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**D2.1 AGRITECH MANAGER
COMPETENCY FRAMEWORK**

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Index

1. EXECUTIVE SUMMARY	6
1.1. Purpose of the Deliverable	7
1.2. Key Findings and Recommendations	7
2. INTRODUCTION.....	10
2.1. Background and Rationale	10
2.2. Scope of the Competency Framework.....	11
2.3. Alignment with AGRITECH Project Objectives and EU Standards.....	12
Intended Uses and Audiences	13
Flexibility and Adaptability	13
Alignment with European and National Standards	14
Implementation and Continuous Improvement	14
Strategic Value	14
3. METHODOLOGY.....	15
3.1. Overview of the Competency Mapping Process.....	15
3.2. Survey Design and Implementation.....	17
3.2.1 Survey Structure and Rationale	17
3.2.2 Implementation and Distribution	19
3.3. Stakeholder Engagement and Data Collection	19
3.3.1 Respondent Distribution and Outreach Realities	19
3.3.2 Partner Involvement and Data Collection	20
3.4. Data Analysis Approach	21
3.4.1 Stakeholder Diversity by Role	21
3.4.2 Geographical and Language Outreach.....	22
3.4.3 Experience Level of Respondents	23
3.5. Limitations and Quality Assurance	23
3.5.1 Limitations	23
3.5.2 Quality Assurance Measures	25
4. SURVEY RESULTS AND KEY INSIGHTS	26
4.1. Profile of Respondents.....	26
4.2. Industry Needs and Skills Gaps Identified.....	27
4.2.1 Tech Trends.....	27
4.2.2 Adoption Speed	31
4.2.4 Impactful Emerging Tech	34
4.2.10 Most Important Technical Skills.....	36
4.3. Analysis of Stakeholder Priorities (HEI, VET, Industry, Policy)	40
4.3.1 Future Skills by Role	40
4.3.2 Preferred Training/Education by Role	43
4.4. Trends in AgriTech and Implications for Competencies	46
4.4.1 Drivers of Change.....	46
4.4.2 Organizational Preparedness.....	49
4.4.3 Barriers to Adoption	51
4.4.4 Skill Gap Rating (14).....	54
4.5. Validation of Proposed Competency Areas	56
4.5.1 Evidence of Alignment from Survey Results	56
4.5.2 Insights from “Other” and Open Comments	57
4.5.3 Gaps and Limitations in Validation	57
4.5.4 Refinement and Next Steps	57
4.5.5 Conclusion.....	57
5. AGRITECH MANAGER COMPETENCY FRAMEWORK.....	58
5.1. Structure of the Competency Framework	58



5.2. Core Competency Domains	59
5.2.1. Technical and Digital Skills	60
5.2.2. Business and Entrepreneurial Skills	62
5.2.3. Sustainability and Green Competencies	64
5.2.4. Policy, Regulation, and Compliance	65
5.2.5. Soft Skills and Leadership	66
5.3. Mapping to EQF Levels (VET and HEI Pathways)	67
5.3.1. Purpose and Rationale	67
5.3.2. Overview of the European Qualifications Framework (EQF)	68
5.3.3. Methodology for EQF Mapping	69
5.3.4. Mapping of Core Competencies to EQF Levels	70
5.3.5. Integration of VET and HEI Pathways	72
5.3.6. Sample EQF Mapping Table	73
5.3.7. Implications for Curriculum Design, Accreditation, and Recognition	75
5.3.8. Review and Updating of EQF Mapping	78
5.4. Competency Descriptions and Proficiency Levels	79
5.4.1. Explanation of Proficiency Levels and Their Alignment with EQF	79
5.4.2. Technical and Digital Skills: Competency Descriptions and Proficiency Levels	80
5.4.3. Business and Entrepreneurial Skills: Competency Descriptions and Proficiency Levels	81
5.4.4. Sustainability and Green Competencies: Competency Descriptions and Proficiency Levels	82
5.4.5. Policy, Regulation, and Compliance: Competency Descriptions and Proficiency Levels	82
5.4.6. Soft Skills and Leadership: Competency Descriptions and Proficiency Levels	83
5.4.7. Practical Use Case: National Qualification Recognition	84
5.5. Role Profiles and Career Progression Paths	85
5.5.1. Definition of Role Profiles	85
5.5.2. Sample Role Profiles	86
5.5.3. Career Progression Paths	87
5.5.4. Link to Lifelong Learning and Recognition	88
5.6. AGRITECH MANAGER PROFILES: ESCO COMPETENCY FRAMEWORK ALIGNMENT	88
6. IMPLEMENTATION GUIDELINES	92
6.1. Recommendations for Integrating Framework into Curricula (HEI & VET)	92
6.2. Alignment with Certification and Accreditation Systems	96
6.3. Stakeholder Roles in Framework Adoption	99
6.4. Supporting Tools and Resources	101
7. IMPACT ASSESSMENT AND FUTURE DIRECTIONS	105
7.1. Expected Impact on AgriTech Workforce Development	105
7.2. Monitoring and Continuous Improvement	107
7.3. Roadmap for Future Updates (Versioning and Review Cycles)	109
8. Conclusion	111
8.1. Summary of Deliverable Outcomes	111
8.2. Next Steps for Partners and Stakeholders	112
8.3. Dissemination and Practitioner Outreach	114
9. ANNEX	115
9.1. Survey Instruments (Questionnaire Used)	115
References	116



List of Figures

Figure 1. Survey responses by country (percentage of total complete responses N=820).	19
Figure 2. Distribution of respondent roles in their organizations.....	22
Figure 3. Years of professional experience among respondents.	23
Figure 4. Most impactful technological trends currently transforming agriculture	30
Figure 5. Progression of technological adoption in agriculture	33
Figure 6. Emerging technologies with the greatest impact	36
Figure 7. Skills important for AgriTech professionals	40
Figure 8. Skills important for AgriTech professionals	43
Figure 9. Education programs bridging the skill gap	45
Figure 10. Primary drivers of technological change	48
Figure 11. Organization preparedness.....	51
Figure 12. Barriers for technology adoption	53
Figure 13. Current skill gap.....	56
Figure 14. Stakeholder Roles and Responsibilities in Framework.....	101

List of Tables

Table 1. Overview of the AGRITECH Manager Survey Structure	18
Table 2. Total numbers of answers received by countries	20
Table 3. Percentage of responses by survey language and respondent country.....	22
Table 4. Percentages of responses by countries from outside the consortium.	22
Table 5. Abbreviations for Key Technological Trends	27
Table 6. Overview of Core Competency Domains Mapped to EQF Levels.....	71
Table 7. Example Mapping of AgriTech Manager Competencies to EQF Levels	74
Table 8. Technical and Digital Skills: Competency Descriptions and Proficiency Levels	81
Table 9. Business and Entrepreneurial Skills: Competency Descriptions and Proficiency Levels	82
Table 10. Sustainability and Green Competencies: Competency Descriptions and Proficiency Levels	82
Table 11. Policy, Regulation, and Compliance: Competency Descriptions and Proficiency Levels	83
Table 12. Soft Skills and Leadership: Competency Descriptions and Proficiency Levels	84
Table 13. Competency Models from Similar Industries.....	94



1. EXECUTIVE SUMMARY

AGRITECH project aims to establish and define a brand-new professional role, the one of **AGRITECH Manager**. This emerging role stands at the crossroads of agriculture, digital transformation, and sustainability, three areas that are rapidly evolving and becoming ever more interdependent across Europe.

The purpose of this document, **D2.1 AGRITECH Manager Competency Framework**, is to map out in detail the core skills, qualifications, and knowledge expected of professionals stepping into this position. The framework itself was shaped through direct input from a wide range of sector stakeholders and validated by an extensive consultation process.

To ensure the framework would truly reflect the realities and challenges of the sector, the project team launched a large-scale, multilingual survey. This survey didn't just skim the surface - it actively engaged agri-business leaders, technology innovators, educators, students, researchers, advisors, and policymakers, both within AGRITECH consortium countries and beyond. The ultimate count was **820 completed responses**, offering a robust data set to identify current skills, critical gaps, and emerging priorities for the future AgriTech workforce.

The analysis and synthesis of these responses led to a Competency Framework organized around five major domains:

1. **Technical and Digital Skills** - including emerging technologies, data analytics, and digital tool literacy.
2. **Business and Entrepreneurial Skills** - covering the innovation management, project development, and value chain thinking areas.
3. **Sustainability and Green Competencies** - with a strong emphasis on ecological practices, resource efficiency, and climate-smart approaches.
4. **Policy, Regulation, and Compliance** - ensuring managers are aware of and able to navigate the evolving legal and policy landscape.
5. **Soft Skills and Leadership** - Highlighting communication, collaboration, critical thinking, and adaptive leadership.

Each domain is described in depth, with recommended proficiency levels and clear links to real-world job tasks. The framework also offers practical guidelines for higher education (**HEI**) and vocational training (**VET**) institutions seeking to update or create curricula, as well as suggestions for aligning these competencies with European and national certification/accreditation systems.

It's also worth noting some of the methodological realities: the survey saw uneven response rates across countries (with a few underrepresented) and a noticeable drop-off after the demographic section - likely due to survey length, perceived complexity, or time constraints. These limitations are acknowledged transparently, but the quality and breadth of the completed responses still provide a solid evidence base for defining the **AGRITECH Manager** role at the European level.

As key recommendations coming out of this work we can name:

- **Promoting more interdisciplinary and cross-sectoral learning**, connecting digital, business, and sustainability competencies;
- **Strengthening digital and data skills** across all training pathways;



- **Actively bridging skill gaps** with a mix of formal education, targeted upskilling, and flexible learning solutions, such as online modules, workshops, and mentoring.

AGRITECH Manager Competency Framework is intended as both a reference and a practical tool - supporting curriculum design, workforce planning, and policy decisions that will shape the future of agriculture and agri-food systems in a rapidly changing, technology-driven context.

1.1. Purpose of the Deliverable

The purpose of this deliverable, **D2.1 AGRITECH Manager Competency Framework**, is to formally define and document the competencies, skills, and qualifications that characterize the emerging **AGRITECH Manager** role in Europe. As agriculture undergoes rapid digital transformation and sustainability pressures intensify, the need for a new generation of professionals - capable of integrating technological innovation, green practices, and business acumen - has become increasingly urgent.

This document serves several key functions:

- **Reference Framework** - provides a comprehensive, evidence-based reference for identifying and describing the essential competencies required of **AGRITECH Managers**, ensuring consistency and clarity for education providers, employers, and policymakers across countries.
- **Foundation for Curriculum Development** - the framework acts as a foundation for updating or designing new curricula and training programmes in both HEI and VET, supporting alignment with EU and national qualification standards.
- **Guidance for Certification and Accreditation** - mapping competencies to proficiency levels and identifying core domains, the deliverable supports the development of relevant certification and accreditation pathways, promoting recognition of **AGRITECH Manager** skills across Europe.
- **Stakeholder Engagement** - it integrates feedback from a wide cross-section of stakeholders - agri-business, tech, education, and policy - ensuring that the framework is practical, forward-looking, and grounded in real sector needs.
- **Policy and Workforce Planning Tool** - acts as a strategic tool for policymakers and employers, offering insights into current skills gaps and future workforce needs, and guiding investments in education, upskilling, and talent development.

Ultimately, D2.1 aims to set a common standard for the **AGRITECH Manager** profile - one that supports innovation, sustainability, and competitiveness in the European agri-food sector, and helps prepare the workforce for ongoing digital and green transitions.

1.2. Key Findings and Recommendations

Key Findings

The analysis of survey data and stakeholder feedback reveals a coherent and urgent profile of the AGRITECH Manager role. The European agri-food sector is undergoing rapid transformation, shaped by digital innovation, environmental imperatives, and evolving market demands. Within this context, several major findings stand out:



- **Critical Skills and Competency Gaps:**

Across all countries and stakeholder groups, there is a broad consensus on the most acute gaps. These include expertise in precision farming, advanced digital skills (notably AI, data analytics, and IoT), and the capacity to integrate sustainability practices into day-to-day management. Digital literacy is not seen as optional but as foundational. Gaps are especially pronounced in mid-career and traditional workforce segments, where upskilling is not keeping pace with technology.

- **Most Critical Domains for AGRITECH Managers:**

The top-priority domains - validated by both survey and qualitative feedback - are:

- **Precision Agriculture:** The ability to implement and manage technology-enabled, data-driven farming systems.
- **Sustainable Agricultural Practices:** Competence in balancing productivity with climate resilience and environmental compliance.
- **AI & Data Analytics:** Proficiency in using advanced analytics, automation, and decision-support tools.
- **Digital and Communication Skills:** The capacity to leverage digital platforms, communicate complex ideas, and facilitate change across teams.
- **Problem Solving and Adaptability:** The agility to respond to rapid sectoral shifts, unforeseen challenges, and new regulatory landscapes.

