MIND STEP

MODELLING INDIVIDUAL DECISIONS TO SUPPORT THE EUROPEAN POLICIES RELATED TO AGRICULTURE

Deliverable D1.1: Key policy questions for ex-ante Impact Assessment of EU Agricultural and Rural Policies

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ACRONYMS

CAP - Common Agricultural Policy

EU - European Union

IDM - Individual Decision Making

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EXECUTIVE SUMMARY

The objective of this report is to review the existing and future policies as well as some key global drivers affecting the agricultural sector in the EU in order to set the research agenda for the EU H2020 project MIND STEP. MIND STEP is aimed at supporting the ex-ante evaluation of future policy settings that might impact the European agricultural and rural sector using Individual Decision Making (IDM) models.

The resulting research agenda is the first step of the MIND STEP conceptual model, which consists of: defining key policy questions; identifying the indicators for monitoring and measuring the impacts of policies; investigating whether current IDM models can be used to for evidence based policy analyses. In particular, this study wanted to answer the following research questions: Q1: *What agricultural policy objectives are relevant and worth of investigation today?; Q2*: *Which benchmark scenarios should be investigated in order to capture the most relevant impacts of these policy objectives on EU agriculture and rural areas?*

These questions have been addressed using a set of qualitative tools. Among them, stakeholders' engagement via interviews, the use of policy expert team and the use of a focus group (including members of the core stakeholder group and the policy expert team) played a crucial role.

The MIND STEP core stakeholder group was carefully chosen to cover a broad range of interests from different groups, including both public and private sector representatives, giving particular attention to the inclusion of policy makers at a strategic level. Through a 5-step qualitative research approach, we ranked the proposed post-2020 Common Agricultural Policy (CAP) objectives based on the stakeholders' answers and the corresponding key policy questions for each post-2020 CAP objective, as defined by the policy expert team. Finally, for each policy question we associated a list of relevant benchmark scenarios as identified by the stakeholders.

A clear focus on environmental policy objectives emerged from the MIND STEP core stakeholder group views. In fact, the post-2020 CAP objectives of "preserving biodiversity, ecosystem services and landscapes", "fostering environmental care" and "climate change action", were the most rated ones. The importance of the environmental issues coherently emerged also for the proposed scenarios, where stakeholders indicated more frequently environmental and low carbon setups. As regards modelling issues, the importance to analyse the trade-offs between economic and environmental objectives, and among environmental objectives, also clearly emerged.

The results presented in this report should allow MIND STEP researchers to have a clearer idea of which policies need to be modelled and thus make them able to give timely impact assessment for evidence-based policy making. In fact, setting the future priorities of agricultural policies is fundamental to understand what research direction IDM models should take. This report also set the stage for the remaining activities in Work Package 1, in particular for the identification of the relevant indicators for monitoring and measuring the impacts of policies (D1.2) and for the analysis of the potentials of IDM models in providing reliable simulations of the impact of these policies (D1.3).

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1. INTRODUCTION

The initiative "Better Legislation EU" launched in 2015 embraces all EU legislation processes and is aimed at putting better regulation at the heart of EU decision-making. Impact assessment and evaluations provide a sound basis for political decision-making, thus they are at the heart of this approach as they allow the implementation of evidence-based policy making.

In this context, the scientific community plays a fundamental role in providing quantitative ex-ante impact assessment analysis to the policy makers, helping the "better regulation EU" process supporting evidence-based policy making and thus improving the science policy dialogue.

For the agricultural sector, the scientific community should develop reliable explanatory models of agricultural systems that allow the assessment of effectiveness and efficiency of policy measures in the absence of empirical data.

Over the last years, the so-called Individual Decision Making (IDM) models have become very relevant in modelling agricultural systems and the impacts of agricultural and rural policies (Kremmydas et al., 2018). These models are appropriate instruments to understand farmers' behaviour in response to policy changing, mostly at the local level (An, 2012; Magliocca *et al*., 2015). They focus on behaviour of individual farmers, interaction among farmers, and between farmers and other actors in the food supply chain and in the non-food sectors. They represent a process-based "bottom-up" approach that, without a priori assumptions on the aggregate system properties, is aimed at analysing the behaviours and interactions among single autonomous agents in order to simulate developing phenomena (Brown *et al*., 2016; Helbing, 2012; Kremmydas et al., 2018).

Since these models appeared in the literature only recently, they have been first applied to a limited type of research questions and also used for a limited set of EU wide impact assessments. It is therefore important to, first, understand what key policy questions (and related benchmark scenarios) are relevant to the European agricultural sector and, second, try to understand whether and how IDM models can accommodate those policies to evaluate their impact on the agricultural sector.

Thus, the objective of this work is to set the research agenda for the H2020 project MIND STEP (Modelling INdividual Decisions to Support The European Policies related to agriculture) which is aimed at developing a highly modular and customisable suite of IDM models focussing on behaviour of individual agents in the agricultural sector. This research agenda should then be used to analyse the impacts of policies in order to support the ex-ante evaluation of future policy settings that might impact the European agricultural and rural sector. Also, it could be suitable to investigate whether current IDM models can be used to analyse these policy scenarios.

In the EU, this objective is very relevant in the light of the forthcoming deep policy changes foreseen by the Farm to Fork (European Commission, 2020) and European Green Deal (European Commission, 2019) strategies and the forthcoming reform of the Common Agricultural Policy (CAP) (European Commission, 2018). These policy changes are in fact supposed to have a great impact on the agricultural and rural sectors as the European Green Deal is aimed at transforming the EU into an economy *"where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use*", while the Farm to Fork strategy, which is at the heart of the Green Deal, "*addresses comprehensively the challenges of sustainable food systems and recognises the inextricable links between healthy people, healthy societies and a healthy planet*". This strategy recognizes that a resilient and sustainable food system can also offer economic gains and ensure that the recovery from the COVID-19 pandemic crisis puts the EU on a sustainable path. However, since these policy transition will take place during the implementation of the forthcoming reform of the CAP, the timing further complicates the design of policy scenarios regarding the EU agricultural and rural areas.

