measure, as well as the payments that are allocated for each activity. Subsequently, the tool should be 'fed' with an assumption regarding the optimization function representing the behaviour of farmers and assumptions regarding the potential interaction effects (or its absence) with regard to Agri-Environmental Climate Measures (AECMs). The tool also requires clear assumptions in terms of the various farm types existing in the Netherlands and their main characteristics. The Farm Accountancy Data Network (FADN) is the most suitable source for this purpose. As part of the final step to populate (and update) the tool, the context in which agricultural activities will take place needs to be captured by the tool. In doing so, information on prices for both agricultural inputs and outputs should be entered in the tool. As will be further elaborated later in this report, the type of output prices that are required could be taken from statistical sources or calculated by another tool such as AGMEMOD.

5.2.2. FARMDYN

More than a decades ago, the FARMDYN (Figure 3) model was developed as a modelling tool to simulate the behaviour of farmers per farming type (e.g., dairy, beef fattening, pig fattening, piglet production, arable farming, biogas plants).[4] The model is currently available for a selection of MSs, including Germany and the Netherlands.

This modelling tool has been used in a variety of studies including the assessment of various novel farm management options, the simulation of the potential impacts of different farming systems with regard to sustainability indicators and the quantification of potential nutrient exchanges between farms in regions of North Rhine-Westphalia. In the Netherlands, this modelling tool has been used also to explore the impacts of Circular Agricultural Policy on Dutch dairy and arable farms (Helming et al., 2023).

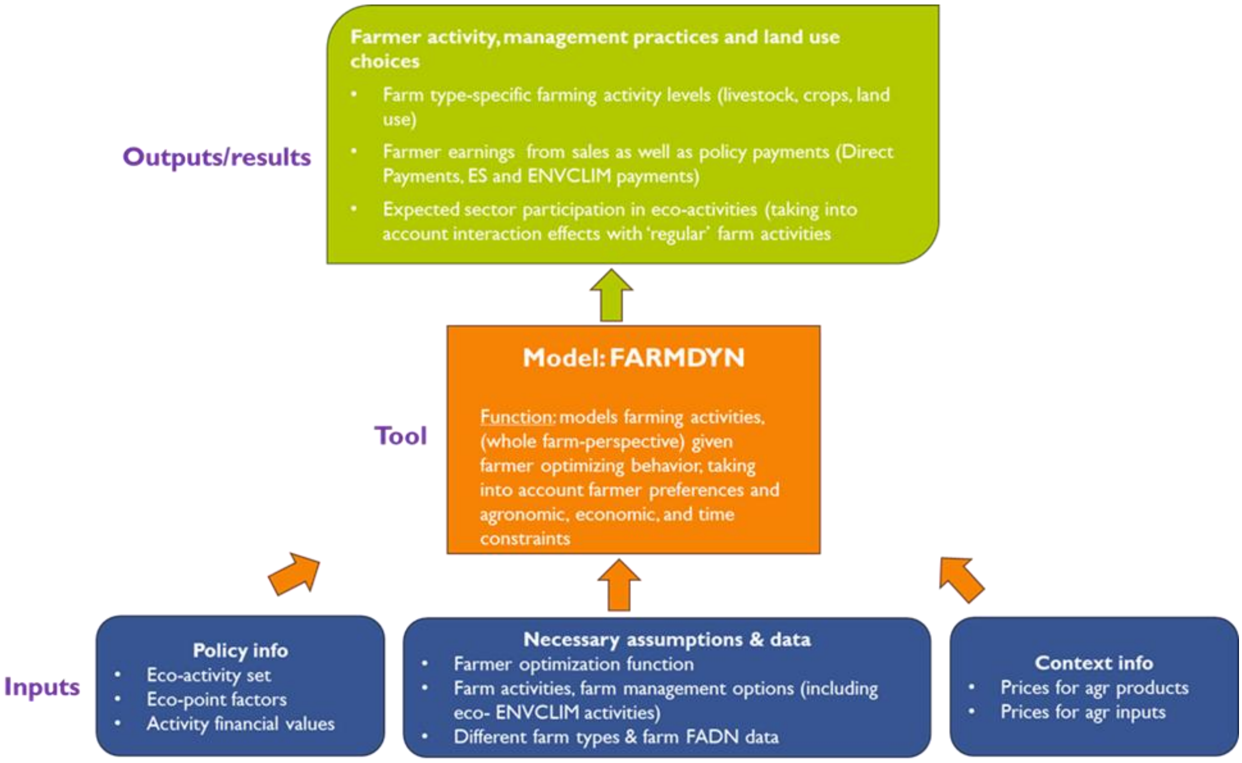
Figure 3 provides a schematic description of the FARMDYN modelling tool by distinguishing key outputs and inputs, as well as highlighting its key functionality. More specifically, the main purpose of FARMDYN is to model farming activities, given a specific farmer optimizing behaviour which is specified by the modeller. The tool takes into account farmer preferences and a set of constraints regarding time, economic and agronomic factors. Drawing attention to the specific outputs, FARMDYN can provide end users with indicators regarding activity levels such as livestock units/production, crop production and land use by farm type. Moreover, it can calculate farmer earnings from different sources, mainly sales as well as policy payments (Direct Payments, eco-scheme and ENVCLIM payments).[5] In addition, end users can also obtain insight regarding the expected sector participation in eco-activities, being the

---

[3] These objectives are: (i) climate; (ii) soil and air; (iii) water; (iv) landscape; and (v) biodiversity.
[4] See also: https://www.ilr1.uni-bonn.de/en/research/research-groups/economic-modeling-of-agricultural-systems/farmdyn.
[5] ENVCLIM refers to environment and climate.

interaction among eco-activities and 'regular' farm activities (by upscaling farm-level outcomes to sector level participation rates).

Figure 3. FARMDYN



Source: Tools4CAP 2024

Moving onto the inputs that are required to populate FARMDYN, we distinguish three categories: (i) policy information; (ii) necessary assumptions and data; and (iii) contextual information. The relevant policy information to be supplied to FARMDYN consist of a set of eco-activities available for a farmer, the level of eco-points obtained when selecting/implementing a measure, as well as the payments that are associated with each activity. These policy variables are also similar to the policy information required by the eco-scheme simulator tool. Moreover, each run of the FARMDYN model also requires introducing assumptions regarding the type of optimisation function to be applied for representing farmer behaviour, as well other assumptions to define farm activities and their related farm management options (including eco-schemes and ENVCLIM activities). In addition, FADN data as the main source for statistical data to define the relevant farm types. In terms of contextual information, and similarly, as in the case of the eco-scheme simulator tool, FARMDYN needs to be provided with price information on the cost of agricultural inputs. Producer prices of agricultural commodities are another input of this modelling tool.