- **Barriers to Competence Development**

Persistent obstacles include financial and resource constraints, lack of access to up-to-date training, cultural resistance to change, and limited digital infrastructure, particularly in rural areas. Organizational preparedness to integrate new technologies remains uneven, with large disparities between countries and enterprise sizes.

- **Stakeholder Alignment:**

The priorities identified are remarkably consistent across higher education, vocational training, industry, and policy respondents - indicating broad agreement on the direction and urgency of skill development, though with nuanced differences in emphasis (e.g., industry's call for more hands-on digital skills, HEI's for sustainability integration).

Recommendations

In response to these findings, the following recommendations are made for curriculum developers, certifying bodies, training providers, and workforce planners:

1. **Embed Digital and Data Skills as Core Competencies** - All AGRITECH Manager programs should ensure that digital literacy, AI, and data analytics are not electives but central, required components.
2. **Prioritize Interdisciplinary and Systems-Based Learning** - Competency frameworks and curricula must bridge agronomic, technical, business, and environmental knowledge - reflecting the complex, interdisciplinary nature of modern AgriTech management.
3. **Integrate Flexible and Modular Learning Pathways** - Given the pace of change and diverse entry points, flexible training options (including micro-credentials, blended learning, and stackable modules) are essential for both new entrants and upskilling the existing workforce.



- 4. Expand Access to Work-Based and Practical Learning** - Internships, apprenticeships, field placements, and industry collaborations should be scaled up to close the gap between classroom and workplace, with an emphasis on real-world technology adoption and change management.
- 5. Develop Targeted Upskilling for Mid-Career Professionals** - Special focus should be placed on reskilling those already in the sector, using short, high-impact courses and targeted outreach to accelerate digital and sustainability adoption.
- 6. Ensure Alignment with Policy and Certification Frameworks** - Programs should be mapped to national and EU qualifications frameworks (EQF, ESCO), with pathways toward recognized certification to support mobility, employability, and career progression.
- 7. Address Structural and Cultural Barriers** - Training and professional development must also address the softer skills of leadership, communication, and change management, enabling AGRITECH Managers to act as effective catalysts within their organizations and communities.

National-Specific Recommendations

While the survey reveals substantial alignment across Europe, the analysis also underscores distinct national realities that should inform the rollout of curriculum and workforce initiatives. In Romania and Hungary, for example, the rapid upskilling of small and medium-sized farms requires targeted outreach, regionally adapted training, and partnerships with local chambers and extension services. Italy's strong emphasis on sustainable practices highlights the need to embed climate and environmental modules tailored to Mediterranean conditions. In the Czech Republic, the focus on technical and vocational training calls for expanded access to advanced, hands-on courses for both new entrants and mid-career professionals. Greece stands out for its integration of digital platforms and export-driven priorities, suggesting a greater role for digital marketplace skills and international compliance. For the wider international audience, accessible online and blended learning pathways - delivered in multiple languages - are essential for inclusivity and reach.

National stakeholders should collaborate to adapt core modules to local needs, ensuring that training content reflects sector priorities, regulatory frameworks, and technology adoption rates in each country. Flexible models should allow for rapid updating of content as new technologies emerge, and for the recognition of prior learning and professional experience in diverse contexts.

Key Messages

- AGRITECH Manager is a uniquely interdisciplinary and future-facing role.
- Digital literacy, sustainability, and adaptability must be at the core of all training and workforce strategies.
- Effective sector transformation depends on both technical skills and the capacity to lead, communicate, and adapt within complex systems.
- Investment in flexible, accessible, and certified learning pathways is critical for closing the skills gap and ensuring Europe's agricultural sector remains competitive and resilient.



2. INTRODUCTION

Across Europe, agriculture is standing at a crossroads. Climate change, digital disruption, and shifting societal expectations are transforming how food is produced and how rural economies operate. Artificial intelligence, big data, and precision technologies are no longer distant buzzwords - they are becoming everyday tools on farms and throughout the agri-food supply chain. At the same time, the European Green Deal and growing calls for environmental responsibility are pushing the sector toward greener, more sustainable practices.

In this context, the skills and mindsets needed in agriculture are changing fast. It's not enough to be an expert in traditional agronomy or business management because tomorrow's leaders must be able to navigate complexity, leverage digital tools, manage change, and champion sustainable innovation.

AGRITECH project was created to help Europe rise to these challenges. By uniting partners from higher education, research, industry, and policy, the project is reshaping what it means to be an agricultural manager in the 21st century. At the heart of this effort is a new professional profile: the **AGRITECH Manager** - someone who can bridge the areas of technology, business, and sustainability, and who can help drive the sector's digital and green transitions.

This document, **AGRITECH Manager Competency Framework**, is the result of that collaborative work. It sets out, for the first time, a clear, evidence-based map of the skills, knowledge, and attitudes required for this role. Built on extensive stakeholder consultation and robust sectoral analysis, the framework is intended as a practical tool for educators, employers, policymakers, and anyone seeking to prepare Europe's agri-food workforce for a future that is already arriving.

The sections that follow outline the rationale for this work, its scope and intended users, and its alignment with key European policies and strategies for skills, innovation, and sustainability.

2.1. Background and Rationale

Europe's agri-food sector finds itself at a pivotal moment. On one hand, it must deliver on the timeless challenge of feeding people safely and efficiently; on the other, it is under increasing pressure to operate sustainably, reduce its carbon footprint, and adapt to a world shaped by climate volatility, resource constraints, and evolving consumer expectations. At the same time, digital technologies - from precision agriculture and smart sensors to data analytics, robotics, and artificial intelligence - are changing what is possible, opening up new ways to manage farms, supply chains, and business operations.

Yet this digital and green transformation brings with it a new layer of complexity. The technologies themselves are rapidly evolving, and their real value can only be realized when they are integrated thoughtfully into real-world agri-food systems. This requires more than just technical know-how. It calls for a new generation of professionals who can translate innovation into practice, lead cross-disciplinary teams, make sense of complex data, understand evolving policy and regulatory frameworks, and champion sustainability as a core business value.

Recent European policies reflect this shift. The European Green Deal, the Farm to Fork Strategy, the Digital Education Action Plan, and the updated European Skills Agenda all highlight the need for a workforce that is both technologically savvy and sustainability-minded. The EU is also calling for



stronger collaboration between educational institutions, research bodies, industry, and policymakers to ensure that skills development keeps pace with the speed of sectoral change.

However, a gap remains. Too often, agricultural professionals receive excellent training in core agronomic or business subjects, but have limited exposure to digital skills or systems thinking. Meanwhile, graduates with strong ICT backgrounds may lack an understanding of the unique challenges and realities of the agri-food domain. Employers report difficulty in finding talent with the hybrid skill set needed to drive innovation and ensure resilience in an uncertain future.

The development of the **AGRITECH Manager** Competency Framework is a direct response to these challenges. Its purpose is to:

- **Clearly define the competencies, skills, and attitudes required for the emerging AGRITECH Manager role** - ensuring these are grounded in real sectoral needs and future trends;
- **Provide a common language and reference for educators, employers, and policymakers** - supporting the design of relevant curricula, professional development programs, and certification pathways;
- **Bridge the gap between traditional agricultural expertise, digital literacy, business acumen, and sustainability leadership** - fostering a new generation of professionals equipped for the complex realities of the 21st century agri-food sector;
- **Promote the alignment of training and qualifications with European frameworks and standards, enhancing mobility, employability, and innovation capacity across Member States.**

By engaging stakeholders from across the agri-food value chain and drawing on wide-ranging survey evidence, this framework aims not only to describe “what is” but also to inspire “what could be” - setting a shared direction for agricultural education, professional growth, and sector transformation across Europe.

2.2. Scope of the Competency Framework

The **AGRITECH Manager** Competency Framework has been developed as a comprehensive tool to articulate, structure, and communicate the essential competencies required for the new **AGRITECH Manager** profile in Europe’s rapidly changing agri-food sector. Its scope is both broad and practical, intended to serve multiple functions and audiences while remaining adaptable to a variety of national, institutional, and industry contexts.

Key Aspects of Scope:

1. Multi-level and Cross-sectoral Applicability

- The framework is designed for use across the entire agri-food value chain, from primary production (farming, horticulture, livestock) through processing, distribution, advisory services, and agri-food technology enterprises.
- It is relevant for both HEI and VET contexts, supporting diverse learning pathways and levels - from early-career entrants to experienced professionals seeking upskilling or reskilling.
- The framework accommodates different national and regional realities, recognising variations in education systems, sector priorities, and the pace of digital and green transitions.

2. Comprehensive Competency Coverage

- The document details core domains for **AGRITECH Managers**: technical and digital skills, business and entrepreneurial abilities, sustainability and green knowledge, policy and regulatory understanding, and soft skills such as leadership and communication.



- For each domain, the framework identifies specific competencies, knowledge areas, and recommended proficiency levels, providing clear guidance for curriculum design and workforce development.

3. Reference for Multiple Stakeholders

- **Educators and Curriculum Developers:** The framework acts as a blueprint for designing or updating study programs, modules, and professional development courses, supporting alignment with labour market needs and European qualification frameworks (such as EQF).
- **Employers and Industry Bodies:** It offers a structured reference for recruitment, skills assessment, career development, and upskilling strategies, making it easier to define job roles and expectations.
- **Policy Makers and Accreditation Agencies:** The framework facilitates dialogue around qualification standards, supports mutual recognition of skills, and informs policy on education, innovation, and workforce planning.
- **Learners and Professionals:** It provides clarity for individuals seeking to understand the competencies expected in this emerging role, supporting informed career planning and targeted self-development.

4. Alignment with EU and National Standards

- The framework is mapped to established European initiatives and standards, including the European Qualifications Framework (EQF), the European Skills Agenda, and relevant national qualification systems.
- This alignment ensures the framework's portability and recognizability across borders, promoting greater mobility and employability for **AGRITECH Managers**.

5. Dynamic and Future-oriented Design

- Recognizing the fast pace of technological and societal change, the framework is designed to be flexible and periodically updated, with mechanisms for stakeholder feedback, monitoring, and review.
- It aims not only to capture current industry needs but also to anticipate emerging skills, trends, and competencies driven by digitalisation, climate change, and evolving policy landscapes.

6. Practical Support for Implementation

- The framework provides recommendations for integrating competencies into curricula (both HEI and VET), examples of possible learning outcomes, and guidance for certification and accreditation processes.
- It encourages collaboration between education providers, employers, and policy makers to ensure relevance, impact, and sustainability.

The AGRITECH Manager Competency Framework is both a detailed map and a practical tool - a living document to guide education, professional development, and policy for a sector in transition. By serving the needs of diverse stakeholders, it aims to support the creation of a future-ready workforce equipped to lead Europe's agri-food sector into the digital and sustainable age.

2.3. Alignment with AGRITECH Project Objectives and EU Standards

The AGRITECH Manager Competency Framework is conceived as a strategic and operational tool designed to guide the identification, development, and recognition of competencies required for effective leadership and innovation in the European agri-food sector. Its scope extends across



educational, professional, and policy-making environments, ensuring its relevance and utility for a wide array of stakeholders. The framework's architecture reflects both the complexity of the agri-food sector and the accelerating pace of digital and green transitions.

Intended Uses and Audiences

The framework is structured to support:

- **Educational Institutions (HEI & VET):** Serving as a reference for the design, revision, and accreditation of curricula, including undergraduate, postgraduate, and lifelong learning programmes. It provides a detailed matrix of competencies and proficiency levels, enabling course developers and trainers to align learning outcomes with industry expectations and European standards.
- **Employers and Sector Organizations:** Offering a common language for recruitment, professional development, and talent management. It allows employers to benchmark candidate skills, design targeted upskilling pathways, and better articulate the competencies sought in **AGRITECH Manager** roles.
- **Policy Makers and Accreditation Bodies:** Supporting policy alignment, standardization, and mutual recognition of qualifications. The framework informs national and European skills strategies and acts as a technical reference in the formulation of sectoral policies and funding programmes.
- **Learners and Professionals:** Providing clear and transparent guidance on the knowledge, skills, and attributes expected for career progression as an **AGRITECH Manager**, facilitating self-assessment and informed career planning.
- **Comprehensive Competency Domains**

The framework outlines five principal domains, each mapped to the core demands of the **AGRITECH Manager** role:

1. **Technical and Digital Skills:** Encompassing expertise in emerging technologies (e.g., precision agriculture, IoT, data analytics, AI, blockchain), digital literacy, and the practical integration of technology into agri-food systems.
2. **Business and Entrepreneurial Skills:** Covering innovation management, business modelling, financial acumen, value chain understanding, and project leadership.
3. **Sustainability and Green Competencies:** Addressing environmental stewardship, resource efficiency, climate-smart agriculture, and the implementation of circular economy principles.
4. **Policy, Regulation, and Compliance:** Focusing on knowledge of relevant legislation, regulatory frameworks, standards, and the ability to anticipate and navigate policy changes at national and European levels.
5. **Soft Skills and Leadership:** Including critical thinking, effective communication, negotiation, team management, and the capacity for adaptive, ethical leadership in complex environments.