In this context, this study aimed to answer the following research questions: Q1: *What agricultural policy objectives are relevant and worth of investigation today?;* Q2: *Which benchmark scenarios should be investigated in order to capture the most relevant impacts of these policy objectives on EU agriculture and rural areas?*

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We addressed these fundamental issues using a set of qualitative tools including: (i) desk research on qualitative research approaches and virtual meetings by the research group that has coordinated the work; (ii) desk research and virtual meetings by a policy expert team on the key policy questions related to agricultural and rural areas; (iii) consultations with public and private stakeholders in order to canvass their opinion on which policy questions deserve attention from the farming sector perspective and which benchmark scenarios are worth modelling.
The stakeholders' engagement played a crucial role. In fact, since a common vision of the key policy questions greatly facilitates the communication between model developers and end-users, especially policy makers, engaging a broad class of stakeholders should help improving models' design and uptake in a science-policy dialogue perspective.
This exercise should allow researchers to have a clearer idea of which policies need to be modelled and thus make them able to give timely impact assessment for evidence-based policy making, thereby improving the science policy dialogue. In fact, setting the future priorities of agricultural policies is fundamental to understand what research direction these models should take.
In section 2 we present the materials and methods used; in section 3, we present the main results and in section 4 we discuss them; while in section 5 we present the conclusions.

2. MATERIALS AND METHODS

We carried out the analysis through a five-steps process using different research tools and involving different actors. In particular, in the first step the policy team of the project's consortium has been involved to define the policy questions per each key policy objective. Then, from step 2 to step 4, the MIND STEP core stakeholders' group has played a prominent role in defining and ranking the policy objectives and in identifying the scenarios to be modelled for each policy objective.
The work has been then finalised in step 5 with the final list of key policy questions and benchmark scenarios. We describe this five-steps process in detail throughout the next sub-sections and synthetize it in figure 1.

2.1. Key policy questions definition

The first step of the process was to prepare a draft proposal on the "key policy questions" to be answered by the MIND STEP modelling system. To this scope a "policy expert team" has been created in the project; this group consisted of researchers belonging to the project's consortium which had a high academic profile in policy evaluation and impact assessment methods.
The policy team reviewed the existing policies and future polices and analysed key global drivers affecting the agricultural sector in the EU. The discussion within the group included the current CAP and the post-2020 CAP legislative proposal and other policies affecting the agricultural and rural areas. After a preliminary analysis and discussion, the group decided to focus on the post-2020 CAP objectives as they are wide ranging and already include many global drivers (e.g. climate change, environment, food consumption, health, energy, innovation). In addition, the CAP reform represents one of the most important policy changes that will impact European agriculture in the near future.
Thus, first, the policy expert team extracted highly pertinent key policy questions from the nine post-2020 proposed CAP objectives (European Commission, 2018). Secondly, they evaluated all the relevant policy questions identified through this method against a set of predetermined selection criteria previously agreed among them. These criteria were:

1. Select policy questions that have an impact on IDM by farmers (or, in some cases, on collective decisions by farmers);
2. Select policy questions related to medium-long term fundamental issues (i.e. five-seven years horizon) and affecting a large number of farmers, to analyse issues that impact a large portion of EU agriculture;

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3. Try to identify policy questions for which (actual and potential) tools can be modelled within the project toolbox. This criterion includes, among others, selecting policies for which it is possible to identify a baseline against which to develop appropriate scenario analysis;
4. Give special weight to environment and climate issues, in the light of the prominence of these objectives for the EU policy agenda.

The work of the policy expert team provided key inputs for the following step 2 and 5. As regards step 2, first, they gave the clear indication to focus on the post-2020 CAP proposed objectives to have the stakeholders' opinion on them. Secondly, they clearly defined the criteria to be used by the stakeholders to select the pertinent scenarios.
As regards step 5, the policy questions identified in step 1 have been used to define the list of key policy questions and benchmark scenarios (see Figure 1).

2.2. The stakeholders' selection

The key phase of the process has been centred on the stakeholders' engagement. This pivotal phase involved 4 different steps (from 2 to 5 in figure 1).
Step 2 of the process consisted in selecting the MIND STEP core stakeholders' group.
Stakeholder engagement has been increasingly pursued in research projects and set in into sustainability sciences (Neshover et al., 2013; De Vente et al., 2016; Hagemann et al., 2020), as it increases the quality and relevance of the research by considering more comprehensive information inputs (Reed, 2008; Reed et al., 2009).
In the present study, the core stakeholder group selection has been carried out to accurately cover different interests' groups, including both public and private sector representatives (e.g. EU, national and regional policy makers, farmers' organisations, international organisations, researchers), and considering gender balance.
Particular attention has been given to the inclusion of two kind of stakeholders: policy makers and researchers. Policy makers at a strategic level are expected to focus on questions with medium to long term time horizon. In light of this objective, we strived to involve people who champion, oversee or guide agricultural policy processes in high level institutions, in order to also foster the dialogue between science and politics (Neßhöver et al., 2013; Greenhough et al. 2020).
Researchers are expected to prioritise policy questions and modelling needs, thereby complementing the work of the policy expert team. Thus, we aimed to include stakeholders that were familiar with the project's modelling approach and can be potentially interested in using the modelling tools developed in the project.
The final stakeholder group composition, thus, was made of 10 people in total, with a large representation of researchers and policy makers and less producer group representatives (see table A1 for the full list of stakeholders). This size and composition of the stakeholder group may have potentially affected the outcomes of the study. However, some measures have been agreed before the interviews in order to mitigate the potential impact of these biases. For example, it has been decided to eventually give higher weight to the replies of the underrepresented groups and consider less relevant those objectives or scenarios that might been pointed only by one stakeholder category (see section 4 for further details).

2.3. The stakeholders' interviews

In the third step, we held individual interviews with the stakeholders' group. We administered a total of 10 interviews between 19 May and 9 June 2020. Since the Covid-19 pandemics hindered the arrangement of physical meetings, we organized a series of online meetings.
The interviews were aimed at: (i) supplementing the work of the policy expert team by providing the perspective of heterogeneous interest groups; (ii) gathering information on key policy issues regarding

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the future of agriculture, in order to explore the user needs in relation to modelling and scenario analysis.

We chose to conduct semi-structured interviews, as with this approach the interviewer asks only a few predetermined inquiries, while the rest of the questions are not planned. Of course, with this method, the specific topics that the interviewer wants to explore should be defined in advance and, usually, preparing a schematic guide is beneficial to address the conversation. This instructional document is typically an informal hierarchy of topics and questions that the interviewer can ask in different ways to different participants. In this work, we defined three groups of topics based on the issues that we wanted to investigate. We also kept the same ordering for all the participants, while small differences emerged depending on the respondents' experience and position.

