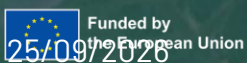




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NOSTRADAMUS STAKEHOLDER NEEDS SURVEY



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EXECUTIVE SUMMARY

The NOSTRADAMUS stakeholder survey was carried out to capture the decision-support needs, data requirements, constraints and expectations of actors across agriculture and food systems, and to provide structured input for the design of the NOSTRADAMUS data infrastructure and for the two Open Calls that will fund third-party Decision-Making and Policy-Shaping applications. The online questionnaire combined a common core section, four role-based modules (farmers; advisors and cooperatives; policymakers, public administration and NGOs; technology and data providers) and four concluding questions. As the survey is still open, this report presents an interim analysis of the responses received to date. Farmers (43%), researchers (21%) and advisors (16%) are the largest groups.

The key findings are:

- **Data needs are operational, local and time-critical.** Day-to-day operational decisions are where stronger support is most needed (47%). Data are required mainly at field (63%) and farm (43%) scale, and 54% of respondents need updates daily or in near-real time.
- **Current data are insufficient.** Only 21% consider their data mostly or fully sufficient. The largest gaps are weather and climate (53%), soil (52%) and pest and disease data (50%), which closely match the four NOSTRADAMUS core modules.
- **Integration is strongly wanted.** 81% rate an integrated platform combining environmental, agricultural and socio-economic data as very or extremely useful. 96% of advisors expect shared infrastructure to improve their advisory quality, and all policy respondents expect integrated dashboards to improve policy effectiveness.
- **Access, timeliness and connectivity are the main barriers.** Limited access to reliable data was ranked first by 42% of respondents, followed by late data and poor connectivity. Among technology providers, the lack of harmonised data standards is the leading technical bottleneck.
- **Digital maturity is moderate and uneven.** 35% of respondents report low or no digitalisation. Apart from weather apps (80%), each digital tool is used by at most a quarter of farmers, and 47% of farmers never combine datasets. Advisors name farmer digital literacy (85%) and cost sensitivity (54%) as the main limitations.
- **Trust is earned through evidence and usability.** Proven accuracy (62%) and transparent methods (51%) drive trust. Farmers ask for demonstrated economic benefit (71%), tools that are easy to use in daily work (78%) and recommendations with explanations rather than full automation (57%).
- **Willingness to engage is high but conditional.** 73% of advisors, 88% of policy respondents and 66% of technology providers are willing to pilot applications or connect to a shared infrastructure, often subject to clear governance, legal safeguards or funding. No technology provider declined.



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For the Open Calls, the results point to applications for in-season monitoring, early warning of climatic and pest risks, nutrient management and economic optimisation. These applications should deliver timely, field-level and explainable outputs through simple interfaces that tolerate weak connectivity, and they should build on open, standardised interfaces and transparent data-governance rules. On-farm demonstrations and advisors acting as intermediaries will be essential for uptake. Results from small sub-groups, particularly the policy module, are indicative and should be validated through further stakeholder engagement.



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ABBREVIATIONS

AKIS	Agricultural Knowledge and Innovation System
API	Application Programming Interface
CAP	Common Agricultural Policy
EO	Earth Observation
EU	European Union
GDPR	General Data Protection Regulation
ICT	Information and Communication Technology
INSPIRE	Infrastructure for Spatial Information in the European Community
IoT	Internet of Things
MAP	Multi-Actor Platform
NGO	Non-Governmental Organisation
OGC	Open Geospatial Consortium
ROI	Return on Investment



1 INTRODUCTION

1.1 PURPOSE AND CONTEXT

NOSTRADAMUS develops a Data Cube-based infrastructure that combines Copernicus Earth Observation, in-situ and IoT, agronomic and socio-economic data. It also develops four core modules: drought and vegetation-stress early warning, crop suitability and yield estimation, soil fertility and nutrient management, and sustainable pest management. The project focuses on cereal-based systems in five demonstration countries: Cyprus, Germany, Serbia, Slovenia and Switzerland [1]. Third parties funded through two Open Calls will build Decision-Making and Policy-Shaping applications on top of this infrastructure.

This report analyses the results of the NOSTRADAMUS stakeholder survey [2], [3]. The survey had three objectives: (i) to understand current challenges and decision-making needs related to agrochemical dependence, digitalisation, food security and agricultural resilience; (ii) to collect the needs, expectations and constraints of a wide range of stakeholders; and (iii) to provide structured input for the Open Calls on functionalities, data requirements, interoperability, trust and governance, and usability.