Each domain is accompanied by precise competency statements, performance indicators, and - where applicable - proficiency descriptors that facilitate assessment and recognition across different contexts.

Flexibility and Adaptability

- The framework is intentionally adaptable, allowing institutions and employers to contextualize and prioritize competencies according to local, national, and sector-specific realities.



- It supports both vertical progression (from foundational to advanced levels) and horizontal mobility (across roles and sub-sectors), reflecting the diverse pathways available in modern agri-food systems.

Alignment with European and National Standards

- The framework is mapped to the European Qualifications Framework (EQF) and is compatible with major national qualification systems, ensuring interoperability and facilitating cross-border recognition of learning and qualifications.
- It is designed to remain consistent with ongoing European initiatives such as the Green Deal, Digital Education Action Plan, European Skills Agenda, and the Farm to Fork Strategy.

Implementation and Continuous Improvement

- Recommendations are provided for the integration of competencies into curricula, teaching and assessment strategies, and professional certification schemes.
- The framework is intended to be dynamic: periodic review and stakeholder feedback mechanisms are envisaged to ensure ongoing relevance in a rapidly evolving sector.

Strategic Value

Thus, AGRITECH Manager Competency Framework is more than a static list of skills, it is a strategic enabler for talent development, workforce mobility, and sectoral transformation. By providing a shared reference across education, industry, and policy, it supports the creation of a future-ready, digitally skilled, and sustainability-focused agri-food workforce - critical for Europe's economic resilience and leadership in global agricultural innovation.



3. METHODOLOGY

The methodology supporting the AGRITECH Manager Competency Framework was designed to ensure a robust, transparent, and replicable process for identifying and validating the core skills and qualifications required for this emerging professional role. The process was built on principles of inclusiveness, evidence-based practice, and cross-sectoral engagement, ensuring that the resulting framework is grounded in real-world needs and current sectoral trends.

At its core, the methodology was structured to achieve four main objectives:

- To standardize the collection of survey data across all partner countries and sectors;
- To provide clear guidance for targeting and engaging key stakeholder groups, including industry leaders, educators, policy makers, and technology experts;
- To outline a rigorous approach for the collection, analysis, and interpretation of both survey and sectoral data;
- To validate the **AGRITECH Manager** competency framework through broad stakeholder feedback and sector analysis.

The overall process followed a multi-phase structure, beginning with the distribution of targeted questionnaires and sectoral data collection, followed by systematic data analysis and synthesis of key findings, and culminating in the structured reporting of conclusions and recommendations. Partners were tasked with ensuring high participation rates among relevant stakeholders and with gathering supplementary data from industry reports, policy documents, and emerging research in agri-food innovation and technology.

Both quantitative and qualitative analysis methods were employed. Survey data were categorized by country, stakeholder type, and expertise level, with frequency analysis used to identify critical and emerging competencies. Open-ended responses were subjected to qualitative coding to detect recurring themes and needs. Parallel to the survey, partners conducted sector analyses using recent literature, market reports, and policy reviews to contextualize survey findings within the wider dynamics of the European and global agri-food landscape.

To ensure alignment and quality, the reporting structure was harmonized across partners and included an executive summary, detailed stakeholder feedback, sectoral analysis findings, and actionable conclusions. The process was designed not only to capture current skills gaps and training needs, but also to support the ongoing evolution and periodic revision of the framework as the sector continues to develop.

The methodology reflects the collaborative, interdisciplinary spirit of the AGRITECH project and underpins the credibility, relevance, and practical value of the Competency Framework produced.

3.1. Overview of the Competency Mapping Process

The competency mapping process was a collaborative effort involving key AGRITECH project partners across Europe. The methodology and survey instruments were developed jointly by AGR, PAMEA, DDTG, and MATE, leveraging expertise in agri-food innovation, digital education, labor market analysis, and sectoral policy. Survey distribution and sector analysis were coordinated by partners in each participating country, ensuring broad stakeholder reach and contextual sensitivity. Data analysis,



validation, and framework refinement were conducted in regular consortium workshops, drawing on the complementary strengths of academic, industry, and research organizations within the partnership. Mapping of competencies for the **AGRITECH Manager** role was undertaken using a multi-layered, iterative approach, combining established best practices in skills profiling with lessons learned from recent European and sectoral initiatives. The process was designed to balance rigor and inclusivity, ensuring the resulting framework would be both evidence-based and grounded in the realities of a rapidly changing agri-food landscape.

1 Conceptual Foundations and Reference Points

The starting point for the mapping was a desk review of existing frameworks and strategic documents - including the European Skills, Competences, Qualifications and Occupations (ESCO) classification, the European Qualifications Framework (EQF), and recent EU policies such as the Green Deal, the Farm to Fork Strategy, and the Digital Education Action Plan. Early drafts also referenced sector-specific research from Horizon Europe projects and national initiatives. This review highlighted both transferable models and notable gaps, particularly in digital and sustainability-oriented competencies.

2 Stakeholder Engagement - Ambition and Reality

A cornerstone of the process was broad stakeholder consultation. Partners set out to engage a representative mix of industry leaders, technology providers, academics, educators, and policymakers, using a multilingual survey distributed via email, professional networks, and high-traffic LinkedIn groups. While this generated strong participation from certain countries and roles, response rates were lower than anticipated in others, and engagement from some industry segments was limited. The project addressed these gaps through targeted follow-up with underrepresented groups and by validating initial findings in consortium meetings.

3 Integrated Data Collection and Analysis

Data collection was structured around two pillars: (1) stakeholder survey responses and (2) sectoral and labor market analysis. Survey data included both quantitative questions (e.g., ranking skills, rating importance) and open-text responses. Quantitative analysis used frequency distributions and cross-tabulation by country and stakeholder type to surface priority domains. Qualitative responses were coded thematically using NVivo, focusing on recurring concepts, critical gaps, and innovative practices. Sector analysis complemented the survey, drawing on recent industry reports (e.g., OECD Agri-food Skills Review, FAO digital transformation papers), national labor market data, and policy trend analysis. Comparing European findings with international benchmarks (such as US and Chinese agri-tech trends) helped situate the **AGRITECH Manager** profile in a global context.

4 Critical Reflections and Methodological Challenges

The process was not without challenges. Variations in partner capacity, stakeholder access, and language occasionally led to uneven data quality or representation. For example, certain countries' responses were dominated by academic voices, while others underrepresented the views of SMEs or young professionals. The project team openly discussed these issues in project meetings and sought to mitigate them by weighting certain responses, conducting supplementary interviews, and openly documenting limitations in the final analysis.

Another challenge was balancing the need for a comprehensive, "future-proof" framework with the risk of over-complexity. To address this, the mapping was refined through multiple feedback loops with both internal and external reviewers, focusing on clarity, usability, and adaptability for different contexts.



5 Ethical and Data Protection Considerations

All data collection and analysis activities adhered to GDPR principles. Participation in the survey was voluntary and for who desired so, anonymous, with informed consent obtained at the point of entry. Data were stored securely, with access limited to the project's research team, and results are reported in aggregate form to protect individual and organizational privacy.

6 Lessons Learned and Value Added

The process revealed not only expected gaps - such as digital skills and data management - but also less-anticipated needs, including competencies in change management, multi-actor collaboration, and ethical leadership. Importantly, the mapping exercise highlighted the diversity of interpretations of "agritech" across countries and subsectors, underscoring the need for flexibility in both the framework and its implementation.

As a result, the final Competency Framework is more than a static list of skills: it is a practical, validated, and adaptable tool for curriculum reform, workforce planning, and policy alignment, and is explicitly designed for continuous improvement as sector needs evolve.

3.2. Survey Design and Implementation

The survey instrument at the heart of the AGRITECH Manager Competency Framework was meticulously designed to ensure the collection of robust, relevant, and actionable data from a diverse cross-section of stakeholders across the European agri-food sector. The design process was guided by three primary objectives:

1. to comprehensively capture the multidimensional skill requirements of the emerging AGRITECH Manager role;
2. to enable meaningful comparison across countries, stakeholder types, and sectors; and
3. to balance quantitative rigor with the flexibility to identify new and unexpected competency needs.

3.2.1 Survey Structure and Rationale

The questionnaire was developed collaboratively by the project's core research and sectoral partners, drawing on prior frameworks (such as ESCO and EQF), recent policy guidance (e.g., Green Deal, Farm to Fork, Digital Skills Agenda), and the findings from initial desk research. The survey structure reflected the following principles:

Thematic Coverage:

The questionnaire was organized into thematic sections covering:

4. **Demographics and stakeholder identification:** capturing respondent country, professional background, and experience level;
5. **Technical and digital skills:** evaluating knowledge of emerging technologies, digital literacy, and their application in agri-food contexts;
6. **Business and entrepreneurial skills:** assessing competencies related to innovation management, project leadership, and value chain understanding;
7. **Sustainability and green skills:** probing awareness and practices regarding sustainable agriculture, resource efficiency, and climate adaptation;



8. **Policy, regulation, and compliance:** exploring familiarity with legislative frameworks, regulatory requirements, and public policy trends;
9. **Soft skills and leadership:** including communication, teamwork, adaptive leadership, and problem-solving;
10. **Open-ended questions:** allowing respondents to highlight additional competencies, perceived gaps, or emerging sector trends not captured in pre-set options.

Question Types:

The survey combined multiple-choice, Likert scale (importance/agreement), ranking, and open-text items. This structure facilitated both statistical analysis and qualitative coding, allowing for nuanced insight and the emergence of novel themes.

Language and Accessibility:

To maximize inclusiveness, the survey was translated and administered in English and all relevant project languages, with careful attention to terminological consistency. Prior to full rollout, the instrument was piloted within each partner country and refined based on respondent feedback to ensure clarity and relevance across cultural and professional contexts.

Section	Main Topics / Example Questions	Question Type(s)	Purpose
1. Introduction & Consent	Survey purpose, consent confirmation	Information, Single choice	Ethics, transparency, voluntary participation
2. Respondent Profile & Demographics	Country, organization/institution, professional role, years of experience	Multiple choice, Drop-down	Stakeholder mapping, respondent segmentation
3. Experience in AGRITECH	Type of organization, experience with digital/agritech solutions, previous projects	Multiple choice, Single choice	Contextualize respondent expertise/sector reach
4. Importance of Competency Domains	Rate importance of: Technical/Digital Skills, Business Skills, Sustainability, Policy, Soft Skills	Likert scale, Ranking	Prioritize main competency domains
5. Detailed Skills & Competencies	Rate importance of specific skills within each domain (e.g., AI, data analysis, leadership)	Likert scale, Multiple choice	Identify priority sub-competencies and skills
6. Gaps and Training Needs	Self-assessed skills gaps, interest in further training, barriers to upskilling	Likert scale, Multiple choice	Assess unmet needs, inform curriculum/training
7. Open Comments & "Other" Answers	Suggestions for additional competencies, sector trends, free-text remarks	Open text	Capture emerging issues and qualitative insights

Table 1. Overview of the AGRITECH Manager Survey Structure

Table 1 summarizes the structure of the AGRITECH Manager survey instrument, detailing the main sections, sample question topics, and types of data collected. This design facilitated both quantitative benchmarking and the collection of qualitative insights, supporting a multidimensional analysis of stakeholder needs and competency gaps. The full questionnaire is provided in Annex 9.1.



3.2.2 Implementation and Distribution

Survey implementation leveraged both digital and network-based strategies:

- **Distribution Channels:** The questionnaire was disseminated electronically using recognized survey platforms and shared widely via partner mailing lists, direct invitations, professional associations, and targeted LinkedIn groups in agri-food, agritech, sustainability, and climate domains.
- **Targeted Follow-up:** To address initial gaps in sector or country representation, partners conducted direct outreach to key stakeholders, including industry leaders, academic experts, and policymakers, and provided reminders and follow-ups to improve completion rates.
- **Data Management and Ethical Compliance:** Participation was voluntary and anonymous. Data protection protocols were strictly observed, in line with GDPR requirements. Informed consent was collected from all respondents, and data were securely stored for analysis by the core project team only.