The main advantages of semi-structured interviews are basically two: first, informants get the freedom to express their views and the interviewer can be more conversational, thus facilitating two-way communication. Second, both the interviewed and interviewer can ask for clarifications. On the cons side, semi-structured interviews are rather time-consuming and thus they cannot be used for large groups of informants.

Each interview covered the following three general topics: (i) "*What agricultural policy objectives do you consider relevant and worth of investigation today and for what reasons?*"; (ii) "*Among the proposed post-2020 CAP objectives, which one you consider to be most relevant and for what reason?";* (iii) "*In this moment, which benchmark scenario could be useful to investigate in order to capture its relevant impacts on EU agriculture and rural areas?*".

To avoid influencing one interviewee's replies, we designed the first question to be as generic as possible. We then posed a more structured inquiry addressing the post-2020 CAP objectives.[1] Moreover, in order to let emerge global drivers not considered by the policy team, we have complemented question (i), when needed, by explaining that the policy objectives may be influenced by the need to respond to new global drivers affecting the agricultural sector.

Prior to discussing the policy questions, we asked the interviewee about her/his working position and her/his knowledge of modelling tools and possible use in his working activity.

To be useful to the project's purposes, we also asked the interviewees to keep in mind that the prioritization and suggestion of policy issues should have complied with the following requirements[2]:

1. Select policy issues that have a clear linkage with a relevant EU policy issue related to agriculture
2. Select policy issues that point to a measurable phenomenon (e.g. production, investments, labour use, farmers' income change, structural changes at farm and sector level, environmental impact like GHG emissions, etc.)
3. Select policy issues that have an impact on farm management/individual decision making by farmers (or in some cases, on collective decisions by farmers)
4. Select policy issues related to medium-long term fundamental issues (i.e. five-seven years) and affecting a large share of EU farmers.

[1] To facilitate the stakeholders' answering to the second question, a slide listing the post-2020 CAP objectives has been shown to the participants.

[2] These requirements reflect some of the selection criteria used by the policy team, but they have been described in a slightly different way to be more understandable by an audience that could not include academic representatives.

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2.4. The focus group

In the fourth step, after the interview sessions, we summarized the results by drafting a shortlist of policy questions (including post-2020 CAP objectives) and benchmark scenarios.
Those materials have been prepared for presentation at the focus group (stakeholders, policy expert and research team) meeting. We chose to discuss within a focus group setting because this approach is recognised as a useful tool to gather qualitative information to answer specific research questions (Bloor et al., 2001). It is therefore helpful to learn more about a subject and to discover stakeholders' opinions (Morgan and Krueger, 1993). In addition, they are useful to let opinions emerge that would not be detectable through other social research methods, such as one-to-one interviews or questionnaire surveys (Gibbs, 1997). This type of discussion may also provide scope and space for interdisciplinary and transdisciplinary conversations with key stakeholders, letting emerge interesting cross-cutting issues for future research.
Of course, focus groups have also several drawbacks. First, the representativeness of the groups may be questionable (Gibbs, 1997). Therefore, they might not provide accurate information on what the reference population thinks about a certain topic (Gamboa and Munda, 2007). Also, if not adequately moderated, it might be difficult to identify an individual message (Gibbs, 1997) as some participants might be discouraged to express their opinion because of the absence of confidentiality (Gibbs, 1997), or due to differences in "social status" that may originate silence among some participants (Bloor et al., 2001)[3]. It could also happen that some participants monopolize the discussion (Smithson, 2000), perhaps due to power relations (Bloor et al., 2001). Although the moderator of the discussion has control, there is no guarantee that some participants may remain silent due to lack of confidentiality, differences in social status or due to established power relations. Having these caveats in mind, we have tried to control for all of these possible drawbacks during the meeting.
The focus group meeting was organized on 24 June 2020. Due to the Covid-19 emergency, however, the focus group took place online via Microsoft Teams®. The number of participants was 22; almost all stakeholders (8 out of 10) attended and helped generating further discussion, together with the five researchers from the research group and nine members of the policy team.
Although the online setting may not be ideal for the discussion, housekeeping rules were clarified before the meeting, and the discussion proceeded rather smoothly. In our experience, none of the drawbacks of focus group methods listed above have emerged during the meeting.
The objectives of the focus group were essentially two: first, to present the results of the interviews to the experts of the core stakeholder group and, second, to get their feedbacks and foster discussion among all the participants. After a brief introduction and participants' self-introduction, the meeting proceeded as intended: results were presented, feedbacks followed and generated a lively discussion.

2.5. Definition of the key policy questions and scenarios

During the fifth and last step, all the results from the focus group meeting were summarized and complemented with the work of the policy expert team. This desk work, also supplemented by feedbacks from the project's partners, allowed us to come up with a final shortlist of key policy questions and related benchmark scenarios that are worth of investigation in the light of the forthcoming EU policy changes.
Figure 1 - The five-step process: actors involved, tools used, and output obtained in this research exercise.

[3] In the present exercise, these drawbacks should have been weakened by the fact that we already had individual interviews that should have given the possibility to everyone to let his opinion emerge in confidentiality.