1.2 SURVEY DESIGN AND METHODOLOGY

The survey was carried out online and took approximately ten minutes to complete. It collected no directly identifying information, and responses were analysed only in aggregate. All respondents first answered a common core section (Q1–Q15) on context, decision-support needs, data sufficiency, digital skills, trust and barriers. They were then routed to one role-based module according to their stated role, and all respondents finished with four common questions on their strategic outlook (Table 1).

Section	Main target group	Questions
Core Part A: context and decision-support needs	All respondents	Q1–Q15
Module 1: Farmers and producers	Farmers and primary producers	Q16–Q38
Module 2: Advisors and cooperatives	Advisory services, cooperatives, producer organisations	Q39–Q61
Module 3: Policy, public administration and NGOs	Public authorities, administrations, NGOs	Q62–Q83
Module 4: Technology and data providers	ICT and data providers, applied researchers	Q84–Q105
Common concluding questions	All respondents	Q106–Q109

TABLE 1: STRUCTURE OF THE SURVEY

Results are reported as percentages of the respondents to each question; for multiple-choice questions they do not add up to 100%. For rating scales, the report gives the share of ratings of 4–5

out of 5, and for ranking questions the share of respondents who ranked an item first or in their top three.

Limitations. Respondents were reached through the consortium's networks and multi-actor platforms rather than sampled at random, so results are indicative rather than statistically representative. As the survey is still open, all results are interim and may change as further responses are received.

2 RESPONDENT PROFILE

Farmers and primary producers are the largest group (43%), followed by researchers and scientists (21%) and farm advisors and extension services (16%) (Figure 1). Technology and ICT providers account for 8% of respondents. Agri-food companies, cooperatives, public bodies, NGOs and financial actors each account for 4% or less.

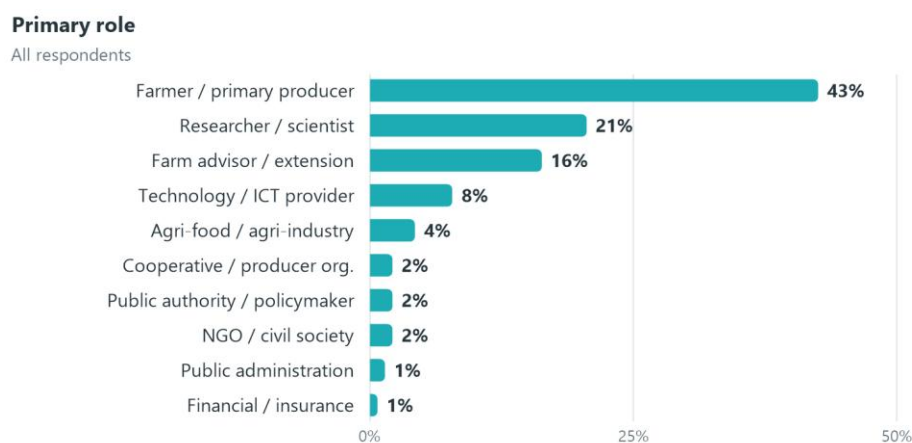


FIGURE 1: RESPONDENTS BY PRIMARY ROLE

Farmers in the dedicated module are mainly cereal producers: 31% grow cereals as their main crop and a further 49% grow them within mixed systems. This confirms that the sample is relevant to the cereal focus of NOSTRADAMUS. Advisors come mostly from public advisory services (62%) and work locally (65%) or regionally (27%). Only 17% of technology providers operate in multi-country or EU scale.

3 CROSS-STAKEHOLDER FINDINGS

3.1 DECISION-SUPPORT NEEDS AND DATA GAPS

Stronger digital decision-support is most needed for operational, day-to-day technical decisions (47%), followed by strategic (33%) and tactical (27%) decisions; 23% point to digital system integration and data interoperability. The most critical decisions are crop management (67%), pest

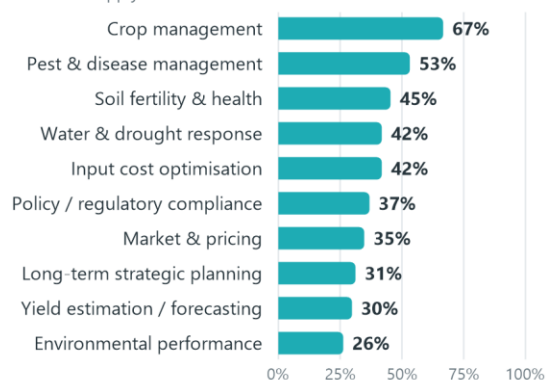


and disease management (53%), soil fertility and soil health (45%), water availability and drought response (42%) and input-cost optimisation (42%)(Figure 2).