A summary overview of the questionnaire structure is presented in Table 1. The complete survey instrument, in all languages, is available in **Annex 9.1** for full reference and auditability.

3.3. Stakeholder Engagement and Data Collection

3.3.1 Respondent Distribution and Outreach Realities

The survey reached a robust number of respondents (820 completed out of 1080 total), with strong representation from all partner countries, though with notable differences in participation levels. Romania was particularly prominent, followed by the Czech Republic, Greece, and Hungary, with Italy and the worldwide (EN) group less represented. Despite active promotion in large international LinkedIn groups, the English-language version yielded relatively few responses, suggesting that network engagement and partner-driven outreach were more effective than generic social media campaigns. The profile of respondents included a mix of project partners, sectoral experts, employers, educators, and others, but with a heavier weighting towards partner organisations and the extremes of experience (very new and very senior professionals). These factors shape the interpretation of the survey data and should be considered when generalising the competency needs and recommendations for the AGRITECH Manager role.



Figure 1. Survey responses by country (percentage of total complete responses N=820).



From the total of 820 fully completed survey responses were collected for the AGRITECH Manager Competency Framework analysis. As illustrated in Figure 1, response rates were highest in Romania (38%), followed by the Czech Republic (20%), Greece (16%), Hungary (15%), with more modest representation from Italy (5%) and respondents from outside the consortium countries (Worldwide, 6%).

This distribution reflects both the established networks of consortium partners and the specific dissemination strategies employed. Notably, the survey was promoted widely through direct institutional channels and by leveraging several LinkedIn groups, some with memberships in the tens of thousands and representing a wide array of stakeholders in agriculture, agritech, and sustainability. Despite this extensive digital outreach and the theoretical reach of the LinkedIn campaign, actual conversion rates from group membership to survey participation were lower than anticipated.

The distribution of completed surveys by country is as follows (as per your chart and summary table):

Country	Total answers submitted	Completed Surveys	% of Total
Romania	414	316	38%
Czech Rep	216	130	20%
Greece	173	144	16%
Hungary	158	134	15%
Italy	61	48	6%
Worldwide*	58	48	5%
TOTAL	1080	820	100%

(*"Worldwide" - responses collected via the EN questionnaire, outside partner countries.)

Table 2. Total numbers of answers received by countries

The survey results are weighted toward the more active partner countries, especially Romania. This has implications for the representativeness and transferability of the findings.

This finding highlights a common challenge in large-scale stakeholder research: **high online visibility does not automatically translate into high engagement or response rates**, especially for voluntary, non-incentivized surveys. It is likely that, as in many pan-European surveys, the strongest participation came from individuals and organizations already engaged with or invested in the AGRITECH project and its partner networks. Cultural factors, perceived relevance, timing, and survey fatigue may also have played a role in the differing levels of response by country and group.

While the overall sample is sufficiently large for robust analysis and comparative insights, the **relative underrepresentation of Italy and international (non-partner) respondents** should be considered when interpreting the findings. These groups may have specific perspectives or needs that are less visible in the present dataset. The project team recognizes this as a limitation and will seek to address it in future rounds of consultation, particularly as the framework is disseminated and validated with broader audiences.

Collected data provide a strong and diverse evidence base for the initial mapping of competencies, but also underscore the importance of continued, targeted engagement strategies - especially with harder-to-reach or underrepresented groups - across the evolving European agritech ecosystem.

3.3.2 Partner Involvement and Data Collection

It is important to highlight that the distribution of survey responses across countries did not simply reflect the number of consortium partners, but rather the quality and effectiveness of local engagement



efforts. The survey achieved a high number of responses across the consortium countries, with particularly strong participation from Romania, the Czech Republic, Greece, Hungary, Italy and Worldwide. These results reflect the collective outreach efforts of all partners and demonstrate substantial engagement from stakeholders throughout the region. It should also be noted that responses from Cyprus were submitted in the Greek language version of the survey and are therefore included within the Greek data set and interpretation. In Hungary, the results were notably strengthened by the outreach efforts of MATE (an associated partner), who, through cooperation with the National Hungarian Agriculture Chamber, significantly broadened the survey's reach within the sector.

Romania's outstanding response rate stands as a testament to the dedicated work of both USAMV (whose team achieved the largest single-country dataset) and AGR, who together ensured a high level of mobilization across networks. Similarly, in the Czech Republic, the active involvement and targeted outreach of ZSCR and WRLS produced a dataset that reflects deep sectoral engagement.

These outcomes suggest that successful stakeholder engagement is not determined solely by the number of consortium members, but by the strategic, proactive involvement of partners and their ability to leverage sectoral relationships and networks. The AGRITECH project wishes to acknowledge and thank these partners for their exceptional efforts in ensuring strong, credible, and representative participation from their countries.

Conversely, countries or regions represented by fewer partners or with less established local networks, such as Italy and the "Worldwide" group, saw lower levels of engagement despite the broader dissemination efforts. This pattern is consistent with established findings in international project research: the depth and quality of national partner involvement has a direct, positive correlation with survey reach and completion rates. Local partners are often able to provide context-sensitive encouragement, follow-up, and trust-building, which drive actual participation beyond mere survey visibility.

This reality underlines both a strength and a limitation of the present analysis. On one hand, the strong participation from countries with a larger consortium presence ensures that the framework is grounded in areas where sector transformation is already a priority and where institutional collaboration is robust. On the other hand, the project recognizes that perspectives from countries with fewer partners - or where stakeholder engagement with digital transformation is less mature - may be underrepresented at this stage.

Moving forward, the consortium intends to address this by expanding engagement with professional associations, sector bodies, and relevant networks, particularly in countries with lower initial response rates, as well as by exploring additional forms of targeted outreach in future project phases.

3.4. Data Analysis Approach

Robust stakeholder engagement and data collection were central to developing the AGRITECH Manager Competency Framework. The project's strategy ensured input from a wide spectrum of professionals and organizations across Europe's agri-food ecosystem, supporting the framework's credibility and practical value.

3.4.1 Stakeholder Diversity by Role

The survey achieved broad coverage across key professional categories. As depicted in Figure 2, respondents included Partners (51.48%), Employers (17.11%), Agriculture Experts (14.01%),

Teachers/Trainers/Educators (11.28%), and Other roles (6.13%). This diversity confirms the framework is grounded in insights from across the sector value chain, including both operational and leadership perspectives, as well as voices from education and advisory services.

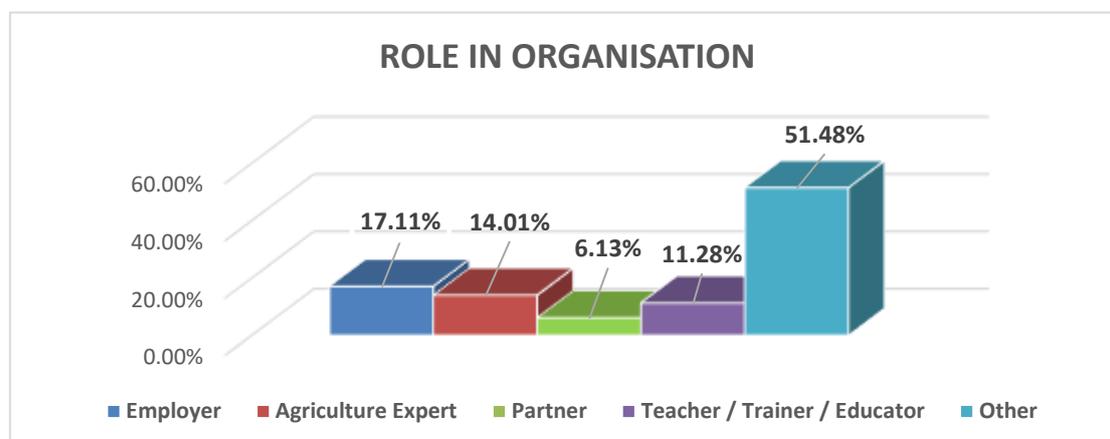


Figure 2. Distribution of respondent roles in their organizations.

3.4.2 Geographical and Language Outreach

To maximize inclusivity and local relevance, the survey was available in English, Romanian, Czech, Greek, Hungarian, and Italian.

Language /Country	Greece	Italy	Romania	Hungary	Cyprus	Czech Republic	Austria	Germany	Other - specify
EN	11.48%	6.56%	6.56%	3.28%	3.28%	0.00%	3.28%	0.00%	65.58%
RO	0.00%	0.24%	95.17%	0.00%	0.00%	0.00%	0.00%	0.00%	4.59%
CZ	0.93%	0.00%	0.00%	0.00%	0.00%	98.15%	0.00%	0.00%	0.93%
GR	85.55%	0.00%	0.00%	0.00%	13.87%	0.00%	0.00%	0.00%	0.58%
HU	0.63%	0.00%	0.00%	96.84%	0.00%	0.00%	0.00%	0.00%	2.53%
IT	0.00%	94.83%	0.00%	0.00%	0.00%	0.00%	0.00%	1.72%	3.45%

Table 3. Percentage of responses by survey language and respondent country.

Table 3 shows the breakdown of responses by language and country. Most respondents completed the survey in their national language (e.g., over 95% in Romania and Czech Republic), while the English version attracted a broad range of respondents from non-partner countries, such as Egypt (4), Iran (4), Turkey (3).

Country	Number	Country	Number	Country	Number	Country	Number
Egypt	8.3%	Ghana	4.2%	Dubai	2.1%	New Zealand	2.1%
Iran	8.3%	Kenya	4.2%	Georgia	2.1%	Nigeria	2.1%
Turkey	6.3%	Netherlands	4.2%	Iraq	2.1%	Syria	2.1%
Belgium	4.2%	Palestine	4.2%	Kazakhstan	2.1%	Zambia	2.1%
Finland	4.2%	Bangladesh	2.1%	Mongolia	2.1%	Wales	2.1%

Table 4. Percentages of responses by countries from outside the consortium.

This approach demonstrates both the project's strong engagement with consortium countries and its successful international reach, ensuring the framework reflects both local and pan-European realities.



3.4.3 Experience Level of Respondents

A further strength of the dataset is the wide range of professional experience represented. As shown in Figure 3, nearly 29% of respondents reported 0 to 2 years of experience, while a further 26.7% had more than 20 years' experience in the agri-food sector. The remainder were distributed across 3-5 years (12%), 5-10 years (16.6%), and 10-20 years (15.6%). This balance ensures the framework integrates the perspectives of both early-career professionals and highly experienced sector leaders.

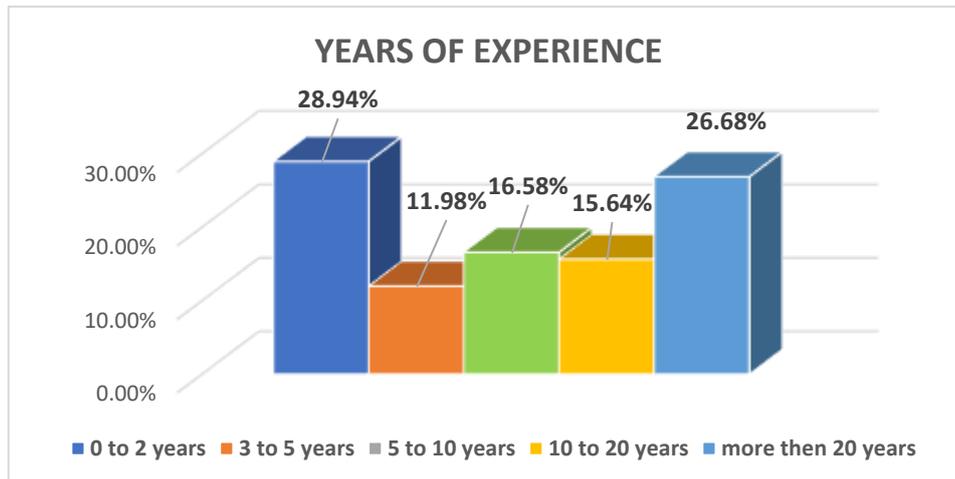


Figure 3. Years of professional experience among respondents.

- **Engagement Methods and Reflections**
- **Direct partner outreach** - via institutional and professional networks - was the main driver of high response rates, especially in countries with multiple active partners.
- **Digital dissemination** through large LinkedIn groups and public channels expanded the survey's visibility, especially internationally, though the conversion from "potential reach" to actual response was, as is common in voluntary surveys, relatively low.
- **Localized language versions** and partner support were critical to accessibility and respondent understanding, as evidenced by the overwhelming preference for native language completion.