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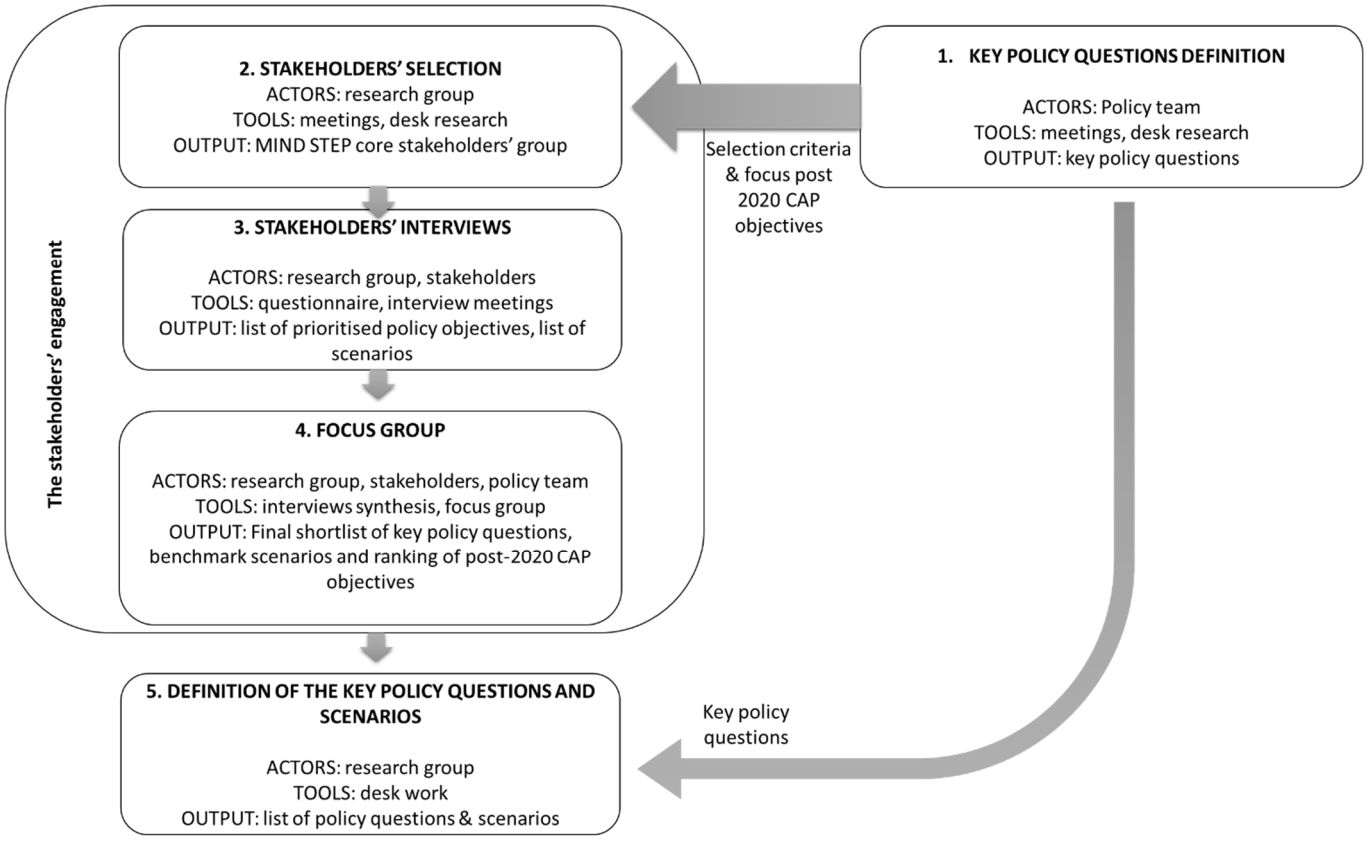

Figure 1 Actors, tools and output of each step of the proposed approach

3. RESULTS

3.1. Policy questions reflecting the post-2020 CAP objectives

The policy expert team developed a conceptual matrix in which they associated sensible policy questions to each of the nine post-2020 proposed CAP objectives. These policy questions were then evaluated against the above listed selection criteria and selected according to their relevance to the project. Table A2 in the annex reports the results of this work.

Overall, all the nine objectives seem to be covered by the project modelling tools, with various degree of inclusion. However, 3 out of 9 items, namely support generational renewal, vibrant rural areas and protect food and health quality, seem less explorable.

Figure 2 summarizes the results of the evaluation of the policy questions against the selection criteria. Coherently with the project's scope, the policy team has selected only policy questions that have an impact on IDM by farmers (or, in some cases, on collective decisions by farmers), thus selection criteria 1) has been satisfied by all the policy questions proposed.

The bulk of the 23 policy questions refers to medium-long term fundamental issues. Almost half (10 out of 23) gives special weight to environment and climate change. 15 out of 23 can be (actually or potentially) modelled by the project's toolbox for quantitative evaluation. For 13 questions it is easy to identify a baseline of policies against which to develop appropriate scenario analysis.

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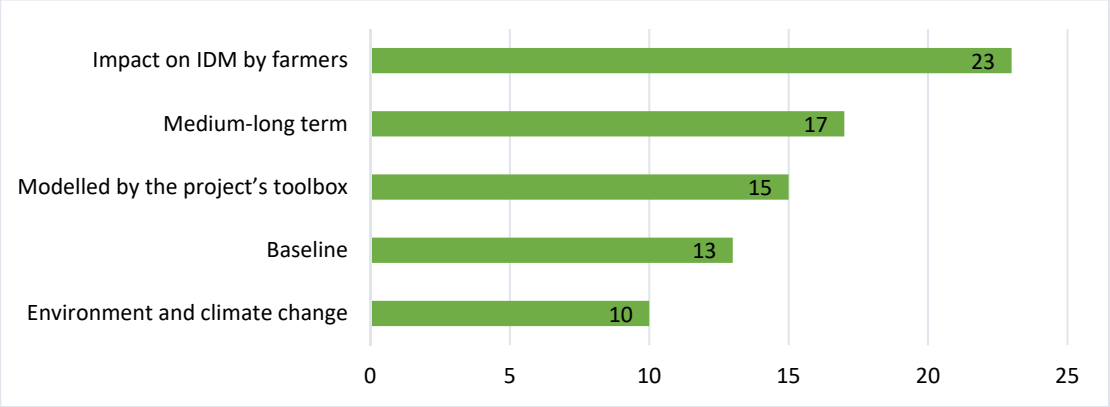

Figure 2 Evaluation of the policy questions against to the selection criteria.

Source: policy team.

3.2. The stakeholders' contribution

3.2.1. Most relevant post-2020 CAP objectives

As detailed in the previous section, during the interviews, stakeholders were asked which of the proposed post-2020 CAP objectives they considered most relevant. Each respondent could indicate more than one objective. Figure 3 shows a histogram of the replies.

