

# Farmers' perceptions of agro-food system actors in biodiversity-related decision-making

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**Abstract** –Little is known on how agro-food system actors, e.g. researchers or bulk buyers, influence farmers' biodiversity-related decision-making (*biodivDM*). By understanding these relationships, it becomes possible to use them in informing future pro-biodiversity campaign and policy design. Therefore, we elicited and analyzed farmers' perceptions of these actors across 10 case study regions. Aiming for a comparative approach, we created a Perception Matrix including 12 stakeholder groups to be quantitatively rated against 8 perception statements, complemented by qualitative interviews to discuss findings with local experts. On average, governmental bodies were perceived most negatively and researchers most positively. Additionally, we found perceptions towards stakeholder groups to be nuanced and, partly, divergent. Randomization tests support these findings indicating significant differences in farmers' perceptions across and within stakeholder groups. Overall, this approach helps to reveal highly valued actors and their perceived strengths and weaknesses. This research can facilitate accurate design of broadly-based, potentially more powerful pro-biodiversity initiatives.

## INTRODUCTION

Farmers' social environment is known to affect their pro-environmental decision-making (Dessart et al., 2019). Acting as information sources, farm input suppliers, researchers or peers influence, for example, farmers' decisions, regarding efficient nitrogen input or the adoption of soil innovations (Stuart et al., 2018; Rust et al., 2022). Perceptions towards these stakeholders, such as taking farmers' interests seriously (Rust et al., 2022) or sharing useful knowledge (Stuart et al., 2018) are found to contribute to explaining the influence of, and trust in, stakeholders. However, regarding biodiversity management, a systematic analysis of stakeholder perceptions remains lacking. To identify highly valued stakeholder groups, we analyzed how farmers perceive agro-food system actors in *biodivDM*. This approach could facilitate behavioral change in agriculture through informing more broadly-based pro-environmental initiative design (media campaigns, policies, etc.), as suggested by Dessart et al. (2019) and Stuart et al. (2018).

## DATA AND METHODS

This study is based on mixed methods. Data was, after pre-testing, collected in 49 farmer interviews across case studies in 10 European countries (UK, NL,

FR, CH, RO, HU, PT, SE, ES, EE) in autumn/winter 2021/22.

To reveal farmers' implicit perceptions of stakeholders as comparable, quantitative data, we applied Perception Matrices (PMs). PMs, as described by Moon et al. (2017), are based on constructionist Repertory Grid (RG) technique (Kelly, 1955). RGs aim to portray individuals' views on their environment by systematically identifying and rating "elements" (here: stakeholder groups) against "constructs" (here: perception statements) worded as quantitative scales. For PMs, researchers objectify the rating process by pre-defining elements and constructs, i.e. the matrix, to enable quantitative comparisons between subjects.

For pre-defining the matrix, we applied a multi-actor approach. Project partners (n=12) proposed stakeholder groups and perception statements reflecting the local context of the research areas. To consider practical relevance, we conducted RGs with three farmers revealing their individually relevant elements and constructs. After checks for redundancy and, by means of scientific literature, completeness, we created a matrix including 12 stakeholder groups and 8 perception statements (Table 1). Statements are *biodiversity-specific* (row 1-4) or *general* (row 5-8). Each statement is worded negatively (1-point end) and positively (5-point end) to define scales on which stakeholder groups are rated. Stakeholders include public, market and social actors.

To analyze PM data, besides descriptive statistics, we applied randomization tests (RTs) to detect significant differences in perceptions both across and within stakeholder groups and between socio-demographically, geographically and management-wise clustered groups of farmers. Non-parametric RTs allow for pairwise comparison of means in within-subject, i.e. non-independent data (Craig and Fisher, 2019). RTs, based on 10.000 repeats, were carried out in R.

To subsequently explain extreme, i.e. most positive and negative, perceptions country-specifically, qualitative interviews with 40 local experts were conducted in winter 2021/22. The sample includes representatives from agricultural administration (14), extension (7), farmers' associations (7), researchers (5), nature organizations (4) and others (3).