3.5. Limitations and Quality Assurance

Before presenting the survey results and subsequent analysis, it is essential to acknowledge both the strengths and constraints inherent in the data collection process. All large-scale stakeholder consultations inevitably face challenges related to sample representativeness, outreach, and data reliability - particularly in fast-evolving, cross-sectoral fields like agritech. The AGRITECH project has prioritized a transparent approach, openly documenting methodological limitations and outlining the quality assurance measures taken to enhance the validity and credibility of its findings. The following section details these limitations and the corresponding strategies for quality assurance, providing readers with the necessary context to interpret results with appropriate nuance.

3.5.1 Limitations

Despite the robust design and extensive outreach of the AGRITECH Manager survey, several important limitations must be acknowledged to ensure an honest and balanced interpretation of the findings:



1. Uneven National Participation and Potential Sampling Bias

Survey response rates varied significantly across partner countries. While Romania, the Czech Republic, Greece, and Hungary contributed the largest number of responses, the “Worldwide” (EN) group were underrepresented. This imbalance reflects, in part, differences in partner engagement, network reach, and the effectiveness of local dissemination strategies. As a result, findings may be disproportionately influenced by the contexts and perspectives prevalent in the more strongly represented countries, potentially limiting their generalizability to less-represented regions.

2. Overrepresentation of Consortium Partners

A significant portion of respondents identified as “Partner,” indicating a strong project-internal presence. While this strengthens the internal validity of the results and reflects active engagement from AGRITECH consortium members, it may introduce bias towards project-aligned perspectives. Independent employers, mid-career professionals, and some sectoral actors were less represented, which may affect the diversity and independence of feedback on competencies and skills gaps.

3. Demographic and Career Stage Gaps

The respondent pool showed a bimodal distribution in years of professional experience, with the highest shares among early-career (<2 years) and very senior (>20 years) individuals, and fewer responses from mid-career professionals (3 - 20 years). This could lead to the underrepresentation of viewpoints from those most active in day-to-day operational management - arguably the core of the target profile.

4. Incomplete Data on Outreach and Response Rates

As of this version, the number of survey invitations sent by country and stakeholder group is not fully documented. This prevents precise calculation of response rates, which is essential for assessing nonresponse bias and the overall representativeness of the data. The project team is actively working to obtain these numbers for future reporting.

5. Potential Nonresponse and Survey Fatigue

Roughly 24% of all initial survey attempts were not completed. Most drop-offs occurred after the demographic questions, likely due to survey fatigue, perceived complexity, or time constraints. It is possible that those who persisted to completion are not fully representative of the overall invited population, introducing further potential bias.

6. Limited Reach via Digital-Only Channels

Despite leveraging several large LinkedIn groups and online forums for survey promotion, actual response rates from these channels were lower than anticipated. This is a common challenge in voluntary, non-incentivized research, where digital “visibility” does not necessarily translate to participation, and network-driven engagement proved more effective.

7. Language and Translation Considerations

While the survey was provided in multiple languages to enhance accessibility, minor variations in translation, interpretation of terminology, or local context could have influenced how questions were understood and answered.

8. Privacy and Data Protection Constraints

Respondents were given the option to provide personal details, but all analysis was conducted at aggregate level to fully comply with GDPR and ethical research standards. Some potentially useful contextual data may have been excluded to protect privacy.



3.5.2 Quality Assurance Measures

To mitigate these limitations and strengthen the reliability and integrity of the findings, the AGRITECH project implemented the following quality assurance measures:

1. Standardized Methodology

A harmonized survey instrument and implementation protocol were used across all countries, ensuring consistency in data collection, question structure, and respondent experience.

2. Multilingual Access and Pilot Testing

All survey versions were carefully translated and piloted in each participating country to confirm clarity and equivalence, with local partners reviewing language and terminology for sectoral relevance.

3. Data Anonymization and GDPR Compliance

Strict data protection procedures were followed, with all personally identifiable information anonymized or excluded from the analysis, and consent obtained from all respondents.

4. Internal and Cross-Country Review

Draft results and interim findings were discussed in consortium meetings, allowing for validation, critical reflection, and triangulation of interpretations between partners.

5. Ongoing Documentation of Limitations

This section transparently documents all known limitations at the time of reporting. As further outreach and engagement data are collected, the project will update the analysis and continue to critically assess the reliability and generalizability of results.

6. Plans for Continuous Improvement

Lessons learned from the current round - such as the need for better invitation tracking, targeted engagement of underrepresented groups, and refinements in question design - will inform future rounds of framework validation and stakeholder consultation.

AGRITECH project acknowledges that, like all large-scale voluntary surveys, its findings are shaped by both strengths and constraints in sample structure, outreach methods, and sector realities. By rigorously documenting these factors and implementing best-practice quality assurance, the project seeks to provide a credible, transparent, and actionable foundation for the ongoing development of the AGRITECH Manager Competency Framework.



4. SURVEY RESULTS AND KEY INSIGHTS

The following section presents a detailed analysis of the responses collected through the AGRITECH Manager survey, highlighting the most significant findings and patterns that emerged across participating countries and stakeholder groups. By examining both quantitative results and qualitative insights, this analysis aims to capture not only the current state of competencies and perceived needs within the agri-food sector, but also the evolving expectations and challenges facing future AGRITECH Managers. The results are organized to first establish the demographic and professional profile of respondents, before moving into thematic insights on key skills, gaps, and trends identified through the survey. Where relevant, differences between countries, roles, or levels of experience are discussed to provide a nuanced understanding of the sector's needs and priorities.

Survey results are presented by theme. Section 4.2 addresses core industry needs and current skills gaps. Section 4.3 compares priorities across stakeholder groups. Section 4.4 discusses major sectoral trends and their implications for competencies, and Section 4.5 focuses on stakeholder validation and policy alignment for the proposed framework.

4.1. Profile of Respondents

The respondent pool for the AGRITECH Manager survey reflects a broad cross-section of the European agri-food sector. A total of 820 fully completed questionnaires were analyzed, with the majority of responses originating from Romania, the Czech Republic, Greece, and Hungary. While the demographic and professional breakdown of respondents is detailed in Chapter 3, key summary characteristics are highlighted below for ease of reference:

- **Country of residence:** Romania (38%), Czech Republic (20%), Greece (16%), Hungary (15%), Italy (6%), and Worldwide (5%).
- **Professional roles:** Partners (51%), Employers (17%), Agriculture Experts (14%), Teachers/Trainers/ Educators (11%), Other (6%).
- **Years of professional experience:** Early-career (0 - 2 years: 29%), Senior professionals (>20 years: 27%), with the remainder spread across 3 - 20 years.
- **Language of survey:** Respondents mostly completed the survey in their native language, with additional international input via the English version.

This diverse mix of countries, roles, and levels of experience provides a robust foundation for the subsequent analysis of skills gaps, competency needs, and sectoral trends presented in the following sections.

AGRITECH Manager survey succeeded in engaging a diverse and substantial pool of respondents, covering a wide range of countries, professional roles, and levels of experience within the European agri-food sector. The strongest participation came from countries where partners leveraged well-established networks and proactive engagement strategies, rather than from consortium size alone. While this provides a robust and credible evidence base for the subsequent analysis, it is important to



acknowledge the relative underrepresentation of some groups - such as mid-career professionals, industry employers outside the consortium, and participants from certain countries.

These characteristics should be kept in mind when interpreting the survey results and drawing conclusions about sector-wide competency needs. Overall, however, the diversity and depth of the respondent profile give confidence that the following insights and recommendations are grounded in real sector experience and are relevant for shaping the AGRITECH Manager role across Europe.

4.2. Industry Needs and Skills Gaps Identified

The dynamic transformation of the agri-food sector - driven by digital innovation, sustainability imperatives, and shifting market expectations - demands an updated understanding of both current and emerging workforce needs. To support the development of a relevant and future-proof AGRITECH Manager Competency Framework, the survey examined stakeholders' perspectives on the most significant technological, business, and regulatory trends, as well as the skills gaps perceived at national and European levels.

This section presents a detailed, question-by-question analysis of survey responses, comparing results across all participating countries and providing an integrated summary of overarching trends. By highlighting both common priorities and country-specific differences, the analysis aims to identify the core competencies, specialized knowledge areas, and critical skill gaps that must be addressed in the design of new curricula, training programs, and professional development pathways for AGRITECH Managers. The findings here form the empirical foundation for the recommendations and framework design that follow in later chapters.

4.2.1 Tech Trends

Comparative Analysis by Country

The survey asked respondents in each country to select the top three technological trends they believe are most significantly transforming agriculture. A cross-country comparison of these rankings reveals both clear patterns and notable country-specific differences.

Full Term	Abbreviation		
		Blockchain for Supply Chain	BL SC
<i>AI & Machine Learning</i>	AI & ML	Precision Agriculture (GIS, GPS, Remote Sensing)	PA
<i>Internet of Things (IoT)</i>	IoT	Smart Irrigation Systems	SIS
<i>Robotics & Automation</i>	R & A	Digital Marketplaces for Farmers	DM F

Table 5. Abbreviations for Key Technological Trends

Explanation of Weighted Average Calculation

When presenting the results for "most impactful technological trends," a **Weighted Average** was calculated to reflect not only the frequency with which each trend was selected, but also the priority assigned to it by respondents. In this ranking system:

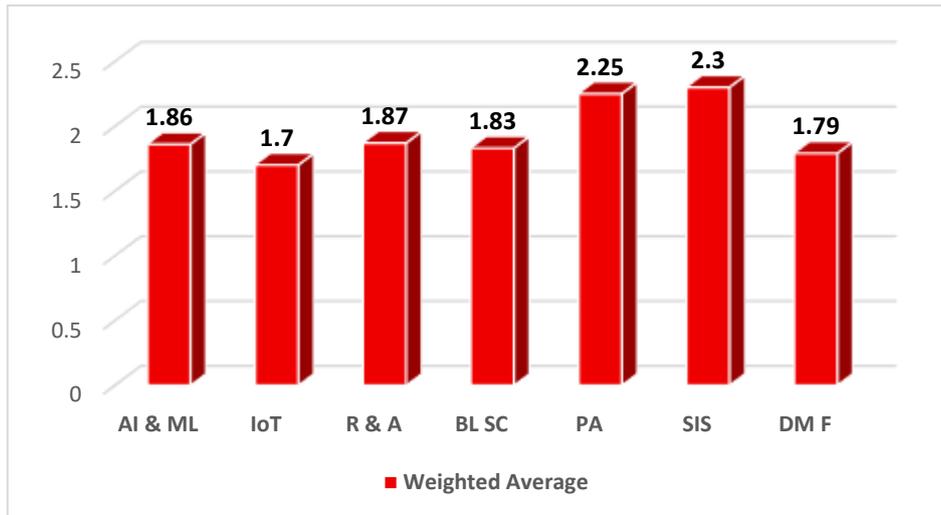
- Each respondent was asked to select and rank their top three trends.
- A weight was assigned to each rank (e.g., "**1st place**" = 3 points, "**2nd place**" = 2 points, "**3rd place**" = 1 point).



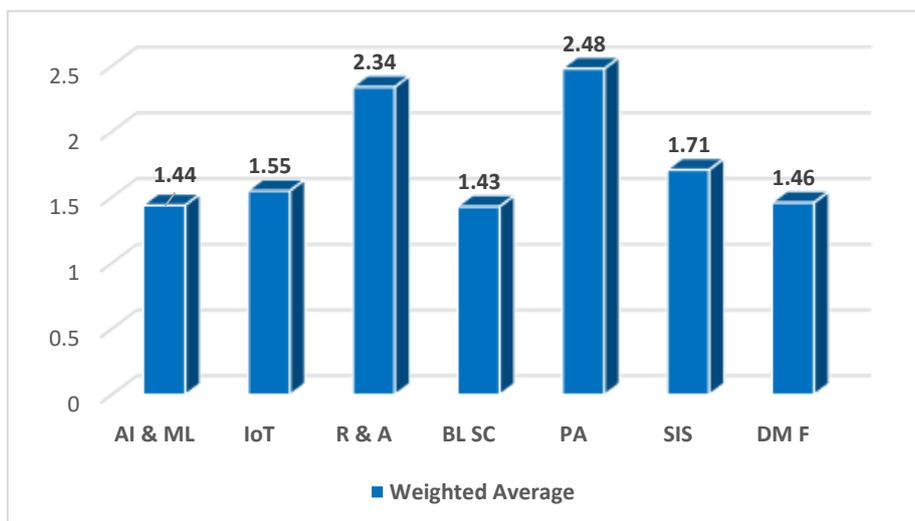
- For each trend, the weighted average was calculated as follows:
 $(\text{Number of 1st place votes} \times 3) + (\text{Number of 2nd place votes} \times 2) + (\text{Number of 3rd place votes} \times 1)$

This sum was then divided by the total number of respondents to normalize the score.