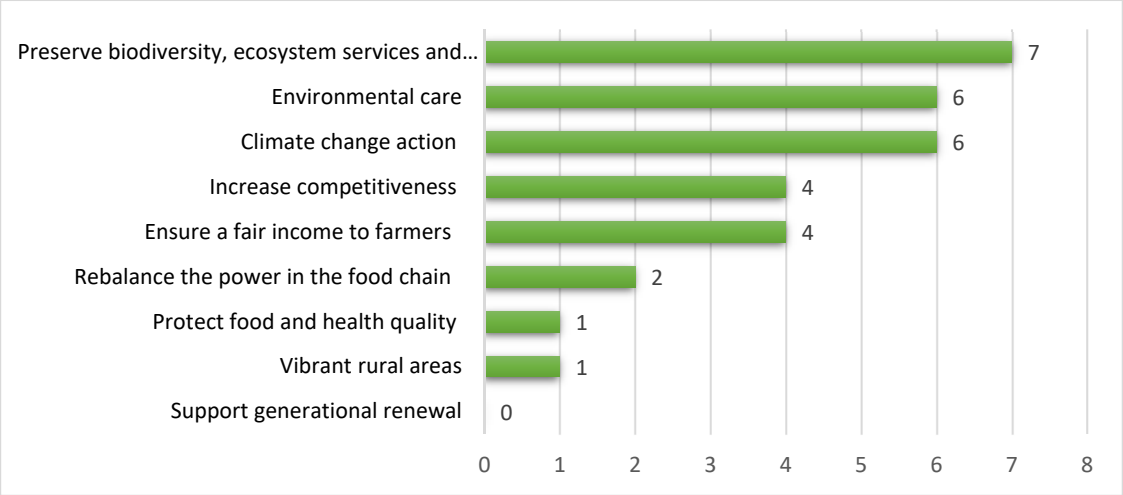

Figure 3: Replies to the question on the most relevant post-2020 CAP objective

Source: stakeholders' interviews.

A clear focus on environmental objectives emerged, with (a) preserving biodiversity, ecosystem services and landscapes, (b) fostering environmental care and (c) climate change action being the most rated post-2020 CAP objectives.
This ranking is not univocal as, for some stakeholders, economic objectives were more important, and, in general, all stakeholders considered all nine objectives relevant and worth of investigation. Interestingly, however, this ranking is in line with what emerged from the policy expert team analysis of the post-2020 CAP proposed objectives. Indeed, the last three policy objectives, that were deemed marginal to the project's scope and poorly manageable within the scope of the modelling effort, are

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also the items regarded as less important by the stakeholders' group (i.e. protect food health and quality, vibrant rural areas and support generational renewal).

3.2.2. Key policy objectives

Results for the key policy objectives differ slightly because, unlike the above discussion, stakeholders were not influenced and restricted to discuss post-2020 CAP objectives.
Almost all stakeholders mentioned, with different degrees of emphasis, environmental topics, highlighting the importance of balancing the economic and environmental performance of the primary sector. Skimming through the most recurrent answers, the shortlisted policy objectives shown to the stakeholders during the focus group were:

1. joint environmental and economic performances: provision of enough healthy food with minimal impact on the environment and reduced reliance on subsidies, increasing efficiency, climate change adaptation and resilience;
2. provision of environmental public goods with a special focus on climate change mitigation;
3. increasing competitiveness: viable farm communities less dependent on subsidies; better risk management;
4. foster innovation in agriculture.

In general, all the stakeholders were substantially in line with the proposed list. They also stressed its ambitiousness and pointed out how challenging analysing these objectives will be. Then, a discussion started on the possible overlaps between objectives 1 and 2, but it has been stressed that the provision of environmental public goods (objective 2) has a wider scope than just minimizing the negative impacts of agriculture.
Of course, the boundaries between these objectives are quite often thin and subjective. This final shortlist summarizes the different opinions emerged that, as anticipated, have many common points.
To complete and better argument the proposed list, the stakeholders also emphasized the following aspects:

a) food supply chain connections, from consumer to farmers, should be emphasised considering the Farm to Fork strategy approach;
b) a specific focus should be dedicated to the multiple trade-offs between economic and environmental objectives and among environmental objectives, e.g. climate change mitigation vs. biodiversity preservation;
c) a major emphasis has been placed on biodiversity issues linked not only to farming practices, but also to land and pesticide use;
d) short-term vs long-term effects of the different scenarios should be explored (e.g. biodiversity effects can be different in the long term);
e) the structural change impact of investments at farm level and of adoption of new technologies should be analysed.

3.2.3. Benchmark scenarios

Finally, the stakeholders were shown the set of proposed benchmark scenarios that emerged from the vis-à-vis semi-structured interviews during which each respondent was asked to select more than one option.
We summarise the results of this process by classifying the type of scenarios proposed according to their main topic. Then, for each topic, we indicate two data: the number of scenarios suggested by the stakeholders per topic and the number of times a topic was indicated in the replies (Table 1).

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Table 1 Proposed benchmark scenarios grouped by category with number of scenarios listed and of stakeholders' replies

Scenario type	Number of scenarios proposed	Number of times cited
Environmental	5	10
Low carbon scenario	7	9
Animal welfare	1	2
First Pillar Payment Changes	4	4
Cross-cutting issues	3	7
Modelling issues	5	5

Source: stakeholders' interviews.

The importance of the environmental issues also emerged within the discussion of the proposed scenarios, where stakeholders indicate environmental and low carbon setups more frequently. Environmental type scenario included creating markets for ecosystem services or fostering their implementation. Low carbon type scenario included the impact of different mitigation measures (livestock number, nutrient management) and simulations of policy instruments (e.g. carbon taxes, nutrient quotas, subsidies, etc.). Farm to Fork strategy type of scenario (e.g.: - 50% chemicals; 25% organic UAA, etc) have also received great attention, since interviews took place on the same days the corresponding strategic document was released. First pillar payments changes include the complete removal of subsidies and the re-coupling of support to environmental services.
Cross-cutting issues involved fostering the adoption of risk management tools and evaluating the impact of technology adoption and energy transition on multiple indicators (farm, environmental and societal). Modelling issues included the possibility to model collective payments to farmers (i.e. the coordination of different farmers to provide environmental outputs), the dynamic analysis of different scenarios (i.e. the impact of the timing of the introduction of a new policy) and the specific evaluation of the new "CAP delivery model" that allows differentiating the responses by Member States. [4]
The following list represents the preliminary shortlisted scenarios presented to the stakeholders during the focus group, based on the frequency by which any scenario had been previously indicated:

1. creating markets for ecosystem services (including carbon sequestration);
2. adopting collective payments to farmers (landscape approach to biodiversity);
3. Farm-to-Fork strategy-type scenario: Mandatory reduction of input use (e.g. -50% pesticides, etc.);
4. allocating x% of the farm area to a public good use (proxy) especially for arable farms;
5. creating incentives for energy transition in agriculture (e.g. renewables);
6. introducing different GHG mitigation measures (i.e. constraints on livestock numbers and/or on nutrient disposal);
7. adopting carbon taxes on agricultural production;
8. adopting subsidies targeted to climate change mitigation;

[4] The importance of trade barriers (i.e. carbon adjustment tax at the borders, or pesticide regulations such as glyphosate use) has been often highlighted. However, as trade issues are not among the project's objectives, the IDM models will not directly look at trade issues, although some impacts of trade policies may be evaluated.