Only 21% of respondents consider the data available to them mostly or fully sufficient for their most important decisions, while 30% consider them not or only slightly sufficient (weighted average 2.8 out of 5). The data most often reported as missing are weather and climate data(53%), soil data(52%) and pest and disease monitoring data (50%), followed by market prices (42%) and crop-condition indicators (40%). These gaps map directly onto the four NOSTRADAMUS core modules. The demand for market and input-cost information shows that the socio-economic layer matters too.

Most critical decision types

Select all that apply



Data missing or most needed

Select all that apply

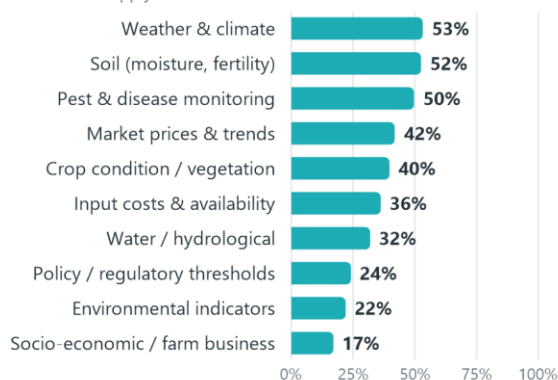


FIGURE 2: MOST CRITICAL DECISION TYPES AND DATA MOST NEEDED TO IMPROVE DECISIONS

Needs are local and time-critical. Data are needed mainly at field or plot level (63%) and at farm level (43%), far more often than at regional (11%), national (16%) or EU level (9%). Over half of respondents (54%) need data updates daily or in near-real time, and 73% need them at least weekly. 82% rate timely or near-real-time data as important, very important or essential.

3.2 DIGITAL READINESS AND THE VALUE OF INTEGRATION

Digital maturity is moderate (Figure 3). About 45% of respondents are very or extremely familiar with digital agricultural tools, and 38% are very or fully confident in interpreting digital outputs such as maps and dashboards. However, 35% describe their farm or organisation as not digitalised or only slightly digitalised, and only 3% as fully digitalised. By contrast, respondents expect integration to be highly valuable: 81% consider an integrated platform combining environmental, agricultural and socio-economic data very or extremely useful (weighted average 4.2 out of 5). This is the most positively rated item in the survey.

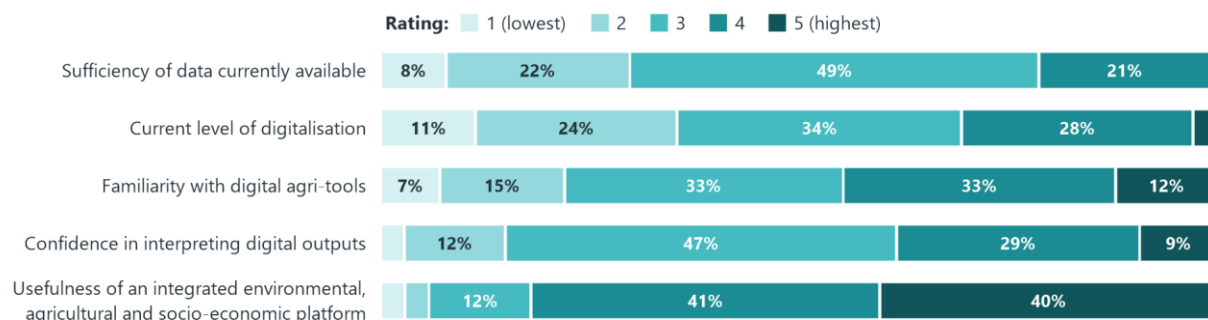


FIGURE 3: DIGITAL READINESS AND PERCEIVED USEFULNESS OF AN INTEGRATED PLATFORM, FIVE-POINT SCALES

3.3 BARRIERS AND TRUST

When asked to rank the barriers to data-driven decision-making, respondents put limited access to reliable data first: 42% ranked it first and 74% placed it in their top three (Figure 4). Data arriving too late (60% top three) and poor connectivity or technical infrastructure (50% top three) follow. Lack of digital skills and the high cost of tools come next, at some distance. Lack of trust in data or data governance was ranked last. Because of the ordering effect described in the methodology, this result should be read with caution, and trust considerations clearly emerge in other questions.