5.2.3. AGMEMOD

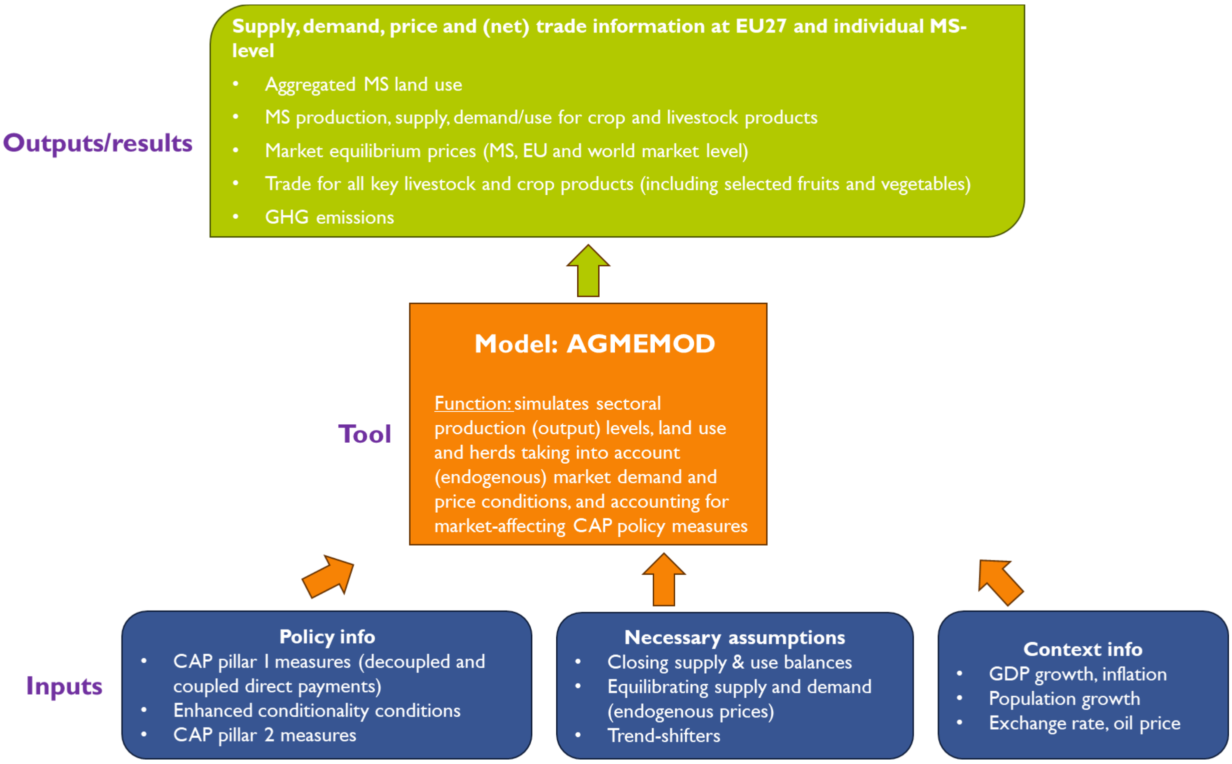
Since the early 2000s, the AGMEMOD model has been increasingly used to produce market outlooks for key agricultural commodities at MS level.[6] The model has been also used to simulate forward-looking scenarios investigating the potential impacts of various shocks on supply and demand, as well as changes to the policy framework affecting primary agriculture. For an illustration of the type of questions that can benefit from insights delivered by this modelling tool, we refer to the simulation of a hypothetical scenario to investigate the potential of consequences of increasing the EFA (Ecological Focus Area) rate by 4% on top of the 2020 application rate across all MSs (Jongeneel et al., 2020) or the simulation of alternative pathways for Dutch agriculture, when certain mitigation packages were implemented (Gonzalez-Martinez et al., 2021).

[6] See, also: https://agmemod.eu/.

Typical policy research questions investigated with this model involve looking at the impacts on production, domestic use, net trade, land allocation and prices which emanate from changes to a wide range of variables such as yields, policy support, consumer preferences, land set-a-side, and market prices at both world and national level.

Focusing on the specific characteristics of this modelling tool, Figure 4 shows the relevant schematic description listing the key indicators that AGMEMOD can deliver as well as the required inputs.

Figure 4. AGMEMOD



Source: Tools4CAP 2024

Overall, the main function of AGMEMOD is to simulate sectoral production (output) levels, land use and livestock units. In doing so, this tool takes into account (endogenous) market demand and price conditions and accounts for CAP policy measures that affect agricultural markets. Looking at the specific outputs on which end users can get insight by means of this modelling tool, AGMEMOD calculates acreage (hectares and shares over total agricultural land) for the different crop activities, as well as production, total supply, demand/use for crop and livestock products. The model also provides market-equilibrium prices for each of the selected agricultural commodities at MS, EU and world level. AGMEMOD is a net trade model, delivering projections for net exports for all key livestock and crop products (including selected fruits and vegetables). Since 2024, AGMEMOD can also calculate Green House Gas (GHG) emissions related to different farming activities. All the indicators delivered by AGMEMOD are calculated at MS level with a yearly frequency.

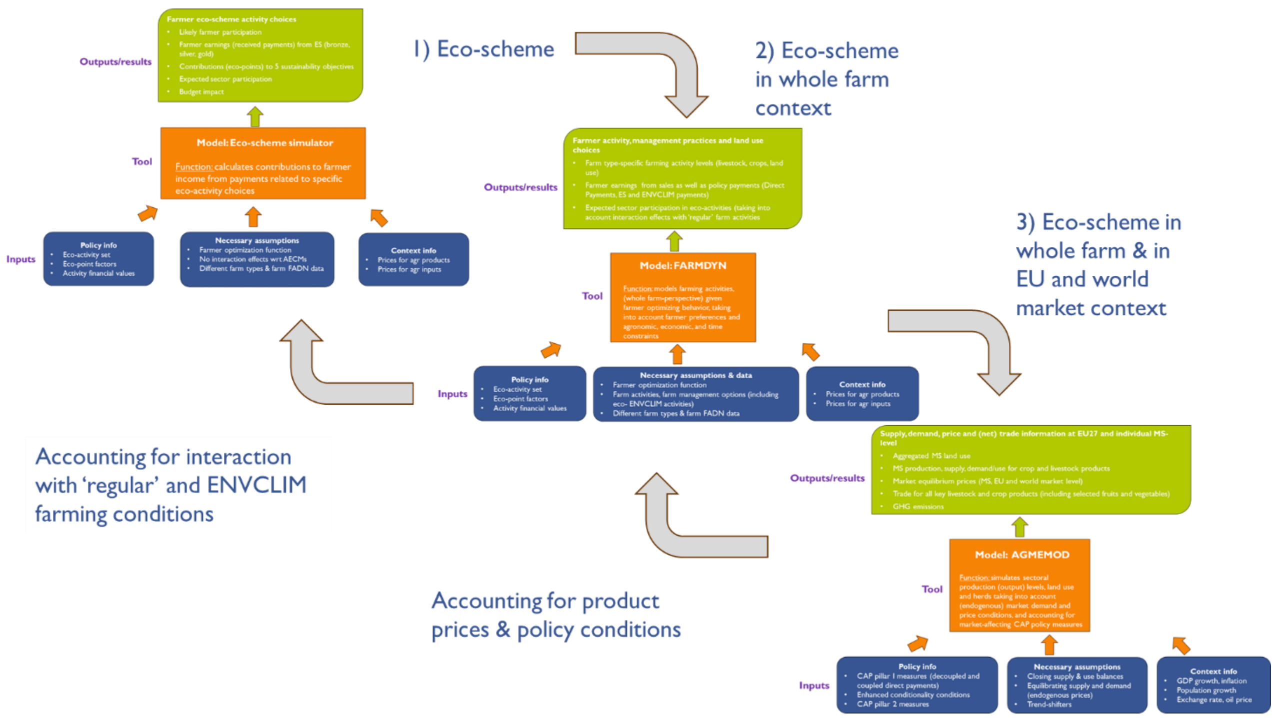
When thinking of the input requirements to populate AGMEMOD, the usual building blocks are distinguished, i.e. policy, assumptions and context. In terms of policy, this modelling tools requires detailed information on the structure and specific financial allocations of CAP pillar I measures (decoupled and coupled direct payments) and CAP pillar 2 measures. Additionally, information regarding the conditions to be satisfied in terms of enhanced conditionality should be included in the model. Looking at the assumptions, key elements for AGMEMOD are the closure of supply and use balances and the conditions to equilibrate supply and demand (endogenous prices). Depending on the type of scenario that is being simulated, the modeller will also need to provide an additional set of assumptions to 'shift' the trend of specific equations. For instance, this type of information becomes relevant to model the impact of reduced fertilisation which is translated into a shock on yields. Drawing attention to the type of contextual information that AGMEMOD needs, the following macroeconomic variables are the key requirements: GDP growth, inflation, population growth, exchange rate and oil prices.