## RESULTS

When comparing the overall means across countries,

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Row number	1 -point end	Government national/local	Researchers	Farm advisors	Other farmers	Producer organization(s)	Fertilizer supplier(s)	Crop protection supplier(s)	Machinery sup- plier(s)	Bulk buyer(s)	Direct buyers /consumers	People in general	People in social environment	5 -point end
1	biodiversity protection in agriculture is <b>not</b> their <b>goal</b> at all	2.94	4.22	3.14	2.83	3.15	2.16	2.13	2.15	3.30	3.63	2.99	3.55	biodiversity protection in agriculture is one of their <b>major goals</b>
2	doesn't take on <b>responsibility</b> re biodiversity	2.72	3.79	2.90	2.86	3.12	2.13	2.21	1.99	2.67	2.86	2.56	3.26	takes on <b>responsibility</b> re biodiversity
3	isn't <b>objective</b> about biodiversity	2.49	3.96	3.02	2.76	3.16	2.53	2.50	2.50	3.03	3.11	2.50	3.27	is <b>objective</b> about bio-diversity
4	doesn't treat me as <b>partner</b> re biodiversity	2.36	3.80	3.30	3.06	3.54	2.58	2.64	2.27	2.85	3.24	2.91	3.54	treats me as <b>partner</b> re biodiversity
5	doesn't <b>understand</b> farmers' reality	2.20	3.13	3.93	4.31	3.92	3.49	3.44	3.53	3.00	2.89	2.41	3.41	<b>understands</b> farmers' reality
6	isn't <b>trustworthy</b>	2.59	3.96	3.65	3.57	3.75	3.13	2.97	3.27	3.26	3.41	3.04	3.91	is <b>trustworthy</b>
7	hinders me from farming in a <b>future-proof</b> way	2.71	3.68	3.82	3.71	4.09	3.66	3.58	3.55	3.55	3.55	3.14	3.86	enables me to farm in a <b>future-proof</b> way
8	isn't <b>reliable</b> re medium-/long-term behavior	2.31	3.98	3.75	3.69	3.82	3.34	3.15	3.14	3.01	3.25	3.04	3.79	is <b>reliable</b> re medium-/long-term behavior

**Table 1:** Average matrix (mean perception ratings across countries); darker shading indicates lower ratings. © The authors, 2022.

*government* is perceived most negatively (2.54) and *researchers* most positively (3.81). Table 1, the *average matrix* (Moon et al., 2017), visualizes mean ratings across the sample for each perception statement.

This matrix reveals differences in average perceptions, i.e. relative strengths and weaknesses, *across* certain stakeholder groups (e.g. machinery suppliers are viewed as taking on lower responsibility for biodiversity than producer organizations) and uncovers similar as well as divergent perceptions *within* these groups. RTs support these findings. Biodiversity-specific statements are, on average, rated significantly differently ( $P < 0.01$ ) for most stakeholder groups. They are rated more negatively for actors primarily associated with farming and profit-orientation. Only for researchers, biodiversity-specific perceptions are rated significantly higher ( $P < 0.01$ ). Pairwise comparison of perception statements, e.g. 3 and 6, for one stakeholder group, e.g. farm advisors, showed that aspects initially considered as similar are perceived significantly ( $P < 0.01$ ) differently.

#### DISCUSSION AND CONCLUSION

Additional to identifying researchers as most positively and government as most negatively perceived actors, we show that farmers' perceptions not only differ *across*, but also *within* stakeholder groups. This finding not only indicates potentially low halo effect, i.e. one strong feeling or perception pre-determining several ratings (Thorndike, 1920). It also might affect policy design. Involving stakeholder groups *generally* being perceived positively but weak regarding *biodiversity* aspects, might in consequence also have low, or even negative, influence on farmers' biodivDM. To avoid adverse effects through uninformed involvement of stakeholders, inclusive pro-biodiversity initiatives require a careful selection process. To gain a deeper understanding of farmers' perceptions, we will compare ratings of diverse farmer groups and analyze national differences. For country-specific explanations, we will apply content analysis on the data generated through qualitative follow-up interviews.

Although small sample size and potential selection bias towards farmers with science affinity might limit generalizability, results show that this approach is powerful in uncovering differences in farmers' perceptions of stakeholder groups. Results can help to pro-

mote more inclusive campaign/policy design and, potentially, sustainable farming. To make best use of perceived strengths (e.g. high trustworthiness) and compensate perceived weaknesses (e.g. low understanding), we recommend to test involving multiple actors.

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