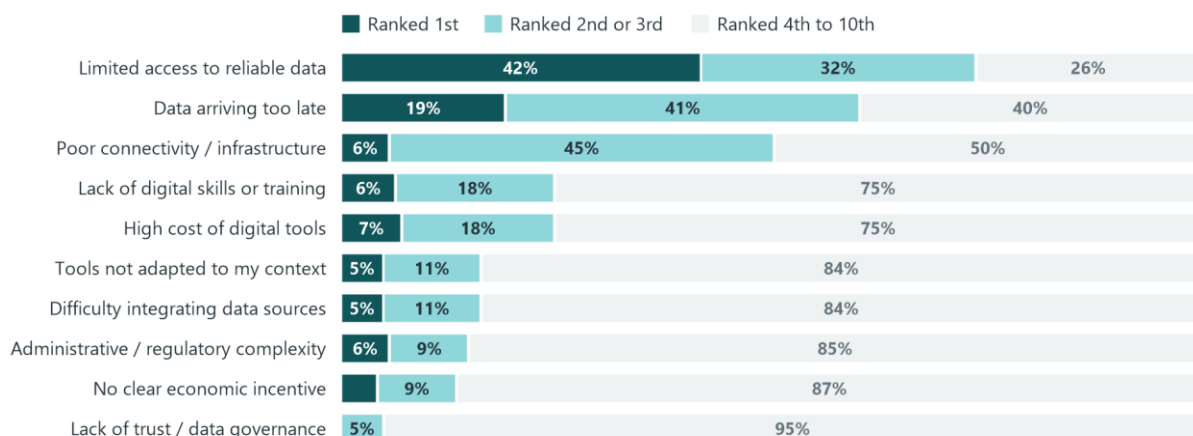


FIGURE 4: RANKING OF THE BARRIERS THAT LIMIT BETTER DATA-DRIVEN DECISION-MAKING

The factors that most influence trust in digital data and decision-support tools are proven accuracy (62%) and transparency of methods (51%). They are followed by clearly demonstrated benefits (39%), recommendations from advisors or peers (32%), alignment with local conditions (31%) and independent validation (29%). Trust therefore rests on evidence of performance and on open, transparent methods.



4 STAKEHOLDER-SPECIFIC FINDINGS

4.1 FARMERS AND PRIMARY PRODUCERS

Weather forecasting apps are the digital tool farmers use most (80%); every other tool is used by about a quarter of farmers or fewer, and 12% use no digital tools at all. 29% of farmers do not use digital data for any crop-management decision, only a third (33%) always or usually rely on digital tools for key decisions, and 47% never combine several datasets for the same decision.

Farmers see the greatest added value in in-season crop monitoring alerts and early warning of production risks (53% each). These are followed by input optimisation (37%), market price or cost alerts (33%) and soil nutrient balance insights (31%) (Figure 5). Climatic risk is the dominant concern (73%), ahead of pest and disease risk (41%) and market volatility (29%). Two-thirds (67%) rate risk early warning systems as very or extremely valuable, and alerts are most useful 2–3 days ahead (43%) or 1–2 weeks ahead (25%). Short-term weather forecasts (59%) and long-term climate projections (37%) are the data improvements farmers want most.