5.2.4. Joint models

Having described the key characteristics of each tool (eco-scheme simulator, FARMDYN and AGMEMOD), we focus in this section on the tool system that can be created when ‘joining models’.[7] Figure 5 provides an overview of the direction of the exchange of information, i.e. the output of one model is used as input for another tool. Firstly, the eco-scheme simulator tool will be run, with its output being used to assess the role/contribution of the eco-schemes in the case of specific farm types. The next step is to investigate the contribution and impacts of the eco-scheme in a broader context, i.e. for all farms in the Netherlands eligible for Eco-scheme payments. In this case, EU and world market conditions will be also taken into account, being this modelled by means of AGMEMOD.

In addition, AGMEMOD prices for agricultural commodities (which also reflects the existing policy conditions) are used as contextual information for both the eco-scheme simulator and FARMDYN. At a later stage, FARMDYN indicators will be used to reflect the interaction of the eco-scheme with regular farming activities, and well as ENVCLIM farming conditions.

Figure 5. Joint models



Source: Tools4CAP 2024

5.3. Steps for implementation

When conducting an assessment by means of ‘joining models’, the following steps need to be considered:

- Identify and mobilise the relevant expertise. This involves getting in touch with the experts that are operating the modelling tools (as well as any other experts who might support the modelling teams) and get their commitment to contribute to the assignment. This is particularly important when there is a need to hire ‘modellers’ to carry out the analysis.
- Secondly, there is a need to arrange a kick-off meeting in order to bring together the researchers behind the various modelling tools that will be ‘joined’. This is a crucial step in order to create a common

[7] In the scientific literature, this is often referred as ‘integrated modelling use’ or ‘model collaboration’.

understanding regarding the data requirements and assumptions (inputs), as well as the capabilities (key function and outcome indicators) of each tool. Another purpose of this meeting is to create a moment for all researchers to discuss and take key decisions regarding the approach for joining the tools. The division of tasks is usually agreed during this meeting.

- Drawing attention to the specific set of models that are used in this case study, the next step is to select the set of viable eco-scheme options that will be further assessed. Subsequently, this information should be used to update and calibrate the eco-scheme simulation model. Then, there is also a need to ensure that the most up-to-date information is included within the supporting models, i.e. FARMDYN and AGMEMOD in this case. Now, that the modelling tools are 'tuned', it is time to run the system of modelling tools and analyse all the scenario outcomes that are generated.
- When the results are generated, it is important to conduct a 'validation' exercise. For example, this could be to carry out a written consultation or a focus group (which is actually the chosen option) to share the scenario outcomes with key stakeholders, i.e. ministry officials, paying agency staff, etc.
- Finally, once the results are discussed/validated and can be considered as final, a report (or policy brief/any other form of written communication) should be drafted to present key insights and modelling outcomes in such a way that the target audiences of the exercise can properly understand the results of the whole exercise. Here it is important to 'adjust' the language and format to the specific needs of the intended reader.

5.4. Challenges and further considerations

Some of the key challenges and considerations that should be kept in mind when conducting a similar case study are listed below:

- Ensuring the availability of the required expertise – in some cases the organisation interested in the assessment is not the one which is maintaining and running the modelling tools, there is a need for licensing the model, etc. In all these cases, there is a need to hire the expertise, and therefore, it is important to have a clear understanding regarding the policy options that will be explored, as well as making clear commitments with the modelling team.
- Technical challenges of joining models – the first time that several modelling tools are 'put to work together' the different modelling teams might encountered technical problems such as variables defined in an inconsistent way across modelling tools, different base year, and different historical data. These challenges can be solved, but it is important to allow the team sufficient time to carry out a comparison of the data, to come up with conversion coefficients, as well as having a good understanding on the reasons underlying these differences.
- Proper planning/time management – when hiring modellers to deliver outcomes which should be used to take decisions within the policy cycle, it is important to set up clear and realistic deadlines since sometimes there are unexpected data issues, or additional fine-tuning tasks (regarding the tool) which should be undertaken to generate accurate and plausible outcomes.
- Validation phase – when modellers generate quantitative scenarios it is important to check these outcomes with relevant stakeholders. In particular, it is important to get their views on the extent to which the simulated developments are realistic/feasible.
- Dissemination of modelling outcomes – it is important to communicate the outcomes/lessons learnt from these processes in such a way that it really reaches the target audience. Therefore, it is important to choose both the format and the language of the communication making sure that the purpose achieved.

6. Case study II: CAPRI

6.1. Description of the case study

Objective

The case study conducted in Hungary aims to analyse the impact of ammonia-related farming technologies implemented in parallel with other CAP measures for domestic livestock sector.

Box 2. Illustration of key policy questions – CAPRI

A selection of key policy questions that can be answered by using the CAPRI model is provided below:

- Is the allocation of the national CAP budget in the CSP done proportionally to expected achievements in the environmental field?
- What is the impact of national ammonia reduction on food security at national and EU level?
- What will be the national impact of the implementation of the mandate to reduce ammonia emissions in livestock sector?
- Is the level of commitment to reaching environmental goals equal around the EU (across the MS?) or could it impose a significant burden on the domestic (national) livestock sector?
- Is the livestock sector more responsive to direct payments when there are higher rate of implementation of GHG mitigation measures?
- Are the adoption rates for the ammonia related farming technologies in line with the available budget?
- How big are the incentives to adopt environmentally friendly farming technologies in the absence of direct payments?
- What is the market impact on the supply and demand level in the livestock sector? What are the socio-economic impacts of different policy measures if evaluated only at the MS market level without considering trade?

Selected tool

The case study focuses on the assessment of the impact on various elements of the NDM implemented in Hungary's CSP. As there is a strong focus on environment in the new CAP, the tool selected must cover a broad range of policy measures, combining new elements with the classical ones. Another reason to choose the CAPRI model for this case study is the national level adoption of a tool which has been used for policy impact assessment at the EU level. Use of the tool would allow users in Hungary "to speak the same language" with EU policy institutions, allowing them to test different policy options and with the same quantitative tool. Importantly applying the CAPRI model gives an opportunity to take a broader scope in examining the impact on various sectors of agriculture, various regions, land use implications, trade impacts, income effects and environmental consequences. This broader scope can sometimes be overlooked, when focusing on the national implementation of policy measures, which could lead to an in-complete analysis which is deficient in its conclusions.

The CAPRI model is a global partial equilibrium model for the agricultural sector and consists of a supply module with detailed coverage of agricultural policies, which is linked to a global market module representing bilateral trade between trading regions. The model is particularly suited to ex-ante impact assessment of agricultural, trade and environmental policies. In 2024 the policy module has been updated to reflect National CSPs which will become a part of the model's standard version.