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9. adopting a carbon border tax adjustment together with previous instruments;
10. simulating the impact of changes in diets on the agricultural sector (e.g. reduction of meat consumption);
11. introducing incentives to increase carbon sinks by farmers (and measure the impact of different land use options);
12. simulating land use changes derived from different livestock management options (e.g. more grazing, constraints on feed, constraints on livestock numbers, etc.);
13. increasing the share of subsidies used for innovation adoption (precision agriculture, conservation agriculture, 5g, robotics, Artificial Intelligence, Blockchain, etc.);
14. introducing first pillar payments changes (removal, full decoupling, linkage of payment to farm labour rather than to farm area, re-coupling to public goods and ecosystem services);
15. adopting publicly supported risk management tools;
16. introducing measures to deal with animal welfare issues.

After the discussion in the focus group meeting, the following points of attention emerged:

1. behavioural factors should be carefully considered as they represent relevant cross-cutting issues across scenarios (e.g. climate change mitigation vs. risk management scenarios);
2. collective payments to farmers and results-based payments should deserve specific attention in modelling;
3. models should distinguish the scale of the farmers for accessing specific policies, since small farmers may have more difficulties than large farmers (i.e. for certification policies);
4. modellers should make a specific effort in modelling certification and labelling policies and the related investments that are very relevant in the Farm to Fork strategy (i.e. animal welfare labelling, carbon, biodiversity and other ecosystem services);
5. modelling efforts on innovation should consider investment behaviour specifically targeted to innovation;
6. risk management is very important also for resilience evaluations (i.e. relatedto cliamate change adaptation)
7. adaptation to climate change should also be addressed;
8. the linkages and potential trade-offs among outputs of the different scenarios should be clearly analysed, especially those linked to the environment;
9. a special attention should be dedicated to modelling the recoupling of payments to ecosystem services, the only rationale for maintaining such payments to farmers.

3.3. Definition of key policy questions and benchmark scenarios

Table 2 presents a synthesis of the work in its entireness throughout steps 1 to 5.
In the table, the proposed post-2020 CAP objectives are presented in the ranking resulting from the stakeholders' answers; for each post-2020 CAP objective the list of key policy questions proposed by the policy expert team is also indicated. Finally, the table lists the corresponding relevant benchmark scenarios defined by the stakeholders and/or by the MIND STEP policy team.
The table helps clarifying which policy question (and related future CAP objective) each scenario should answer to.

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Table 2 List of policy questions and benchmark scenarios

Policy Objectives & Related Key Policy Questions	Scenario Proposed
Preserve biodiversity, ecosystem services and landscapes	
What is the impact of the various policy scenarios on farmland biodiversity?	Creating markets for ecosystem services
	Adoption of collective payments to farmers (landscape approach to biodiversity)
Environmental care (air, soil, water)	
What is the impact of the various policy scenarios on soil protection (i.e. soil fertility, soil erosion, etc.) and on water quality?	Farm-to-Fork strategy-type scenario: Mandatory reduction of input use (e.g. -50% pesticides, etc.)
	Farm to Fork strategy-type scenario: Mandatory UAA cultivated with organic farming methods (e.g. 25% UAA organic)
	Adoption of collective payments to farmers (territorial approach to environmental care) (e.g.: new approaches to nutrient policies or agri-environmental payments)
What is the potential impact of soil-protecting and water-saving technological innovation (i.e. rotation, soil cover, precision agriculture, no-tillage, minimum tillage, new irrigation systems, etc.) on some key agricultural indicators (i.e. crop mix, yields, farm income, etc.)?	Allocate x% of the farm area to a public good use (proxy) especially for arable farms
	Create incentives linked to the environmental footprint of agricultural activities
	Create incentives for energy transition in agriculture (e.g. renewables)
	Increased use of EU subsidies for various types of agri-environmental measures
Climate change action	
What is the likely impact of climate change trends (i.e. changes in temperature, changes in precipitation, frequency and severity of extreme events, etc.) on some key agricultural indicators (i.e. crop mix, yields, farm income, etc.)?	Impact of different GHG mitigation measures (i.e. constraints on livestock numbers and/or on nutrient disposal).
	Simulate the adoption of carbon taxes on agricultural production
	Simulate the adoption of emission trading systems between farms
	Simulate the adoption of subsidies targeted to climate change mitigation

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Policy Objectives & Related Key Policy Questions	Scenario Proposed
What is the impact of the various policy scenarios on GHG emissions due to agriculture?	Simulate the adoption of a carbon border tax adjustment together with previous instruments
	Simulate the impact on the agricultural sector of changes in diets (e.g. reduction of meat consumption)
What is the potential impact of technological innovation (i.e. new soil management techniques, biomass production, carbon sequestration technologies, new livestock management, etc.) on GHG emissions?	Create incentives to increase carbon sinks by farmers (and measure the impact of different land use options)
	Simulate land use changes derived from different livestock management options (e.g. more grazing, constraints on feed, constraints on livestock numbers, etc.)
Increase competitiveness	
What is the impact of the various policy scenarios on individual farm productivity, and then at the regional, country and EU level?	Model an increased use of subsidies for innovation adoption (precision agriculture, conservation agriculture, 5g, robotics, Artificial Intelligence, Blockchain, etc.)
What is the impact of the various policy scenarios on productivity of the various factor of production (i.e. land, labour? capital)	
What is the potential role of technological innovation in productivity change?	
What is the potential impact of the various policy scenarios on the technological choices by farmers (i.e. organic vs conventional agriculture; precision vs. conventional agriculture)	
Ensure a fair income to farmers	
What is the impact of the various policy scenarios on individual farm income and its distribution across country, regions, type of farms and fam size classes?	Model the removal of first pillar direct payments
What is the impact of changes in first pillar direct payments on farm income?	Model a further full decoupling of first pillar payments
	Model a fundamental change in the distribution of direct payments (i.e. linkage of payment to farm labour rather than to farm area or other parameters, etc….)