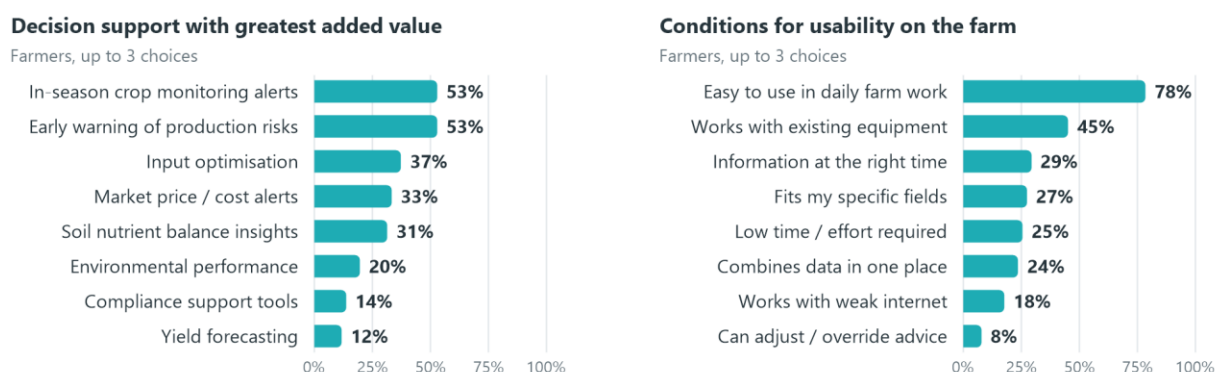


FIGURE 5: FARMERS' PRIORITIES FOR DECISION SUPPORT AND CONDITIONS FOR USABILITY

Usability is decisive. 78% of farmers name ease of use in daily farm work as a key condition, followed by compatibility with existing equipment (45%). Farmers prefer moderately detailed field-level advice (47%) to either simple general advice (27%) or highly precise zone-specific recommendations (25%), and 47% find whole-field averages detailed enough. Most prefer tools that suggest optimal actions with explanations (57%); 27% are open to automation, and none reject digital decision support. Demonstrated economic benefit (71%) and transparent data sources (53%) would most increase their confidence in digital recommendations. Control over farm data is important or extremely important to 63% of farmers, yet 45% are willing to share anonymised data for regional benchmarking and a further 49% might do so. Training should focus on using precision agriculture tools (57%) and understanding soil and crop data (43%), preferably through on-farm demonstrations (59%).

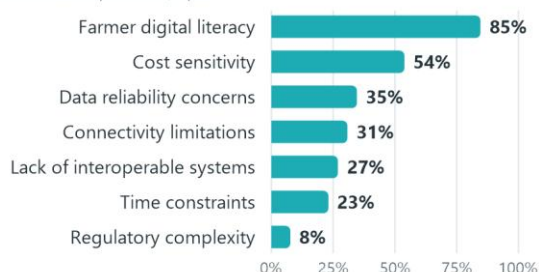


4.2 ADVISORS AND COOPERATIVES

Advisory organisations use digital tools moderately (54%) or extensively (38%), but only 31% systematically integrate environmental, agronomic and economic data, and only 8% use predictive analytics operationally. Farmer digital literacy (85%) and cost sensitivity (54%) are by far the main limitations on digital advisory work (Figure 6). 46% of advisors estimate that at most 30% of their farmers are ready for advanced digital solutions. On the technical side, incompatible data formats are the leading constraint (65%). 38% of advisors find interoperability very or extremely challenging, and 46% say connectivity moderately or strongly limits the effectiveness of their services.

What limits effective digital advisory

Advisors & cooperatives, up to 3



Capabilities missing in advisory systems

Advisors & cooperatives, up to 3

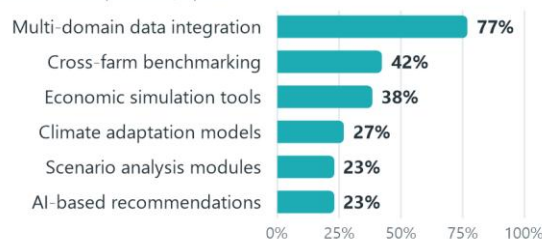


FIGURE 6: ADVISORS' MAIN LIMITATIONS AND THE CAPABILITIES MISSING FROM ADVISORY SYSTEMS

Advisors see economic optimisation (62%) and risk early warning (54%) as farmers' greatest unmet needs. The capability most missing from advisory systems is multi-domain data integration (77%), followed by cross-farm benchmarking (42%) and economic simulation (38%). Advisors would prioritise economic planning (69%) and input optimisation (58%) for new applications. The business case remains fragile: no organisation considers its digital advisory services fully financially sustainable, and only 8% formally assess the economic impact of digital recommendations. Nearly all advisors (96%) expect a shared infrastructure combining environmental, agronomic and economic data to improve advisory quality, and they see demonstrated economic benefit (69%) and transparency (54%) as the main drivers of farmer trust.