Relevant policy design and monitoring tasks

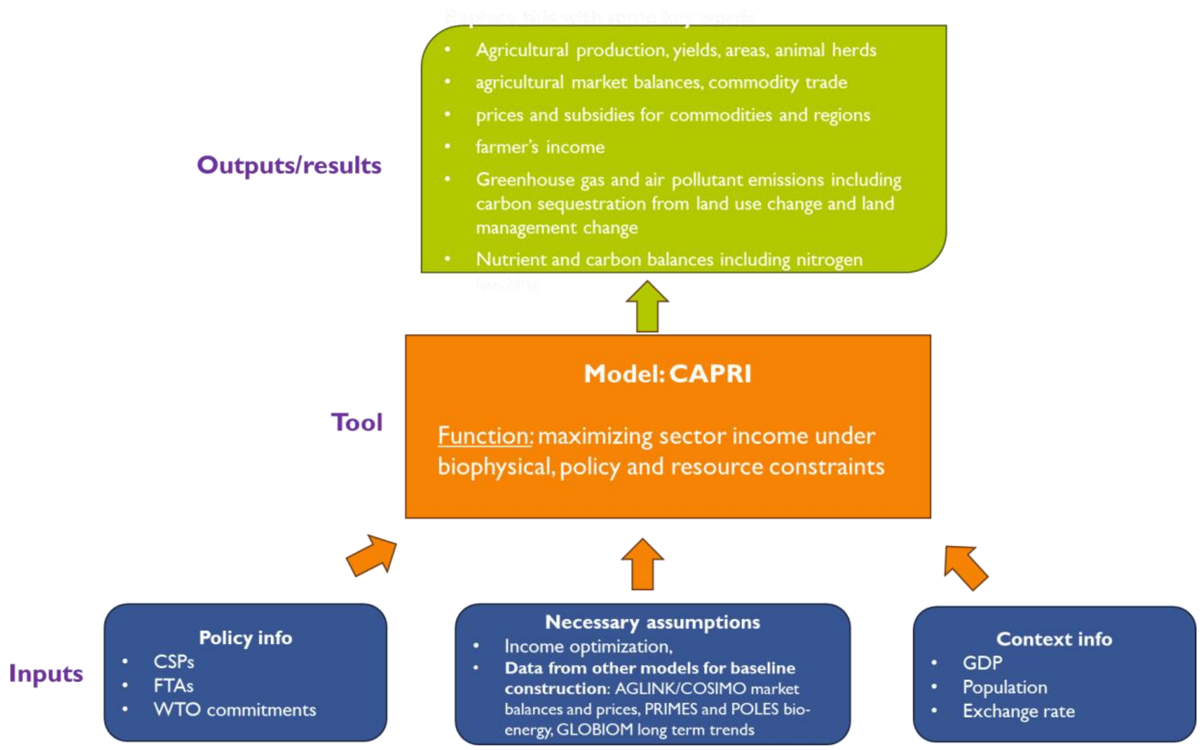
The CAPRI model case study could be used in the future mainly as an example of stepwise transfer of the model application knowledge to national research team. Similar policy questions are relevant in most EU Member States, and ex-ante analysis in terms of the potential impacts of different farm technologies and direct payment options can be carried out for other countries as well.

6.2. Description of the tool

The first operational version of the CAPRI model dates to 1999. It was funded and developed through EU-funded research grants. Since then, the model has evolved considerably. Model development and the topics analysed using the model always reflect policy challenges which emerge, e.g. Agenda 2000, dairy and sugar sector reforms, trade reforms, GHG permits and mitigation, CAP 2014-2023 greening, water use in agriculture, Green Deal, CAP 2024-2027 CSPs etc. In the baseline scenario, CAPRI is integrated with input from external models, mainly from AGLINK, GLOBIOM and PRIMES, while imposing technical consistency (balances, feed requirements etc.). The CAPRI model's ability to provide detailed regional insights makes it an essential tool for policymakers aiming to understand the impacts of European agricultural policies at both the local level and global levels, facilitating evidence-based decision-making.

CAPRI is a partial equilibrium model, with a focus on the agricultural sector, while excluding interactions with non-agricultural sectors. The model is primarily meant for scenario analysis, providing insights into how changes in policies or market conditions might affect agricultural markets. The model incorporates two main components: a supply module and a market module. The supply module covers approximately 280 regional farm models across the EU27, Norway, and the Western Balkans, all of which are at the NUTS 2 level. Each region can be further disaggregated into low- and high-yield farm types, allowing for detailed analysis of agricultural practices and their economic implications. The module relies on nonlinear programming to maximise farmers' agricultural income based on calculated prices and subsidies, while adhering to constraints related to land use and resource availability. The market module is a global multi-commodity model that represents bilateral trade among about 44 trade regions globally, encompassing around 60 agricultural products. It incorporates approximately 40,000 equations that describe supply, demand, processing, and final consumption dynamics. Prices are calculated endogenously using market-clearing logic, ensuring that supply and demand balance across regions.

Figure 6. CAPRI



Source: Tools4CAP 2024

CAPRI's specific strength is socio-economic analysis coupled with thorough environmental assessments, allowing for a comprehensive analysis of agricultural policy impacts. The CAPRI model relies in its endogenous implementation of GHG accounting and modelling. Environmental indicators are calculated in the CAPRI supply module, with nutrient balance equations considering nutrient uptake by crops and supply of nutrients. The information from the supply module is also used to compute greenhouse gas emissions, based on the IPCC methodology, while more recently other indicators have been added e.g. for biodiversity questions.

Regarding policy implementation in the CAPRI model, the information to quantify CSPs for modelling purposes covers all measures and interventions: direct and coupled support, eco-schemes, climate and other rural development measures for ANCs. Average, maximum and minimum planned unit amounts per hectare as well as ceilings and outputs are considered as well. Good agricultural and environmental conditions (GAECs) modelled as constraint or as mitigation technologies/farming practices linked to environmental effects.

Given the explicit link between production activities and input use in the CAPRI model, the alternative scenarios can provide a framework to address various livestock production technologies, including cattle, pigs and poultry activities, with respect to nutrient balances. The CAPRI model allows for analysis of different farming practices. which are described by different input coefficients, e.g., animal fodder uptake, manure excretion etc., covering the entire life cycle of an animal. Modifying the crude protein (CP) content of the fodder is suggested as a potential approach to reduce ammonia excretion.

6.3. Steps for implementation

To address the challenge, a step-by-step strategy has to be implemented:

- Set up the team and to get in touch with the experts who are the core of the CAPRI's models development, maintenance and use and get their commitment to contribute their technical expertise in order to carry out the study. The model is built in the GAMS (General Algebraic Modelling System) language, which is complemented by a graphical user interface developed in Java.
- Organise and conduct a kick-off meeting involving all the team, including a description of the tasks and division of work, in order to launch the activities. To have regular further communication during all the next steps.
- Baseline generation. This initial phase establishes a reference point against which scenarios are compared. Sufficient time has to be allocated at this stage, as the effort required during this phase could be the most demanding, particularly from the technical point of view.
- Scenario simulation: Once the baseline is calculated, various policy scenarios can be implemented.
- Post-model analysis: After simulations are run, results are analysed to assess their implications for policy decision-making. This includes evaluating economic indicators and potential environmental impacts.

6.4. Challenges and further considerations

The main challenges which can appear during implementation steps:

- Human resources – the community of CAPRI modellers is rather scarce and there are challenges and constraints in terms of time and human resources in the amount and the timing of advice and technical support that is available. Due to high entrance costs (in terms of time needed to obtain the required skills in understanding and operating the model) it can be a major challenge to quickly build a new team for model implementation, both at research level or in the Ministry of Agriculture.
- Technical problems – unexpected technical problems are usual during the baseline calibration (as the model performance differs depending on the software version applied and computer resources available. As different modules of the CAPRI model are developed by different people within the CAPRI research community, some updates to particular CAPRI modules might affect the other modules.
- Scenario development – policy scenario design needs to align an appropriately constructed policy question with the model's structure and its analytical capacity to analyse and answer that question.

- Communication of key results – in communication with stakeholders and policy makers, there will always be certain prior expectations regarding the modelling output and scenario results. It is important to build trust in the model's capacity, especially where scenario results might not align with expectations.

7. Case study III: GLOBIOM

7.1. Description of the case study

Objective

The case study conducted in Czechia aims at identifying synergies and trade-offs between EU targets — such as climate resilience and environmental sustainability — and the competitiveness and viability of Czech agriculture in the context of climate change. By assessing the socio-economic and environmental impacts of CAP interventions in Czechia, long-term pathways will be developed and quantified in terms of output indicators for the country.