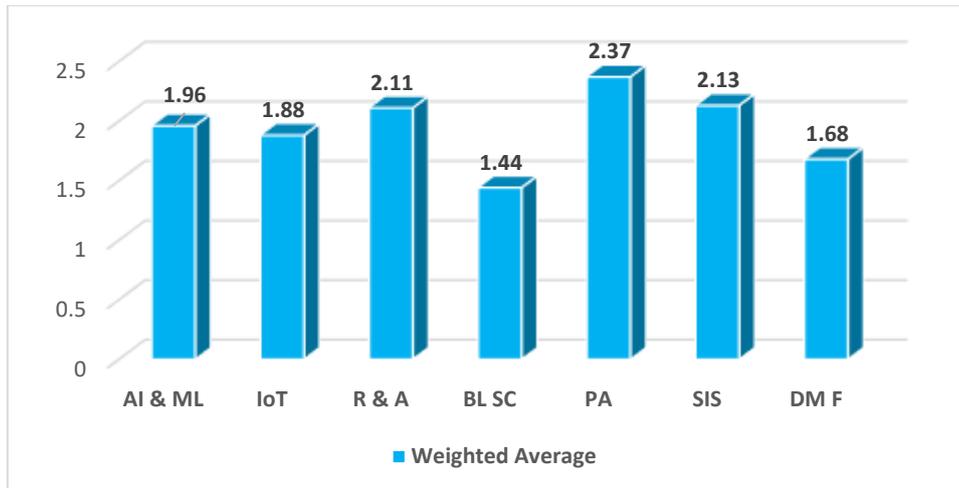
Romania: Respondents most frequently placed **precision agriculture, data analytics & artificial intelligence (AI)**, and **automation/robotics** in their top three. Precision agriculture led strongly, reflecting a local focus on optimizing inputs and outputs, possibly driven by national investment priorities and the availability of new technologies in the Romanian agri-food sector.



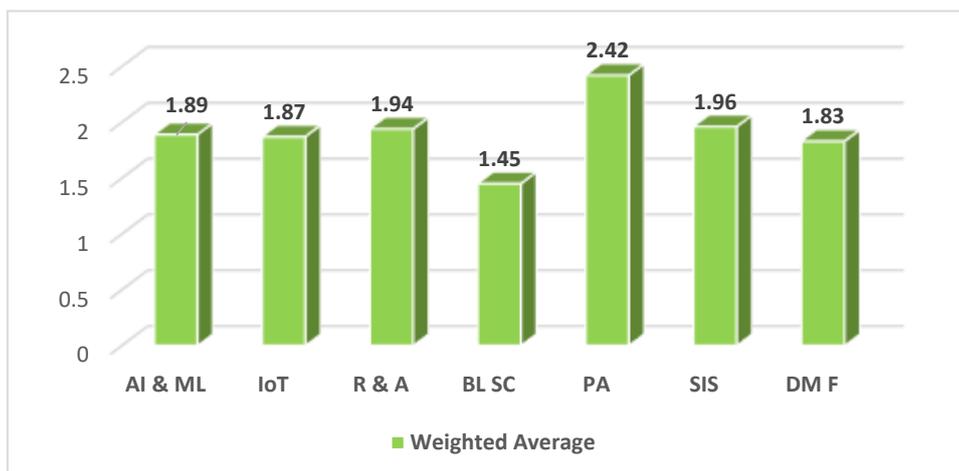
Czech Republic: The Czech sample also emphasized **automation/robotics** and **precision agriculture**, but **IoT applications** (Internet of Things) were notably prominent as well. This may indicate an ecosystem where connected technologies and machine-to-machine integration are increasingly important in farm management.



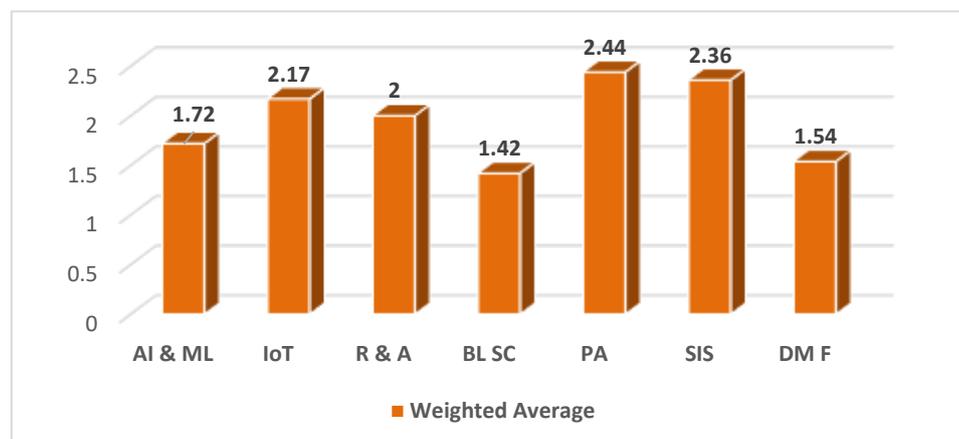
Greece: Greek respondents showed a somewhat different profile. While **precision agriculture** remained important, **blockchain for traceability** and **digital supply chain platforms** ranked much higher here than in other countries. This likely reflects both local agri-food export requirements and growing national interest in transparent supply chains.



Hungary: The Hungarian responses were consistent with the general regional pattern, with **precision agriculture** and **automation/robotics** as leading trends, closely followed by **data analytics & AI**. The strong ranking of automation aligns with the country's policy push for modernizing agricultural practices and workforce upskilling.

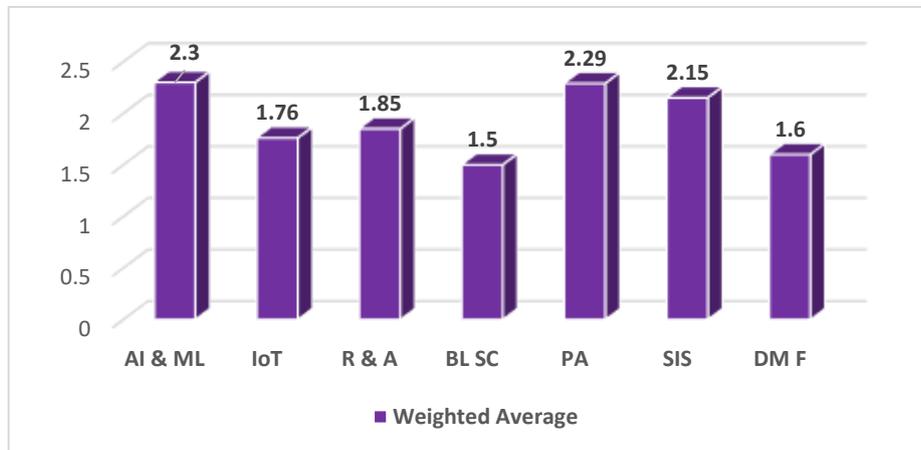


Italy: Italian participants ranked **IoT applications**, **precision agriculture**, and **automation/robotics** as their most impactful trends. The prominence of IoT may reflect Italy's ongoing investments in smart farming and regional pilot projects in connected agriculture.





Worldwide: International respondents placed the highest emphasis on **data analytics & AI, automation/robotics, and IoT applications**. Precision agriculture also appeared but was slightly less dominant, possibly reflecting a broader, more technology-neutral view from outside the core consortium.



This side-by-side analysis shows that, while **precision agriculture** and **automation/robotics** are nearly universally seen as transformative, some technologies (notably **IoT** and **blockchain**) are perceived as especially important in specific national contexts.

TOTAL Results and Interpretation

Aggregated across all countries, the top-ranked technological trends shaping the future of agriculture are:

- **Precision agriculture**
- **Automation/robotics**
- **Data analytics & artificial intelligence**
- **IoT applications**
- **Blockchain for traceability**

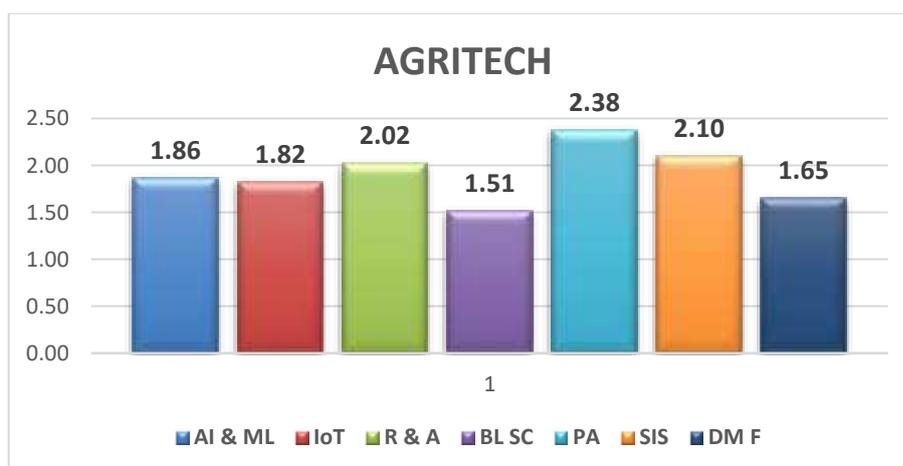


Figure 4. Most impactful technological trends currently transforming agriculture

Precision agriculture is the most frequently identified trend, underlining the sector-wide focus on optimizing resource use and boosting efficiency. **Automation/robotics** and **data analytics & AI** closely follow, emphasizing the shift toward digitized, smart farming systems. **IoT** and **blockchain** are rising in



importance, but their perceived impact varies more strongly by country, possibly due to differing adoption rates or policy priorities.

Implication for the Competency Framework

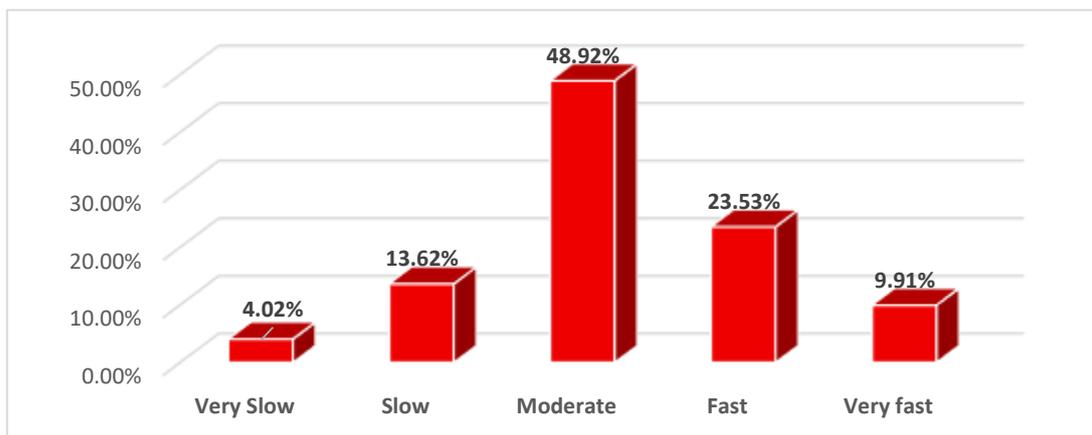
The evidence clearly supports the inclusion of advanced digital, automation, and data management skills as foundational competencies for the AGRITECH Manager role. Furthermore, the importance of IoT and blockchain - especially in certain national contexts - suggests that the framework should allow for country-specific modules or specializations, enabling training and workforce development to keep pace with emerging technologies.