4.3 POLICYMAKERS, PUBLIC ADMINISTRATION AND NGOS

Respondents to the policy module so far are regional authorities and NGOs, together with national authorities and ministries. Most operate at national level, and given the small number of responses the findings are indicative. Respondents rely mainly on administrative farm data (63%), and 38% use Earth Observation or socio-economic data. 63% find it very challenging to monitor policy effectiveness with current data systems, citing data fragmentation across agencies (75%) and insufficient spatial resolution (50%). 63% also find interoperability between agricultural, environmental and economic platforms very challenging. Most see current governance frameworks as moderately or strongly limiting data sharing between institutions, and legal liability is the main sensitivity (63%). 88% consider transparent methods behind digital indicators very or extremely important.



The capabilities most missing are cross-sector data integration (75%) and policy impact modelling (63%), followed by early-warning dashboards and regional benchmarking (50% each). All respondents expect integrated dashboards to improve policy effectiveness, 63% of them significantly. Respondents ranked climate risk governance and adaptation planning, food security monitoring and early warning, and CAP monitoring, reporting and evaluation as the domains where digital decision-support would add most value (Appendix A). Institutional capacity to act on digital insights is mixed: 38% report no or limited capacity.

4.4 TECHNOLOGY AND DATA PROVIDERS

Technology respondents mainly offer IoT and sensor systems (63%), decision-support software (60%), AI analytics (57%) and EO services (54%), applied above all to crop productivity (54%) and soil and nutrient management (43%). Solutions are mostly cloud-based (60%): only 29% offer edge or offline-capable tools and only 6% operate fully offline, although 63% report that rural connectivity affects performance at least moderately. Interoperability is only partly built in. 40% expose open REST APIs, but only 11% support OGC services and 6% INSPIRE-compatible services, and 31% are unsure which standards they support. Explainability is limited, with 14% of solutions fully explainable. Validation relies mostly on field trials (51%) and peer-reviewed methods (46%), and 14% of solutions are not formally validated.

The main limitations to scaling are insufficient harmonised public datasets (40%) and interoperability and market-adoption barriers (34% each). 43% rank the lack of harmonised data standards as the single biggest technical bottleneck, followed by poor data quality or inconsistent metadata. Accordingly, providers would most value standardised APIs and cross-sector harmonised datasets (60% each) from a shared infrastructure, followed by AI-ready pre-processed data (46%) and high-resolution geospatial layers (37%) (Figure 7). The main benefits they expect from joining a shared ecosystem are access to harmonised datasets (66%) and easier integration with public data infrastructures (63%). Better connections with farmers (71%) and advisory services (54%) would do most to increase uptake of their solutions.



Capabilities that would most enhance solutions if offered through a shared infrastructure