Box 3. Illustration of key policy questions – GLOBIOM

A selection of key policy questions that can be answered by means of GLOBIOM is provided below:

- How do different CAP policies affect the competitiveness of Czech farmers in both EU and global markets?
- What are the socio-economic impacts of various CAP interventions on rural communities in Czechia?
- How do agricultural practices under different policy scenarios contribute to climate resilience and sustainability?
- What are the trade-offs between increasing agricultural productivity and preserving natural resources?
- How do policy changes impact greenhouse gas emissions from the agricultural sector?
- What synergies can be achieved by aligning agricultural, forestry, and bioenergy policies?
- How do different policy pathways influence the long-term viability and sustainability of Czech agriculture up to 2050?
- What are the potential impacts of climate change scenarios on Czech agriculture under various policy frameworks?
- How do CAP policies influence biodiversity and ecosystem services in agricultural landscapes?
- How do changes in agricultural policy affect water usage in various regions of Czechia?

Selected tool

The GLOBIOM-CZ model is an integrated modelling tool specifically calibrated for the Czech context in this case study. Its primary purpose is to serve as the foundational framework for exploring and analyzing agricultural pathways under various policy scenarios. This model facilitates the alignment of local data with broader policy objectives, enabling a comprehensive evaluation of how different policy changes can impact land use, agricultural practices, and sustainability within Czechia. The model incorporates relevant datasets, mapped and integrated in collaboration with stakeholders, ensuring that the data aligns with the study's objectives and supports the creation of meaningful and practical agricultural pathways. It guides policy development by reflecting national priorities and EU policy targets related to climate change, biodiversity, and sustainable agricultural practices, thereby crafting policies that are locally relevant and contribute to broader EU sustainability goals. Through scenario analysis, the model projects and analyses the impacts of various policy changes on land use and agricultural sustainability, providing valuable insights for policymakers. A comprehensive literature review and stakeholder engagement inform the selection of relevant indicators, ensuring that the pathways are scientifically robust and policy-relevant. The model produces these indicators, which are then presented in accessible formats such as dashboards. Continuous stakeholder engagement throughout the process ensures that the pathways remain grounded in practical, real-world concerns and reflect diverse perspectives. By using the GLOBIOM model, this case study aims to generate data-driven insights that help Czech authorities and stakeholders make informed, evidence-based decisions, supporting both immediate policy needs and long-term national and EU objectives for sustainable agriculture.

Relevant policy design and monitoring tasks

The GLOBIOM model is suitable for ex-ante analyses and Strategic Environmental Assessments (SEAs) due to its integrated approach and comprehensive data capabilities. By simulating the impacts of various policy scenarios on agricultural practices, land use, and environmental sustainability, GLOBIOM enables stakeholders to project and evaluate the socio-economic and environmental outcomes of proposed policies before they are implemented. This forward-looking analysis is crucial for anticipating potential trade-offs and synergies, ensuring that policy decisions are well-informed and balanced. Additionally, GLOBIOM's ability to incorporate a wide range of datasets and align with both national priorities and EU policy targets, makes it a robust tool for SEAs, providing a holistic view of the environmental implications of strategic plans. By supporting evidence-based decision-making, GLOBIOM enhances the capability of authorities to design effective policies that promote sustainability, climate resilience, and agricultural competitiveness.

7.2. Description of the tool

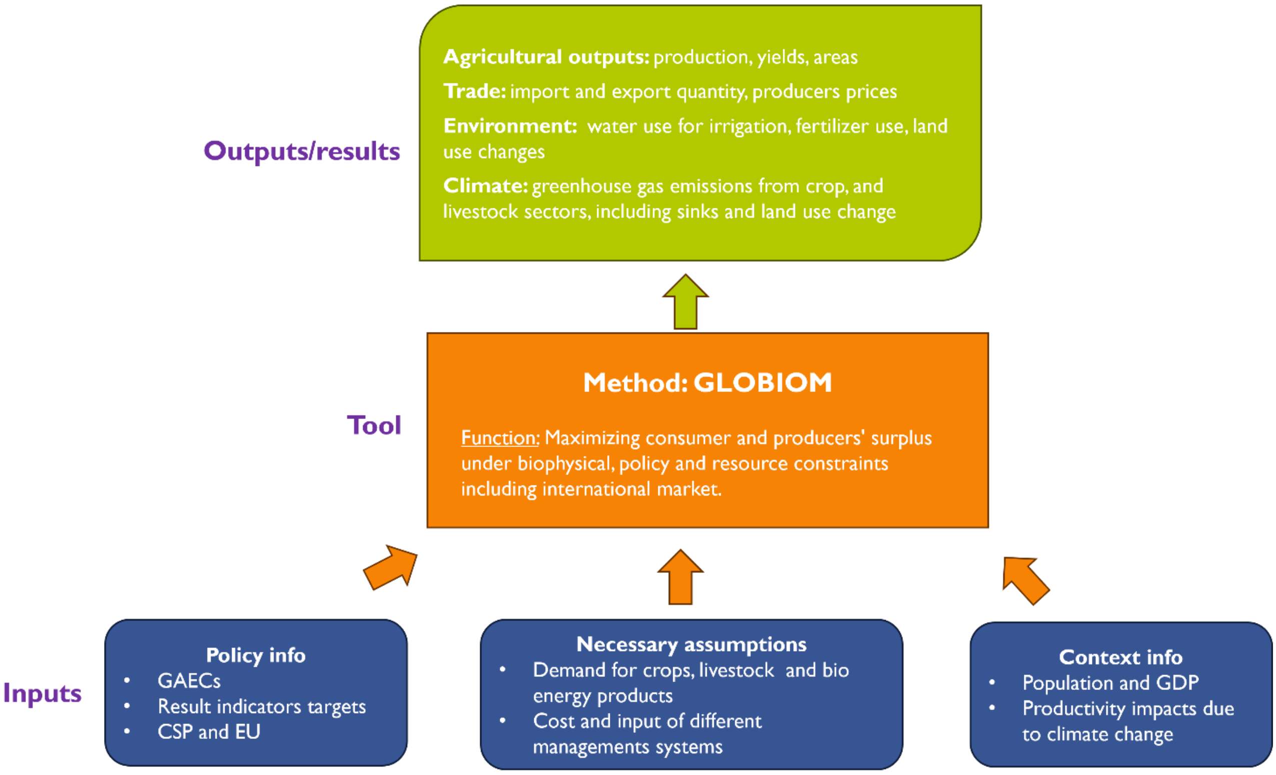
GLOBIOM is a global partial equilibrium model that is used to model the supply and demand of agricultural products at a high spatial resolution in an integrated approach that considers the impacts of global change (socioeconomic and climatic) on food, feed, and fiber markets. GLOBIOM models the supply and demand for various agricultural and forestry products using regional level and spatially explicit data inputs. In GLOBIOM, land is allocated or converted to production activities in the agricultural and forestry sector in order to maximize the sum of producer and consumer surpluses, subject to market equilibrium and resource, technological, and policy constraints. The equations of the model are linear or have ben linearized so that the model can be solved using a linear programming method. The model is recursive-dynamic and run on ten-year timesteps, meaning that endogenous model solutions depend on the solutions found for the previous period.

The supply side of the model follows a bottom-up approach based on detailed spatial units' information, including land cover, land use, management system, and other biophysical and technical cost information, together with environmental impacts, including greenhouse gas and nutrient emissions. The representation of crops, livestock, and forest production activities relies on detailed biophysical models. Six land use types are dynamically modelled (cropland, grassland, short rotation tree plantation, managed forests, natural forests, and other natural land) which can be converted into each other depending on the demand on the one side, and profitability of the different land-based activities on the other side.

