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ARTIFICIAL INTELLIGENCE ADOPTION AND ENTREPRENEURIAL INNOVATION IN ROMANIAN AGRI-FOOD SMEs: EVIDENCE FROM A TECHNOLOGY–ORGANISATION–ENVIRONMENT SURVEY

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1 INTRODUCTION

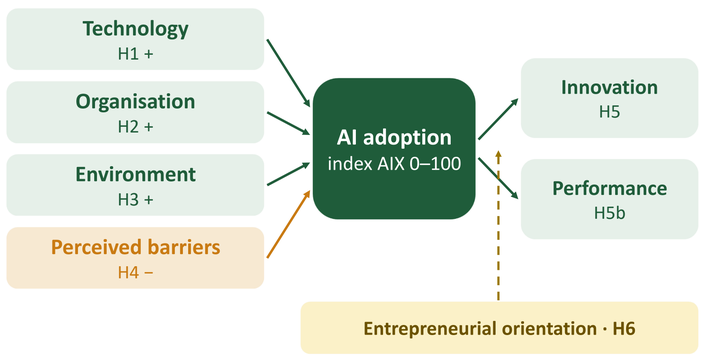
- In 2025, **20.0%** of EU enterprises used AI; Romania had the lowest share, **5.2%** (Eurostat, 2025a).
- Romania has **2.9 million** farms, 32.6% of the EU total; 90.2% farm less than 5 ha (Eurostat, 2026).
- Evidence on AI in agri-food SMEs, especially in emerging economies, is scarce.

Aim: identify the technological, organisational and environmental (TOE) factors associated with AI adoption, and how adoption relates to innovation.

2 MATERIALS AND METHODS

- **Online questionnaire:** 41 questions in 7 sections (TOE, technology acceptance, entrepreneurial orientation, Oslo Manual innovation).
- **155 SMEs** from 40 of 42 territorial units: 67.7% micro, 24.5% small, 7.7% medium.
- **AI adoption index (AIX, 0–100):** stage ×0.5 + tools ×0.3 + intensity ×0.2; five alternative weightings tested.
- **Analysis:** Cronbach's α, Spearman ρ with Holm correction, Kruskal–Wallis with Dunn tests, OLS with 95% CI and HC3 errors.

3 RESEARCH MODEL



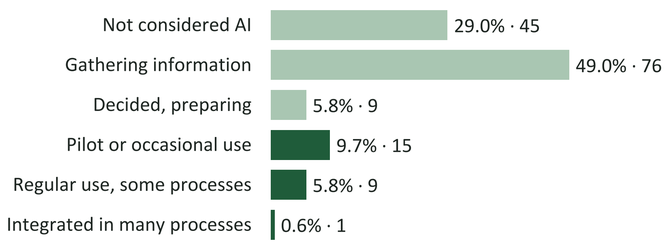
4 RESULTS AND DISCUSSIONS

STAGE OF ADOPTION

Adoption is at an early stage

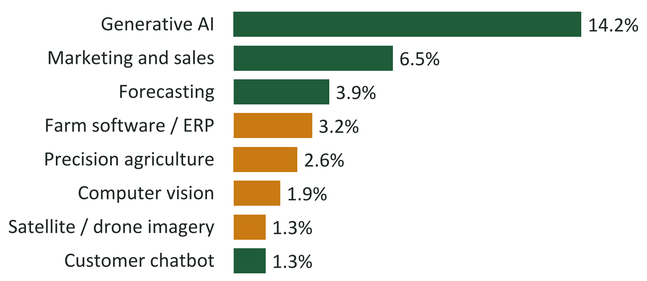
16.1% at the pilot stage or beyond (25 firms)

17.4% use at least one AI tool (27 firms)