Technology & data providers, incl. applied researchers; select all that apply

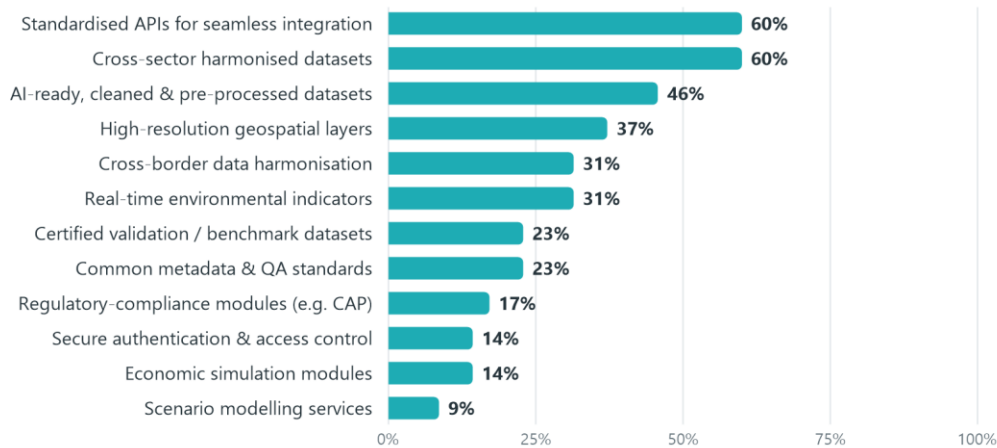


FIGURE 7: CAPABILITIES TECHNOLOGY AND DATA PROVIDERS WOULD MOST VALUE FROM A SHARED INFRASTRUCTURE

5 READINESS TO ENGAGE AND FUTURE OUTLOOK

Willingness to engage with a shared NOSTRADAMUS-type infrastructure is high across all groups, but it is often conditional (Figure 8). 38% of advisors and 38% of policy respondents are actively interested in piloting applications. A further 35% of advisors and 50% of policy respondents are interested if governance, legal safeguards or funded technical support are clearly in place. Two-thirds of technology providers (66%) are willing to connect their solutions, mostly under conditions, and none declined. Among farmers, 61% already use or would adopt site-specific management supported by reliable digital mapping, and the rest would consider it.

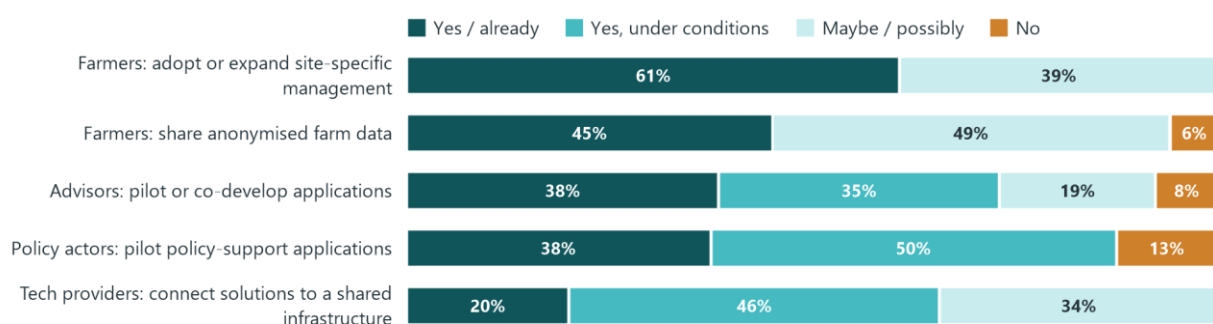


FIGURE 8: WILLINGNESS TO ADOPT, SHARE DATA, PILOT OR CONNECT TO A SHARED INFRASTRUCTURE, BY STAKEHOLDER GROUP

Looking ahead, increasing operational efficiency (32%) and strengthening economic resilience (19%) are the strategic priorities that will most shape respondents' approach to digital transformation, while 10% plan no major transformation. If digital integration remains fragmented, respondents see the main risks as operational inefficiency (28%), reduced competitiveness (19%) and poor policy or management decisions (17%). Two-thirds expect digital transformation to proceed at a moderate



(40%) or a rapid-to-disruptive (27%) pace. In a future ecosystem, respondents see themselves as technology or service providers (24%), end-user decision makers (20%), data contributors (19%) or innovation partners (15%); only 4% do not plan to participate.

6 IMPLICATIONS FOR THE INFRASTRUCTURE AND THE OPEN CALLS

Table 2 translates the main findings into requirements for the NOSTRADAMUS infrastructure and for the applications that third parties will develop through the Open Calls.

Requirement area	Survey evidence	Implication
Thematic priorities	Gaps in weather and climate (53%), soil (52%) and pest and disease (50%) data; climatic risk is the main farm concern (73%); in-season alerts and early warning are farmers' top needs (53%)	Prioritise agro-climatic, drought and pest and disease early warning, in-season crop monitoring and nutrient-management applications built on the core modules
Economic dimension	Economic optimisation is farmers' greatest unmet need according to advisors (62%); economic planning is the top application priority for advisors (69%); demonstrated economic benefit drives farmer trust (71%)	Include cost, margin and input-optimisation indicators; ask applicants to demonstrate economic benefit in pilots
Timeliness and spatial detail	54% need daily or near-real-time updates; field (63%) and farm (43%) scale; alerts most useful 2–3 days ahead (43%)	Near-real-time processing; field-level outputs; short-range forecasts covering a few days to two weeks
Usability and explainability	Ease of use (78%); suggestions with explanations preferred (57%); moderately detailed field-level advice preferred (47%)	Simple, mobile-friendly interfaces; explainable recommendations that users can adjust; avoid unnecessary complexity
Interoperability	Incompatible formats (65% of advisors); harmonised standards are the top technical bottleneck (43%); standardised APIs and harmonised datasets requested (60%)	Open, documented APIs (OpenAPI, OGC), common metadata and a shared data dictionary; use standards compliance as an evaluation criterion
Connectivity	63% of providers report effects of rural connectivity; only 6% of solutions work fully offline; 46% of advisors are limited by connectivity	Support edge or hybrid deployment with offline and low-bandwidth modes
Trust and data governance	Proven accuracy (62%) and transparency (51%); farm data control important (63%); legal liability is the main public-sector sensitivity	Publish validation results and methods; clear rules on data ownership, consent and licensing; anonymised benchmarking
Capacity building	Farmer digital literacy is the main advisory limitation (85%); training on precision tools requested (57%); on-farm demonstrations preferred (59%)	Pair applications with on-farm demonstrations and advisor-led training; involve advisors as intermediaries