The GLOBIOM model was improved to enable a more comprehensive analysis of the climate impacts across various agricultural and forest sectors. The model incorporated the latest revisions of the Shared Socioeconomic Pathways (SSP) data which directly affect the changes in food demand, as well as changes in water demand from non-agricultural sectors, these improvements provide additional details on how the water for irrigation and sustainable irrigation is considered within GLOBIOM. GLOBIOM was enhanced to include the full suite of climate impacts on different agriculture and forest sectors as well as on the water balances. The inclusion of heat stress impacts on livestock and grassland productivity impacts were implemented to enable a more holistic representation and the most advanced representation of cross-sectoral climate impacts on the land-based sectors.

Implicitly, the model included the CSP by aligning the baseline with the European Agricultural Outlook and other models like GLOBIOM. Explicitly, GLOBIOM included the Good Agricultural and Environmental Conditions (GAECs) modelled as constraint or as mitigation technologies. Figure 7 depicts the inputs needed by the model and the relevant outputs for assessing the CSP.

Figure 7. GLOBIOM



Source: Tools4CAP 2023

7.3. Steps for implementation

Implementing the GLOBIOM model to support agricultural policy in EU countries involves a structured approach that ensures the model is effectively tailored to each country's unique context:

- Calibrate the GLOBIOM Model: Adapt the GLOBIOM model specifically for the context of the target EU country, ensuring it reflects local agricultural, environmental, and socio-economic conditions.
- Integrate relevant datasets: Collaborate with local stakeholders, including national research institutions and authorities, to map and incorporate relevant datasets into the GLOBIOM model. This ensures that the data aligns with the study's objectives and supports meaningful agricultural pathways.
- Define agricultural pathways: Develop agricultural pathways guided by both national priorities and EU policy targets, focusing on areas such as climate change, biodiversity, and sustainable agricultural practices. Reflect how different policy scenarios impact land use, agricultural practices, and sustainability.
- Conduct literature review: Perform a comprehensive literature review to inform the selection of the most relevant indicators for the case study. Ensure that the agricultural pathways reflect both scientific and policy considerations.
- Engage stakeholders: Organize initial focus groups with key stakeholders, such as local agricultural chambers, research institutions, and environmental NGOs, to gather insights and feedback on the preliminary pathways and indicators.
- Design and integrate pathways: Use the insights from the literature review and stakeholder engagement to design and integrate the agricultural pathways into the GLOBIOM model. Produce relevant indicators and present them in accessible formats such as dashboards.

- Validate and refine Pathways: Hold follow-up focus groups to present the results of the preliminary pathways to a broader range of stakeholders. Gather feedback to refine and adjust the pathways to ensure they are practical and reflect real-world concerns.
- Tailor outputs for stakeholders: Customize the outputs of the study to meet the unique needs of different stakeholder groups, including government agencies, farmers, NGOs, and researchers. Ensure that each group has relevant, accessible information to support their role in the CAP process.
- Report and disseminate findings: Share the findings of the study through reports, presentations, and publications. Ensure that the information is disseminated to all relevant stakeholders and contributes to national and EU-level policy discussions.

By following these steps, other EU countries can effectively apply this methodology to support their own CAP Strategic Plans and address both local and EU-wide agricultural policy goals.

7.4. Challenges and further considerations

Some of the key challenges and considerations that should be kept in mind when conducting a similar case study are listed below:

- Ensuring the availability of required expertise – additional expertise to run and maintain the model is required therefore is suggested to clearly understand the policy options to be explored and make firm commitments with the modelling team to ensure that the necessary expertise is available and effectively utilized.
- Reconciling conflicting goals among stakeholders – balancing economic profitability with environmental sustainability often leads to conflicting goals among stakeholders, which can delay consensus or result in compromised outcome uptake for policy design. Implementing iterative feedback loops to revisit and refine the agricultural pathways based on ongoing stakeholder feedback is suggested. This approach ensures that all perspectives are considered, and the pathways remain relevant and maintain stakeholder buy-in throughout the process.
- Dissemination of Modelling Outcomes – effectively communicating the outcomes and lessons learned to the target audience is a challenge, therefore select appropriate formats and languages for communication to ensure the findings reach and are understood by the intended audience.

8. Case study IV: Experimental economics

8.1. Description of the case study

Objective

The case study conducted in the region Occitanie in France targets a specific CAP intervention: Agri-Environment-Climate Measures "transition of practices" (AECMt). The aim for farmers involved in animal production to is to increase their feed protein content self-sufficiency and allow the definition of recommendations for future modifications while assessing the feasibility of the tool in a regional context (evaluation of EARFD interventions).

Box 4. Illustration of key policy questions – Experimental economics

A selection of key policy questions that can be answered by relying on experimental economics is provided below:

- What is the impact of the policy interventions (ex-post)?
- Are public interventions justifiable in terms of effectiveness?
- How can the adoption rate be increased (in the current case: how can feed protein content self-sufficiency in livestock farming be improved)?
- What is the willingness to accept (ex-ante) various policy design options prior to policy implementation?
- What are farmers' priorities with respect to potential policy measures?
- How to policy effectiveness and adoption be enhanced (in current case AECMt policy)?

Selected tool

The Discrete Choice Experiment (DCE) methodology is the approach used for assessing farmers' preferences regarding new policy measures by estimating their willingness to accept various design options before implementation. This is an ex-ante quantitative experimental and impact evaluation method relying on data collected through a carefully designed experimental protocol to elicit stated preferences in a hypothetical setting.

The selection of the CAP intervention to be valued, selection of attributes and assignment of levels is conducted in cooperation with the Managing Authority (region Occitanie) and through discussions with farmers and other relevant stakeholders. By means of a survey of farmers, choice sets are presented, allowing farmer preferences to be elicited. In addition, secondary contextual questions are included in the survey. The data collection takes place preferably online, or face to face with trained enumerators.

Econometric analysis reveals farmers' utility and willingness to accept (WTA) the levels related to each attribute (requirement, payments, etc.). These insights will facilitate the tailoring of the AECM studied, to align it with farmers' priorities, enhancing both the effectiveness of the policy and the level of policy engagement (i.e., adoption).

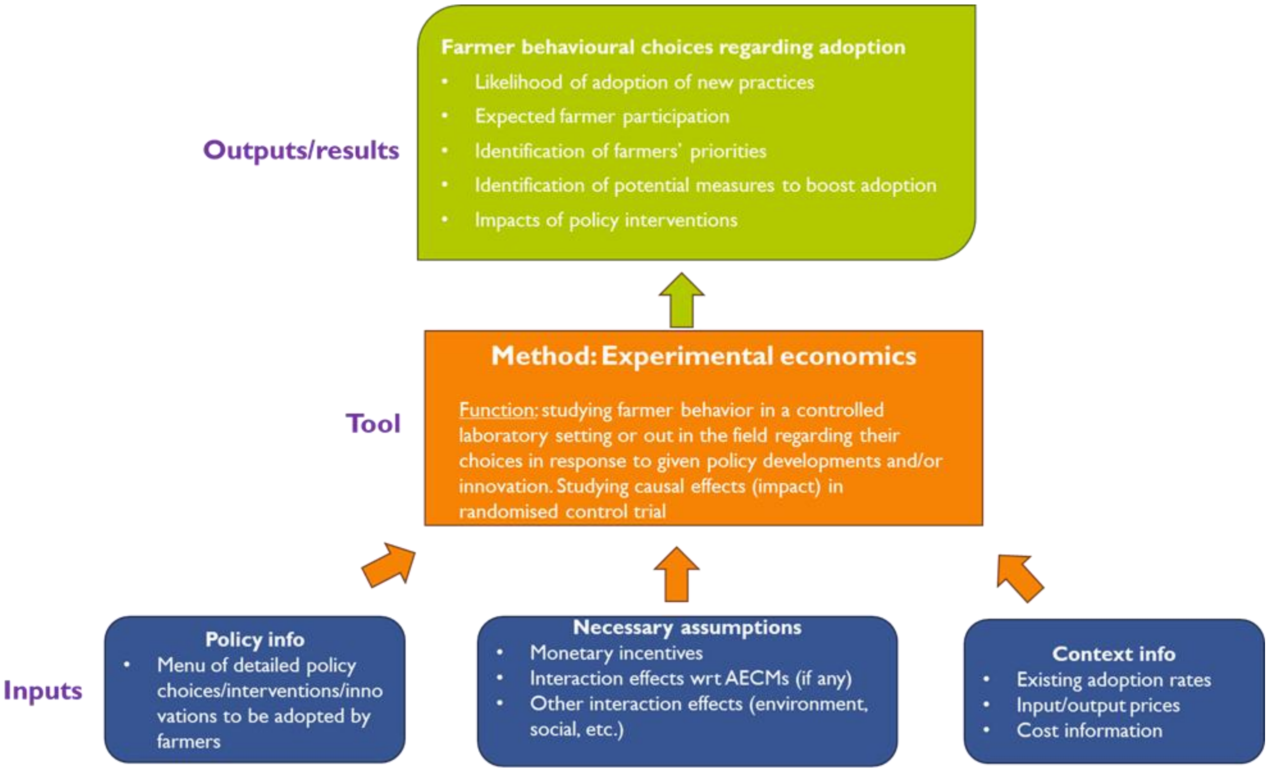
Relevant policy design and monitoring tasks