4.2.2 Adoption Speed

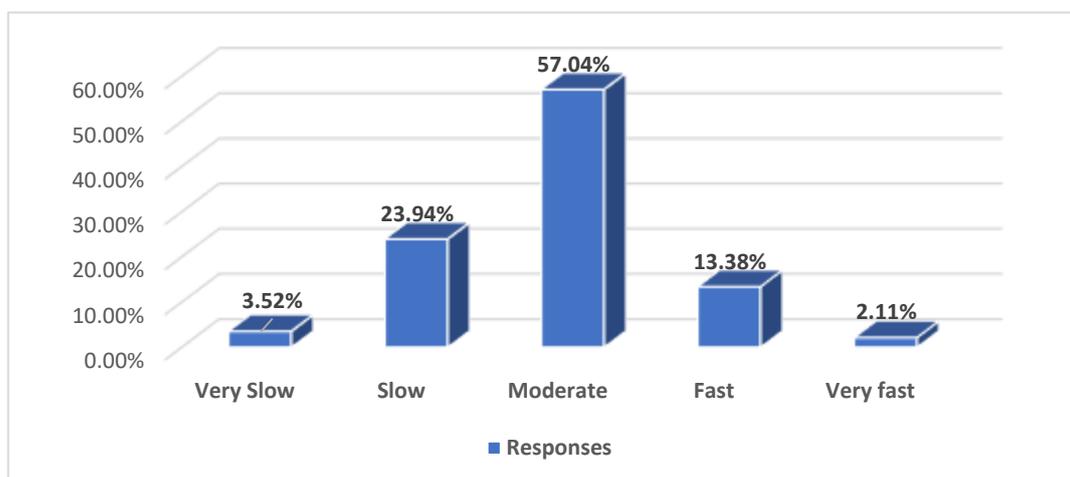
Comparative Analysis by Country

The survey asked respondents in each participating country to assess the speed at which new agricultural technologies are being adopted within their context. The results show both regional similarities and notable distinctions:

Romania: Respondents predominantly described the speed of adoption as “moderate,” with a smaller but visible group perceiving it as “slow.” Very few selected “fast” or “very fast,” suggesting that while there is openness to innovation, structural or resource barriers may be tempering the pace of change.

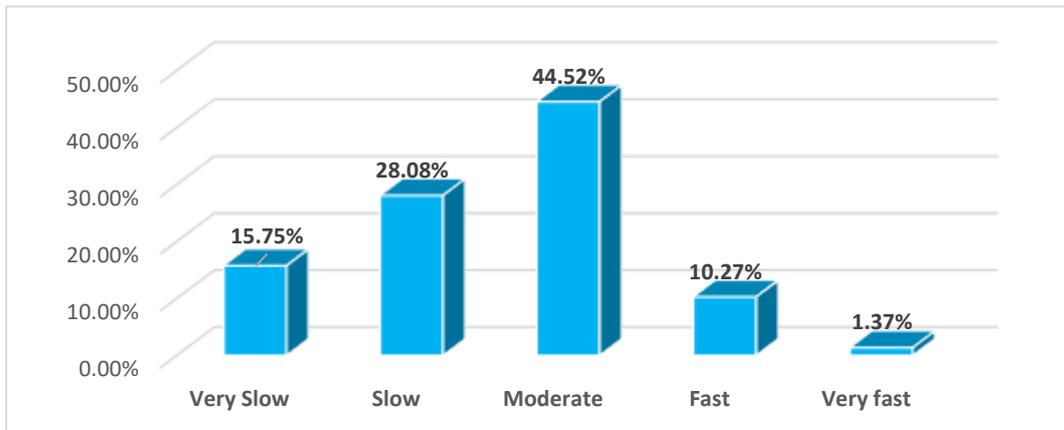


Czech Republic: Czech stakeholders were slightly more optimistic, with a higher share indicating “moderate to fast” adoption. However, a significant portion still categorized adoption speed as “moderate,” reflecting a generally cautious, incremental approach to technology integration.

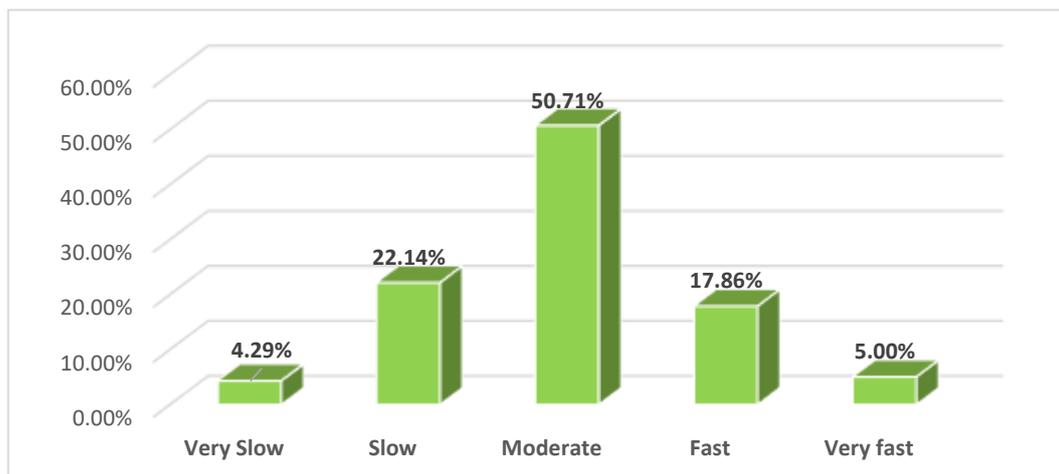




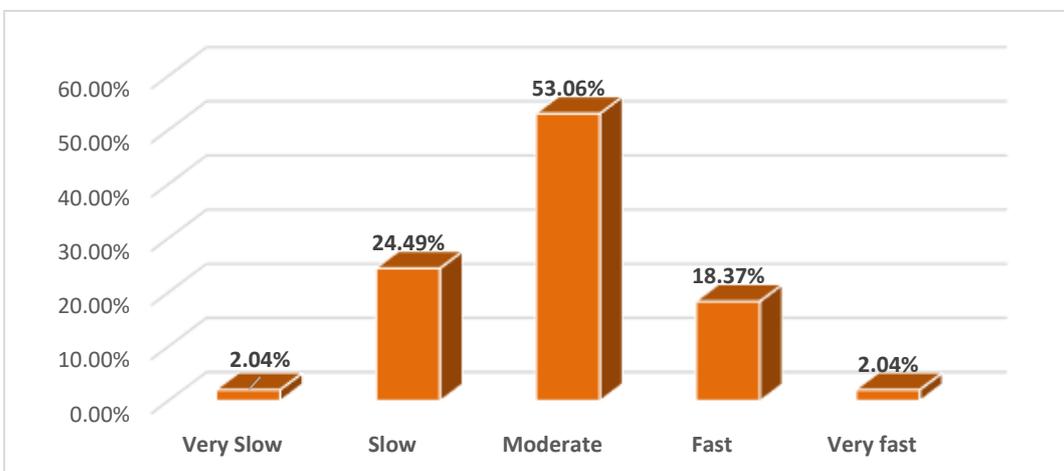
Greece: Greek responses leaned towards “moderate” and “slow,” with few indicating “fast” adoption. This may point to systemic obstacles such as fragmented farm structures, regulatory hurdles, or financial constraints in scaling up innovation.



Hungary: The Hungarian sample displayed a relatively balanced distribution between “moderate” and “slow,” with only a minority perceiving adoption as “fast.” This may reflect sectoral differences, where some subsectors (e.g., larger commercial farms) innovate more rapidly than others.

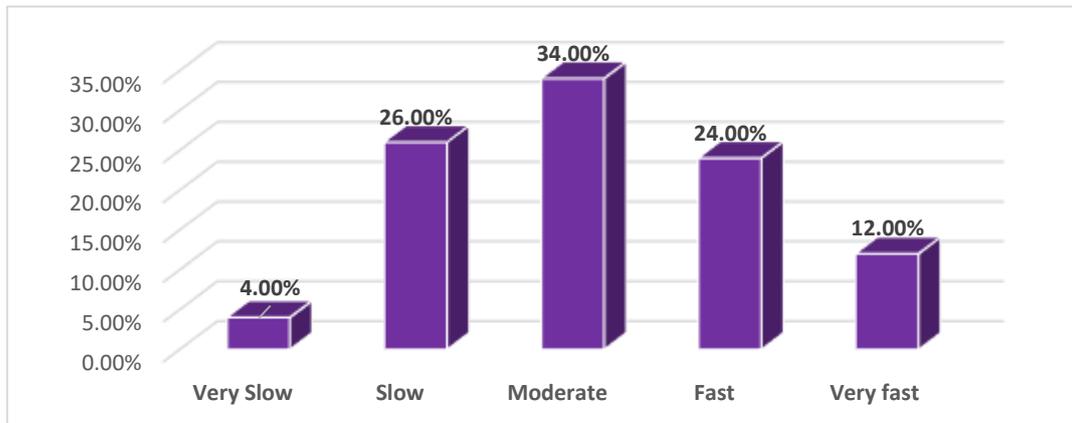


Italy: Italian respondents reported a higher frequency of “slow” adoption compared to their peers, possibly reflecting traditional sector structures, or less widespread digital infrastructure in rural areas.





Worldwide: International responses showed a slight skew towards “fast” and “moderate” adoption, likely reflecting contexts with more advanced agri-tech ecosystems, access to capital, or public policy incentives.



TOTAL Results and Interpretation

When aggregated across all countries, the prevailing perception is that the **adoption speed of new agricultural technologies is “moderate”**, with relatively few stakeholders viewing it as “fast” or “very fast.” “Slow” adoption remains a concern in several countries, especially Italy and, to a lesser extent, Greece and Romania.

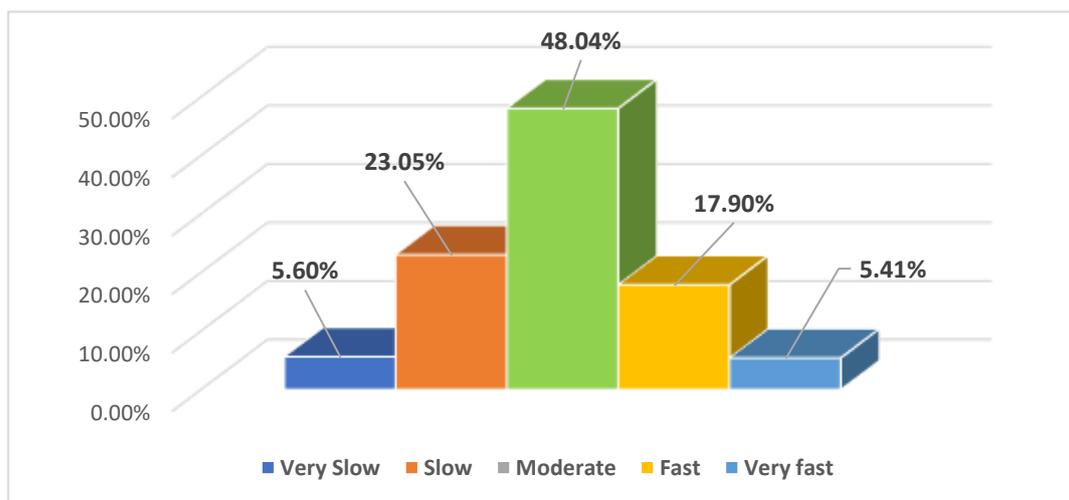


Figure 5. Progression of technological adoption in agriculture

These findings suggest that, while there is momentum toward technological transformation in European agriculture, **significant barriers - financial, structural, cultural, or regulatory - continue to limit the pace at which innovation diffuses through the sector.** There is also a clear variation based on national context, with countries that have stronger institutional support, larger farms, or more investment in agri-tech infrastructure reporting higher adoption speeds.

Implication for the Competency Framework

The results highlight the need for AGRITECH Managers to possess not only technical expertise, but also **change management, communication, and stakeholder engagement skills**, enabling them to overcome resistance, build trust, and facilitate smoother transitions in environments where adoption is not automatic or universal. Tailored strategies may be required to address the specific bottlenecks present in different national and sectoral contexts.