Requirement area	Survey evidence	Implication
Policy support	Cross-sector integration (75%) and impact modelling (63%) are missing; all policy respondents expect dashboards to help	Integrated indicator dashboards, scenario and impact-assessment tools, and support for CAP monitoring

TABLE 2: SURVEY-BASED REQUIREMENTS FOR THE NOSTRADAMUS INFRASTRUCTURE AND THE OPEN CALL APPLICATIONS

7 CONCLUSIONS

The survey gives a consistent picture across stakeholder groups. Stakeholders need timely field- and farm-level information on weather and climate, soil and pests, delivered in a way that fits their daily work. They strongly value integrated environmental, agronomic and economic data. Interest is high; the obstacles are limited access to reliable and timely data, fragmented and non-standardised data flows, connectivity constraints, limited digital skills and an unproven business case. Trust will depend on demonstrable accuracy, transparent methods, clear economic benefit and clear data governance.

These findings support the direction of the core modules. They indicate that applications funded through the Open Calls should combine agronomic early warning with economic optimisation, work reliably under weak connectivity and rely on open standards. As next steps, the results will be used to refine the Open Call topics and evaluation criteria and fed into the needs-based data requirements and data dictionary of the infrastructure. They will also be validated in the multi-actor platforms, with particular attention to policy stakeholders, and serve as a baseline for assessing the socio-economic impact of the applications developed.



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- [2] NOSTRADAMUS Consortium, "NOSTRADAMUS Stakeholder Survey, questionnaire version 2", 2026.
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APPENDIX A: RESULTS OF THE RANKING QUESTIONS

This appendix gives the full results of the two ranking questions. As noted in the methodology, both rankings closely follow the order in which the options were presented, so they should be read with caution.

Policy domain (policy module)	Average ranking score (max. 9)
Climate risk governance and adaptation planning	7.50
Food security monitoring and early warning	6.38
CAP monitoring, reporting and evaluation	5.25
Environmental compliance and enforcement	5.13
Cross-sector policy coordination (agriculture, environment, economy)	5.13
Socio-economic resilience and rural development analysis	4.63
Multi-scale impact assessment (farm to regional level)	4.50
Market stability and supply-chain risk monitoring	3.50
Data harmonisation and interoperability services	3.00

TABLE 3: DOMAINS WHERE DIGITAL DECISION-SUPPORT WOULD CREATE THE GREATEST ADDED VALUE (POLICY RESPONDENTS)

Technical bottleneck (technology module)	Ranked 1st	Ranked in top 3
Lack of harmonised data standards	43%	74%
Poor data quality or inconsistent metadata	14%	63%
Insufficient long-term funding or investment	11%	20%
Weak business models or unclear value capture	9%	17%
Lack of trust between stakeholders (data-sharing reluctance)	9%	26%
Fragmented data ownership and access restrictions	3%	31%
Legacy IT systems incompatible with modern architectures	3%	17%
Limited interoperability between platforms	3%	11%
Limited institutional coordination	3%	6%
Shortage of specialised technical skills	3%	6%
Regulatory uncertainty or compliance complexity	0%	14%
Connectivity constraints in rural areas	0%	9%
Lack of modern tools (low-code or no-code)	0%	6%

TABLE 4: SINGLE BIGGEST TECHNICAL BOTTLENECK FOR DIGITAL TRANSFORMATION (TECHNOLOGY AND DATA PROVIDERS)