The tool that has been developed for this specific case could be reused in the future to carry out ex-ante analysis in terms of the potential impacts of new policy measures on farm-level adoption.

8.2. Description of the tool

Figure 8 provides a schematic description of the experiment economics tool by distinguishing key outputs and inputs, as well as highlighting its key functionality. Experimental approaches can expand and complement the existing CAP toolset for supporting evidence-based decision-making in at least three ways (Colen et al., 2016; Lefebvre et al., 2021). Firstly, the controlled setting and randomised assignment of participants enable a robust and verifiable assessment of the causality, mostly in ex-post evaluations. Experiments can thus help decision-makers to understand if a particular policy intervention provides measurable net impacts and to justify the public spending. Secondly, experimental approaches can be used for pre-testing policy measures in order to anticipate farmers' reactions to policy changes or their compliance with new regulations. The data gathered can also reveal the potential heterogeneity of the responses and reasons for it. Finally, economic experiments have been extensively used to discern the role that behavioural factors, such as perceived risks, resistance to change and social norms, play in particular decision contexts. By relaxing the neoclassical assumption that farmers behave as rational economic agents, decision-makers can fine-tune the policy design to properly address or even make use of these behavioural mechanisms and cognitive biases (Dessart et al., 2019). This is particularly relevant for the increasingly prominent and diverse set of instruments in the second pillar of the CAP, because the carefully designed decision context is essential for the effectiveness of voluntary measures, such as the incentives to adopt agri-environmental practices or risk management tools (Thoyer and Preget, 2019). In addition, behavioural parameters from such experiments can also be used to fine-tune predictions in simulation models (Colen et al., 2016).

Figure 8. Experimental economics



Source: Tools4CAP 2023

The methodological approach used to apply experimental economics is diverse, and various typologies of experimental tools have been developed in the economics literature. In general, four types of experimental approaches for the purpose of CAP strategic planning, evaluations and monitoring are of interest (i.e., laboratory experiments, discrete choice experiment, randomised control trials, and quasi-experimental tools) (Lefebvre et al., 2021; Thoyer and Preget, 2019).

- In laboratory (lab) experiments, participants are asked to play an economic game, which aims to reveal their behavioural responses to different decontextualised scenarios. The game takes place in an economic lab (usually a computer room) and can be played either by students or real economic agents (stakeholders). To simulate real-world behaviour, participants receive a monetary incentive depending on the choices they make during the game. With the appropriate infrastructure, lab experiments provide a quick and flexible tool to test new policy approaches or incentives. However, if the intervention of interest needs to be tested with the relevant economic context, contextualised field experiments with stakeholders can be used to more closely simulate a naturally occurring decision-making environment. In addition to experiments in a lab setting, field/pilot based experiments are becoming more used (Samson et al., 2013; OECD, 2022).

- In contrast to laboratory (lab) experiments approaches, which aim to reveal actual behaviour, discrete choice experiment (DCE) is a survey-based tool for eliciting stated preferences in a hypothetical setting (Mariel et al., 2021). The respondents are asked to conduct a choice task, where they are typically presented with a series of choice cards. On each card, they need to make a choice between two or more alternatives. DCE is particularly useful for assessing farmers' preferences towards novel policy measures, because it enables a monetary estimation of their willingness to accept alternative policy design options. They have also been extensively used for assessing public preferences for policy interventions, particularly in terms of environmental or landscape improvements (Colen et al., 2016).
- Another tool is the randomised controlled trial (RCT), which is used to evaluate interventions during the implementation of the policy in the real-world setting. To measure the causal effects of the intervention, participants are randomly assigned to either a treatment or control group.
- Quasi-experimental tools is a statistical method, and although they are not true experiments, quasi-experimental tools can be particularly useful when it is not possible to design a more rigorous experimental protocol due to ethical, administrative or other issues (Thoyer and Preget, 2019). Examples include Difference in Difference (DID), statistical matching, instrumental variables and regression discontinuity methods (Castaño et al., 2019).
- Drawing attention to the EU context, field experiments and pilots are becoming increasing used. The reader is referred to Samsom et al. (2013) which provide an overview of the most common types of experiments, e.g. framed field experiments, natural field experiments, as well as some key considerations that researchers should keep in mind when thinking of carrying out them, e.g. proper reporting of practices and procedures, providing the right motivation, etc. Moreover, OECD (2022) presents a multi-country choice experiment conducted with farmers to explore their preferences for different types of payments to understand their preferences of practice-based and results-based payments.

With respect to inputs, the experiments differ from other tools, because they rely on primary data collected through a carefully designed experimental protocol, instead of observed data from 'naturally occurring' economic situations or derived from (other) simulation models. Quasi-experimental tools, however, do not necessarily require primary data collection, as they use various statistical methods to 'create' artificial counterfactual or control group data, which are then compared with the observation data.

8.3. Steps for implementation

When conducting an assessment by means of 'experimental economics', the following steps need to be considered (following the main methodological stages of the study are as followed (OECD, 2018)):

- Study design – selection of the CAP intervention to be valued, selection of attributes, assignment of levels. This step should be conducted in cooperation with the Managing Authority and through discussions with farmers and other relevant stakeholders.
- Survey creation – choice of experimental design, construction of choice sets, selection of secondary questions in the survey (contextual). This step will require access and use of relevant software
- Piloting – the survey and experimental design are pre-tested on a small sample of farmers. The results of the pilot are used to modify the survey where necessary and to calculate priors, which are used for generating the final experimental design.
- Data collection – the survey is sent to farmers. They are asked to choose their most preferred options among the alternatives on the choice sets they are presented with. Data collection can take place online (preferably in this case study) or face to face with trained enumerators.
- Result analysis – econometric analysis of the data with relevant choice models to estimate the utility and willingness to accept (WTA) the levels related to each attribute.

8.4. Challenges and further considerations

Some of the main challenges and general observations that should not be forgotten when carrying out a similar case study are described below:

- Select a suitable methodology – Experimental economics is a broad field in which several methodologies can be applied. Some techniques that are broadly used are DCE, DID and RTC. When thinking of applying these methodologies, a detailed reading of Colen et al. (2015) would be of benefit. They discuss several techniques and their potential application in the context of agricultural policy.
- Ensure the availability of the required expertise – in some cases the organisation interested in the results of the assessment is not the one conducting the experiment. It is important to have a clear understanding regarding the policy options that will be explored to identify the relevant research questions in order to design a suitable experimental protocol.
- Farmer participation rates, and the extent to which the composition of participants is representativeness of the targeted group as a whole, is crucial. Non-response from some of those surveyed is an inherent risk when using this tool.
- Proper planning/time management – running an experiment takes time (following the steps for implementation elaborated on in section 7.3). Data collection can take place online or face to face with trained enumerators (the latter taking more time and being more costly, but also more likely to be representative given that some farmers might not be comfortable with online engagement).
- Dissemination of modelling outcomes – the proper dissemination of any modelling outcomes requires that the target audience understand the results. Hence, it is crucial to make correct choices regarding communication style (scientific language versus layman's terms, written documents versus oral communications, type of written/oral communication, etc.).