AI TOOLS IN USE

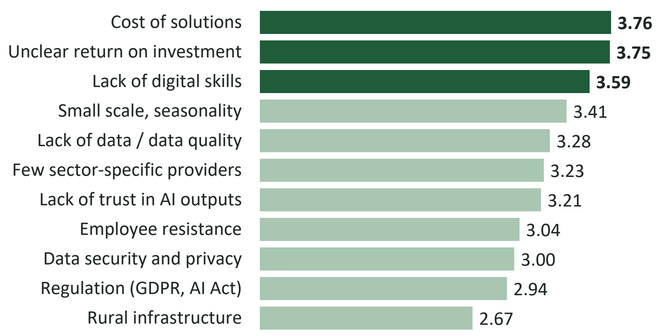
General-purpose tools dominate



82.6% of firms use no AI tool. Among the 25 adopters, **72%** use AI in marketing and sales. Orange: agri-specific systems.

PERCEIVED OBSTACLES

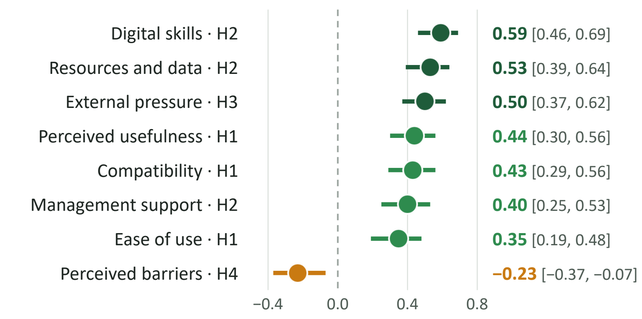
Cost, unclear return and missing skills



Mean rating, 1 = not an obstacle, 5 = major obstacle.

H1–H4 · SPEARMAN ρ WITH AIX [95% CI]

Skills, data and pressure go with adoption



All eight remain significant after Holm correction (adjusted p ≤ 0.017): **H1–H4 supported.**

MODEL M1 · OLS, STANDARDISED β [95% CI]

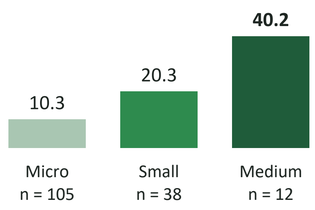
Size, compatibility and skills hold jointly

0.26 **Firm size** [0.13, 0.39]

0.20 **Compatibility** [0.07, 0.33]

0.19 **Digital skills** [0.05, 0.34]

R^2 = 0.47 · robust (HC3) and stable across AIX weights



Mean AIX by size

All pairs differ (Dunn, Holm p ≤ 0.027).

Export gap after size control: **+3.9 [−4.2, 12.1], p = 0.35**

H5, H5b, H6 · OUTCOMES

Adoption is weakly related to innovation

ρ = 0.17 — **H5 · Innovation intensity**
Holm-adjusted p = 0.09 · **Not supported**

ρ = 0.17 — **H5b · Relative performance**
Holm-adjusted p = 0.09 · **Not supported**

β = −0.02 — **H6 · Moderation by EO**
95% CI [−0.15, 0.11] · **Not detected**

Entrepreneurial orientation predicts innovation **(β = 0.41 [0.26, 0.56], p < 0.001)**; AIX does not (β = 0.03). With 25 adopters, power is limited.

5 CONCLUSIONS

1. **Early stage:** 16.1% of firms are at the pilot stage or beyond; generative AI and marketing uses dominate.
2. **Capabilities matter:** digital skills, resources and data and external pressure are the strongest correlates; size, compatibility and skills hold jointly (R^2 = 0.47).
3. **Obstacles:** cost, unclear return and missing skills. Support should combine short applied training with low-cost, demonstrable use cases, tailored to micro-enterprises.
4. **Innovation:** so far adoption adds little to innovation; entrepreneurial orientation drives it. Larger, longitudinal samples should test this again.

Full paper and study page
panaitmihaivlad.ro/ai-innovation

6 ACKNOWLEDGEMENTS

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7 REFERENCES

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