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Policy Objectives & Related Key Policy Questions	Scenario Proposed
How volatile is farm income under different policy scenarios and global shocks (i.e. climate shocks, price shocks, etc.)?	Model a re-coupling of the First Pillar Payments to public goods and ecosystem services
	Simulate other re-instrumentation for the first pillar payments
What is the potential impact of risk management tools on the level and volatility of farm income?	Model the adoption of publicly supported risk management tools (i.e. subsidised income stabilisation tools)
	Model the impacts of the adoption of market-based risk management tools (future markets, options)
Rebalance the power in the food chain	
What is the impact of the various policy scenarios on the distribution of value added along the food supply chain?	Simulate the adoption of supply chain management tools such as contracting and producers' organisations
How relevant is the imbalance in market power along the chain in different countries and sectors?	
Can some policy tools contribute to rebalancing market power along the chain (i.e. farmers' cooperatives, producer organisations, inter-branch organisations, contracting, etc.?	
Are high quality food chains (organic agriculture, geographical indications, etc.) a tool for increasing the farmer's share of value added along the chain?	
Protect food and health quality	
What is the impact of the various policy scenarios on some key indicators of food quality at the farm level (i.e. use of chemicals, use of antibiotics in animal husbandry)?	Introduction of measures to deal with animal welfare issues (regulations)
	Introduction of measures to deal with animal welfare issues (labelling)
Vibrant rural areas	
What is the impact of the various policy scenarios on employment in agriculture and rural areas (i.e. number and size of farms)?	Evaluate the indirect impact of previous scenarios on labour

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Policy Objectives & Related Key Policy Questions	Scenario Proposed
What is the impact of the various policy scenarios on poverty in rural areas?	Evaluate the indirect impact of previous scenarios on income
Support generational renewal	
What is the impact of the various policy scenarios on structural change in agriculture (i.e. number and size of farms)?	Simulate farm exit behaviour according to different policy settings
What is the impact of the various policy scenarios on generation renewal and access by new farmers?	

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4. DISCUSSION

Table 2 presents the final shortlisted key policy questions and benchmark scenarios for ex-ante impact assessment of EU agricultural and rural policies as resulting from the five-steps process adopted here. The main objective of this process was in fact to identify the key policy questions (and the related scenarios) to be answered by the IDM models, while policy objectives have been mainly used to define the wider context in which each policy question is placed.

The classification of these objectives refers explicitly to the post-2020 CAP objectives for two main reasons. First, because, for the projects' purposes, it was important to remain as close as possible to the CAP reform proposal framework. Secondly, and more importantly, because during the stakeholders' interviews and the focus group, the set of CAP reform proposal objectives has been confirmed as main reference for future policy goals, with just a more comprehensive definition of the same objectives.[5]

In this respect, the stakeholder engagement lead to two major indications: (i) prioritizing environmental issues and (ii) jointly analysing different objectives as much as possible (mainly the joint economic and environmental performances).

Although the stakeholders' composition might well have affected these results, opinions proved substantially homogeneous within each category of stakeholder. Rather, all the actors involved shared a very common vision of future policy goals. For example, farms' economic sustainability was not only mentioned by the farmers' representative, but also by all other stakeholders. In fact, the whole group agreed that such goal should be pursued in conjunction with environmental sustainability. Although consumers' representatives were not engaged, consumption-related issues have often emerged in terms of healthy viable foods and labelling requirements.

The indications derived from the stakeholder meeting have been primarily used to rank the relative prominence of the post-2020 CAP objectives and to better define and further elaborate the final key policy questions to be answered and modelled by the project. As a result, an overall prominent importance has been given to environmental and climate objectives, followed by a recommendation to broaden the scope of the policy questions, thus including the possibility to combine different objectives and exploring the potential trade-offs between objectives.

All the scenarios suggested by the stakeholders have been included in the final shortlist. In addition, to follow the stakeholders' suggestions, specific modelling issues have been further detailed as aspects to be analysed by each scenario proposed. These modelling issues are the following:

1. Exploring relevant differences across countries, regions and sectors
2. Analyse the trade-off between economic and environmental objectives
3. Analyse the trade-off between environmental objectives
4. Analyse the relevance of the timing and the dynamics of the scenario.

Of the points of attention listed in section 3.2.3, only that related to the modelling of farmers' collective payments has been converted into a specific scenario. On the other hand, all the other aspects will be considered cross-cutting issues when building the scenarios.

Coherently with the suggestions received by the stakeholders, 17 scenarios are proposed for the three environmentally related objectives, while 9 scenarios touch competitiveness-related objectives. As regards the other policy goals (rural development, generational renewal and food health and quality) only 5 scenarios have been suggested, although many other scenarios will produce results that have an impact on these three policy objectives, which will be explicitly evaluated.

[5] For example, climate change emerged by far as the most cited global driver of changes for the primary sector and this driver is widely considered in the future CAP setting.

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It is worth noticing that while the proposed list of scenarios will be a key input in the MIND STEP project, probably only a selected number of these scenarios will be actually modelled. In addition, the definition of each scenario can still be modified to fit the capacities of the models. These aspects will be further investigated in task 1.3 dealing with the modelling gaps of IDM models.

5. CONCLUSIONS

This report introduced the relevant policy questions and related benchmark scenarios that could be modelled in the MIND STEP project to address the IDM response of EU farmers to potential policy changes. These policy questions and scenarios are the result of a 5-step approach, based on qualitative research, including online interviews with a selected group of stakeholders (the MIND STEP core stakeholder group) and focus group activities.

Modelling these scenarios will provide a quantitative assessment of their potential impacts, which should help the policy making process, favouring an evidence-based approach in the light of the forthcoming major reforms of the CAP. Of course, the proposed list of scenarios represents a first suggestion for the work to be done, while only a selected number of these scenarios will be actually modelled by the project's toolbox.

Stakeholders' engagement has been crucial to have pertinent opinion on which policy objectives and related scenarios are relevant for EU agriculture, and thus worth modelling efforts.