9. Conclusion

9.1. Key findings

Using appropriate modelling tools play a critical role in ensuring the effectiveness and inclusiveness of CAP Strategic Planning and aligning plans with the demands of the New Delivery Model, creating robust, adaptable, and transparent CSPs aligned with EU-wide objectives. These tools ensure that CAP interventions are performance-driven and evidence-based, shifting the focus from compliance with prescriptive rules to achieving measurable outcomes and empowering MSs and their constituencies in formulating plans that better meet local needs. They enhance policy coherence by systematically linking interventions to CAP objectives and provide structured frameworks for balancing economic, environmental, and social goals. By fostering the use of models, these tools improve the legitimacy, accountability, and relevance of CSPs. Moreover, modelling tools enable adaptive management, allowing MSs to anticipate expected trends and impacts of policies and other shocks, extending the time frame in which policy-makers can adjust/fine-tune policies.

The successful implementation of modelling tools in CAP Strategic planning depends on several factors:

- Capacity building (ensuring the availability of the required expertise): The community of modellers (FARMDYN, AGMEMOD, CAPRI and GLOBIOM) is rather scarce and there are obstacles in terms of time and human resources when looking for advice and technical support. Due to high entrance costs (in terms of time needed to obtain pre-required skills) it can be problematic to build a new team for model implementation both at research and Ministry of Agriculture level.
- Policymakers engagement: Policy makers are end users but are usually not informed on modelling opportunities and limitations. Policy scenario design needs to align the reasonably constructed policy question with the model structure capacity to analyse and answer it.
- Validation: When modellers generate quantitative scenarios it is important to check these outcomes with relevant stakeholders. In particular, it is important to get their views on how realistic/feasible the simulated development are.
- Dissemination of modelling outcomes: Effectively communicating the model assumption and outcomes, as well lessons learned to the target audience is a challenged, therefore select appropriate formats and languages for communication to ensure the findings reach and are understood by the intended audience
- At the EU level, it would be reasonable to consider that the use of a quantitative impact assessment, would be a compulsory obligation for policy makers to provide the justification for specific policy choices (e.g. those involving changes in the direct payment system) and the (ex-ante) result indicator claims attached to that. In addition, a list of recommended modelling tools could be suggested, guaranteeing the use of models that have a certain recognition for their value and quality. If policy makers were required to follow such an approach, this would have to be accompanied by institutional support through the establishment of clear, harmonized guidelines for implementing the tools across MSs, as well as funding and technical assistance for capacity-building initiatives and the development of modelling tools.

The future of modelling tools lies in their comprehensive integration into every stage of CAP planning, implementation, and monitoring. Capacity building, policymakers engagement, validation and dissemination of modelling outcomes are requirements for successful implementation of modelling tools. By addressing these priorities, MSs can fully harness modelling tools to develop CSPs that are effective and aligned with the EU's broader goals for sustainable and resilient agriculture.

9.2. Lessons learnt

The lessons learnt will be derived from the case studies to be implemented in 2025 and will be included in the update as foreseen in the Grant Agreement (M38).

References

- Castaño, J., Blanco, M. and Martinez, P. (2019). Reviewing Counterfactual Analyses to Assess Impacts of EU Rural Development Programmes: What Lessons Can Be Learned from the 2007–2013 Ex-Post Evaluations? *Sustainability*, 11(4), 1105. https://doi.org/10.3390/su11041105
- Colen, L., Gomez y Paloma, S., Latacz-Lohmann, U., Lefebvre, M., Préget, R. and Thoyer, S. (2015). (How) can economic experiments inform EU agricultural policy?, JRC Science and Policy Report. Publications Office of the European Union, https://data.europa.eu/doi/10.2791/17634
- Colen, L., et al. (2016). Economic Experiments as a Tool for Agricultural Policy Evaluation: Insights from the European CAP. *Canadian Journal of Agricultural Economics*, 64(4), 639-647. https://doi.org/10.1111/cjag.12107
- Dessart, F. J., Barreiro-Hurlé, J. and van Bavel, R. (2019). Behavioural factors affecting the adoption of sustainable farming practices: a policy-oriented review. European Review of Agricultural Economics, 46(3), 417–471. https://doi.org/10.1093/erae/jbz019
- Gonzalez-Martinez, A. R., Jongeneel, R., Kros, H., Lesschen, J. P., de Vries, M., Reijs, J., and Verhoog, D. (2021). Aligning agricultural production and environmental regulation: An integrated assessment of the Netherlands. *Land Use Policy*, 105, Article 105388. https://doi.org/10.1016/j.landusepol.2021.105388
- Helming, J., Daatselaar, C., van Dijk, W., Mollenhorst, H., & Pishgar-Komleh, S. H. (2023). Model Collaboration between Farm Level Models with Application on Dutch Dairy and Arable Farms Regarding Circular Agricultural Policy. *Sustainability*, 15(6), 5020. https://www.mdpi.com/2071-1050/15/6/5020
- Herzfeld, Th. and Jongeneel, R. (2011) Why Do Farmers Behave as They Do? Understanding Compliance with Rural, Agricultural and Food Attribute Standards, Land Use Policy 29-1: 250-260.
- Jongeneel, R., Gonzalez-Martinez, A.R., Lesschen, J.P. and Blanco, M. (2020). Agricultural Policy Scenario Description and Divergence Analysis, Deliverable 3.2., SUPREMA project. https://www.suprema-project.eu/images/Deliverable_D32.pdf
- Jongeneel, R. and Daatselaar, C. (2024). The Dutch Eco-scheme investigated. A contribution to a recalibration, Eco-regeling tegen het licht: Een bijdrage aan een herijking. (Rapport / Wageningen Economic Research; No. 2024-092). Wageningen Economic Research. https://doi.org/10.18174/661087
- Jongeneel, R. and Gonzalez-Martinez, A.R. (2023). Implementing the EU eco-scheme in the Netherlands: A results-based points system approach, *EuroChoices*. Available at: https://onlinelibrary.wiley.com/doi/full/10.1111/1746-692X.12388
- Lefebvre, M., et al. (2021). Can Economic Experiments Contribute to a More Effective CAP? EuroChoices, 20(2), 28-35. https://doi.org/10.1111/1746-692X.12324
- Mariel, P., et al. (2021). Environmental Valuation with Discrete Choice Experiments: Guidance on Design, Implementation, and Data Analysis. SpringerBriefs in Economics.
- OECD (2018). Discrete choice experiments. In: Cost-Benefit Analysis and the Environment: Further Developments and Policy Use, OECD Publishing, Paris. DOI: https://doi.org/10.1787/9789264085169-8-en

- OECD (2022), Making Agri-Environmental Payments More Cost Effective, OECD Publishing, Paris, https://doi.org/10.1787/4cf10d76-en.
- Samson, G.S., Gardebroek, C., Jongeneel, R.A. (2013). Analysing Dutch dairy farmer behaviour towards the provision of public goods: The added value of an economic simulation experiment. Land Use Policy, 34: 321– 331.
- Thoyer, S. and Préget, R. (2019). Enriching the CAP evaluation toolbox with experimental approaches: introduction to the special issue. European Review of Agricultural Economics, 46(3), 347–366. https://doi.org/10.1093/erae/jbz024