The main message coming from this engagement was to give as much importance as possible to environmental issues and thus to put a strong effort in modelling the environmental impact of policies, in order to be able to analyse the joint objectives of economic and environmental performances of the EU agricultural sector and the potential trade-offs between environmental objectives.

This importance of the environmental issues reflects also in the clear ranking of the post-2020 CAP objectives, among which the environmental ones are judged as the most important policy goals, and in the high frequency of environmental and low carbon scenarios that have been proposed by the stakeholders.

The synthesis of the work has resulted into a detailed list of key policy questions and related benchmark scenarios that should be modelled. The most relevant policy questions are those related to the environmental and competitiveness related objectives, as classified by the post-2020 CAP reform proposal, although the other policy goals (rural development, generational renewal and food health and quality) have been also judged important, given their links to the previous ones. Overall, 17 scenarios are proposed for the three environmentally related objectives, 9 for the competitiveness-related objectives and 5 for the rural development, generational renewal and food health and quality.

Results presented here represent just an initial, but promising exercise that has tried to gather valuable opinion and expertise in order to design the research agenda for the IDM modelling approach to support evidence-based policy making with reference to the CAP ex-ante impact assessment.

Further steps of the analysis include the identification of bottlenecks and gaps of current models and modelling approaches with respect to their ability to simulate the suggested scenarios, as well as the selection of proper indicators to capture the impact of the policy scenarios.

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APPENDIX 1

Table A1 List of the core stakeholder group members interviewed

	Name	Organisation
1	David Baldock	IEEP
2	Robert Finger	ETH
3	Christopher Genillard	Genillard & Co Consultant Company
4	Reina Groen	Province of Flevoland (NL)
5	Eva Iglesias Martínez	CEIGRAM
6	Simon Kay	EC DG CLIMA
7	Jussi Lankoski	OECD
8	Simon Schlüter	German farmer association in Brussels
9	Ben Van Doorslaer	EC DG AGRI
10	Stefan Van Merrienboer	Rabobank

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APPENDIX 2

Table A2: Matrix of the post-2020 proposed CAP objective and their evaluation against predetermined criteria

	CRITERIA			
	1. Impact on IDM by farmers	**2. Medium-long term issues & affecting a large number of farmers**	**3. Modelled in MIND STEP**	**4. Environmental/ climate**
POLICY QUESTIONS				
1. Ensure a fair income to farmers				
What is the impact of the various policy scenarios on individual farm income and its distribution across country, regions, type of farms and fam size classes?	x	x	x	
What is the impact of changes in first pillar direct payments on farm income?	x	x	x*	
How volatile is farm income under different policy scenarios and global shocks (i.e. climate shocks, price shocks,…)?	x	x	x	x
What is the potential impact of risk management tools on the level and volatility of farm income?	x	x	x	x
2. Increase competitiveness				
What is the impact of the various policy scenarios on individual farm productivity, and then at the regional, country and EU level? What are the relevant differences across countries, regions and sectors?	x	x	x	
What is the impact of the various policy scenarios on productivity of the various factor of production (i.e. land, labour, capital)	x	x	x	
What is the potential role of technological innovation in productivity change?	x		x	

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What is the potential impact of the various policy scenarios on the technological choices by farmers (i.e. organic vs conventional agriculture; precision vs. conventional agriculture)	x	x	x	x
3. Rebalance the power in the food chain				
What is the impact of the various policy scenarios on the distribution of value added along the food supply chain? Are there relevant differences across countries and sectors?	x	x	x	
How relevant is the imbalance in market power along the chain in different countries and sectors?	x	x	x	
Can some policy tools contribute to rebalancing market power along the chain (i.e. farmers' cooperatives, producer organisations, inter-branch organisations, contracting,…)?	x	x	x	
Are high quality food chains (organic agriculture, geographical indications,…) a tools for increasing the farmer's share of value added along the chain?	x		a*	x
4. Climate change action (adopt tech; organic matter balance in soil)				
What is the likely impact of climate change trends (i.e. changes in temperature, changes in precipitation, frequency and severity of extreme events,…) on some key agricultural indicators (i.e. crop mix, yields, farm income…)? What are the relevant differences across countries, regions and sectors?	x	x	b	x
What is the impact of the various policy scenarios on GHG emissions due to agriculture?	x	x	x	x

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What is the potential impact of technological innovation (i.e. new soil management techniques, biomass production, carbon sequestration technologies, new livestock management,…) on GHG emissions?	x		x	x
5. Environmental care (adoption of tech more crop protection)				
What is the impact of the various policy scenarios on soil protection (i.e. soil fertility, soil erosion,…)? Are there relevant differences across countries, regions and sectors?	x	x	a*	x
What is the potential impact of soil-protecting technological innovation (i.e. sustainable soil practices: rotation, soil cover, precision agriculture, no-tillage, minimum tillage, …) on some key agricultural indicators (i.e. crop mix, yields, farm income…)?	x	x	x*	x
6. Preserve landscapes and biodiversity (crop diversity/crop mix)				
What is the impact of the various policy scenarios on farmland biodiversity (i.e. interpreted as crop mix rather than landscape,…)? Are there relevant differences across countries, regions and sectors?	x		a*	
7. Support generational renewal				
What is the impact of the various policy scenarios on structural change in agriculture (i.e. number and size of farms)? Are there relevant differences across countries, regions and sectors?	x	x	x	
What is the impact of the various policy scenarios on generation renewal and access by new farmers? Are there relevant differences across countries, regions and sectors?	x		a*	
8. Vibrant rural areas[d]				

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What is the impact of the various policy scenarios on employment in agriculture and rural areas (i.e. number and size of farms)? Are there relevant differences across countries, regions and sectors?	x	x	c	
What is the impact of the various policy scenarios on poverty in rural areas? Are there relevant differences across countries, regions and sectors?	x		d	
9. Protect food and health quality				
What is the impact of the various policy scenarios on some key indicators of food quality at the farm level (i.e. use of chemicals, use of antibiotics in animal husbandry)? Are there relevant differences across countries, regions and sectors?	X	x	e	x
Sum per each criterion	**23**	**17**	**15**	**10**

*: difficult to identify a baseline
a: Difficult to model. Should be checked
b: Climatic data are inputs for models, not output
c: Interpreting labor as input use
d: No specific model. Only indirectly through income (linked to previous areas 1, 2, 3)
e: Mainly as use of chemicals, not for antibiotics

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