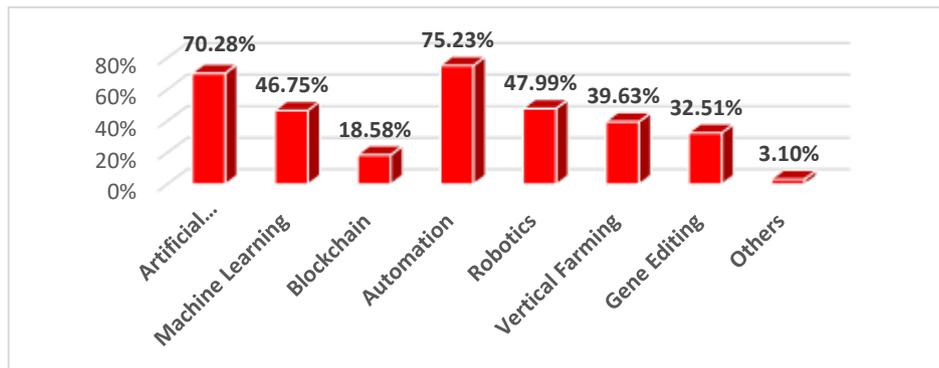


4.2.4 Impactful Emerging Tech

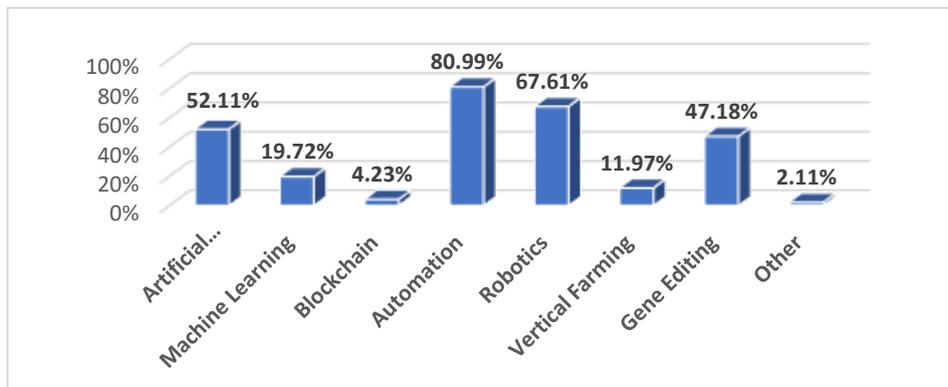
Comparative Analysis by Country

Survey respondents across all participating countries were asked to identify the emerging technologies they believe will have the greatest impact on agriculture in the next five years. The responses show a consistent focus on a cluster of core innovations, with some nuanced national differences:

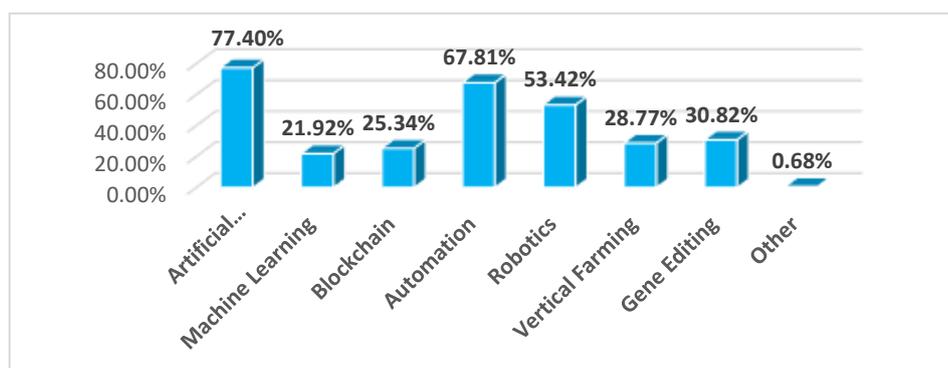
Romania: The leading technologies cited were **AI & Data Analytics**, **Precision Agriculture**, and **Robotics & Automation**. These align closely with both national investment priorities and the current landscape of digital transformation within the Romanian agri-food sector.



Czech Republic: Czech respondents prioritized **Precision Agriculture** and **AI & Data Analytics**, with a notable emphasis on **Robotics & Automation** as well. **IoT applications** also featured prominently, reflecting growing attention to connected farm systems.

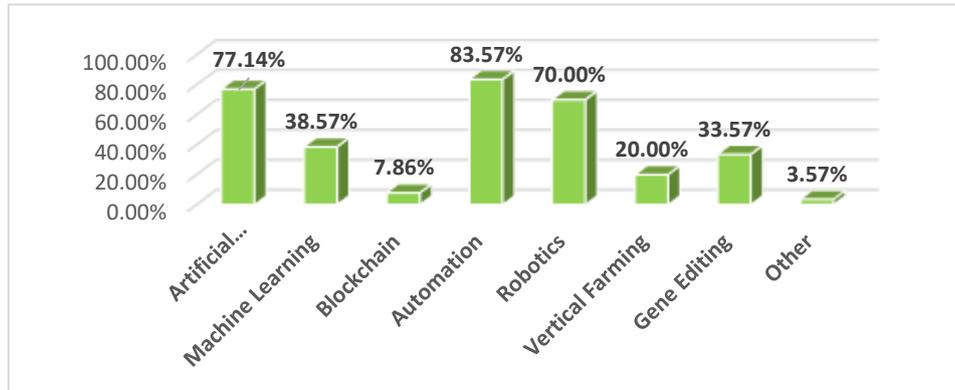


Greece: Greek stakeholders highlighted **AI & Data Analytics** and **Digital Marketplaces** as particularly impactful, suggesting a dual focus on farm-level optimization and digital solutions for supply chain and market access.

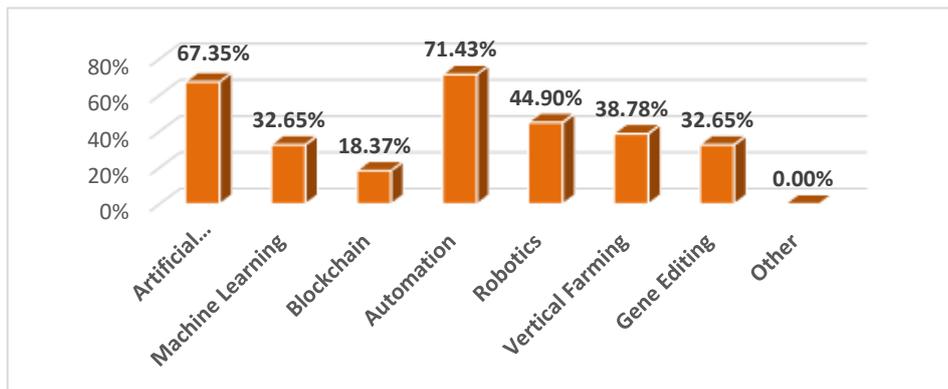




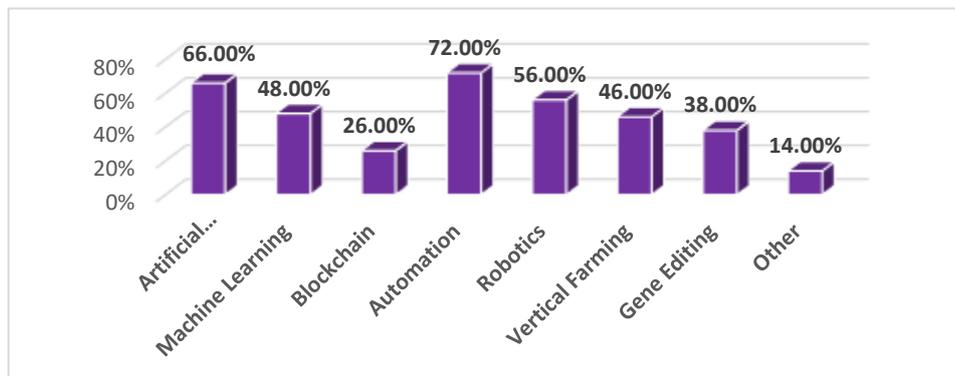
Hungary: Hungarian responses mirrored those of Romania and Czechia, with **AI & Data Analytics**, **Precision Agriculture**, and **Robotics & Automation** consistently at the top. There was also moderate interest in **Climate-Smart Agriculture Tools**.



Italy: Italian participants gave the greatest weight to **Sustainable Agricultural Practices**, alongside **Precision Agriculture** and **Smart Irrigation Systems**, perhaps reflecting Italy’s climate challenges and national sustainability priorities.



Worldwide: International respondents highlighted **AI & Data Analytics**, **IoT**, and **Robotics & Automation** as top game-changers, demonstrating a global consensus on the transformative potential of digital technologies in agriculture.



While the “big three” technologies (**AI & Data Analytics**, **Precision Agriculture**, and **Robotics & Automation**) are consistently seen as most impactful, the exact ordering and the importance of sustainability-related tools or digital marketplaces vary by national context, influenced by sector maturity, climate, and policy environment.



TOTAL Results and Interpretation

When results are aggregated, the technologies viewed as most impactful in the next five years are:

- **AI & Data Analytics**
- **Precision Agriculture**
- **Robotics & Automation**
- **Sustainable Agricultural Practices**
- **IoT and Digital Marketplaces** (at a slightly lower but still significant frequency)

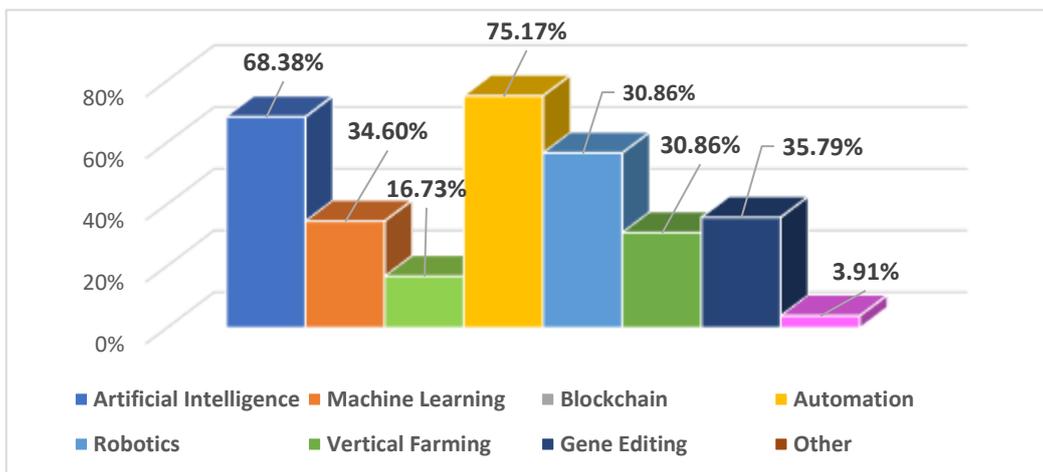


Figure 6. Emerging technologies with the greatest impact

This consensus underlines a sector-wide expectation that the next wave of agricultural transformation will be driven by the integration of advanced digital tools, data-driven management, and increased automation. The notable emphasis on sustainability in some countries - especially Italy - signals that digital innovation is seen not just as a productivity driver, but also as a means to achieve environmental and climate goals.

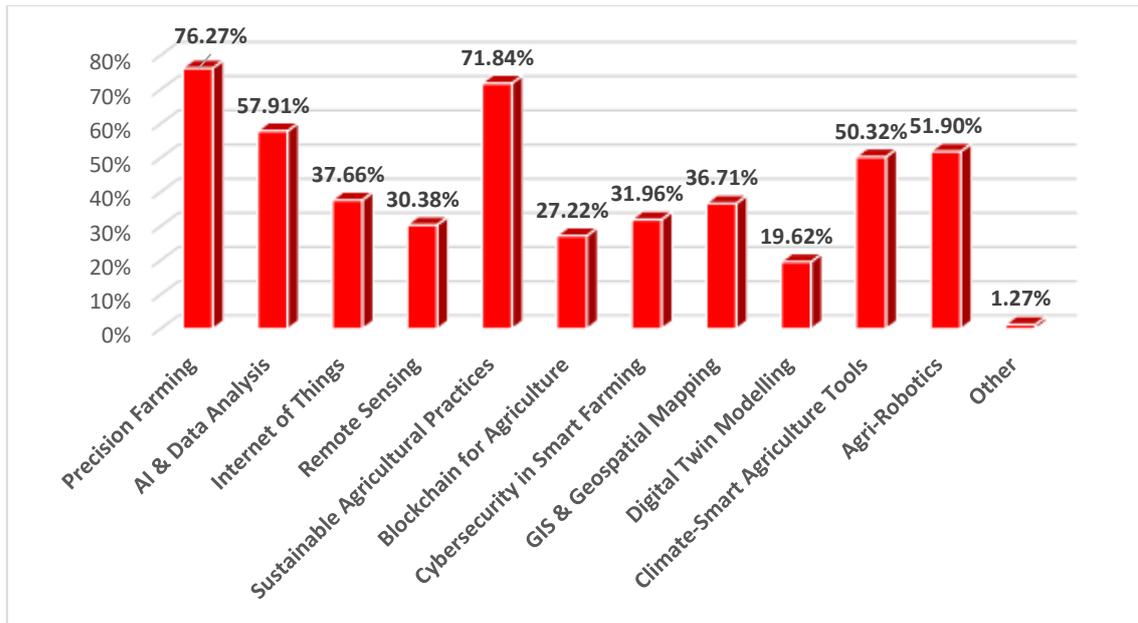
Implication for the Competency Framework

AgriTech managers will need to be fluent in both the use and strategic deployment of AI, robotics, and precision technologies, while also having a strong understanding of sustainability tools and the digital marketplace ecosystem. The framework should ensure that training and upskilling in these areas are prioritized, while allowing for tailored modules or electives that reflect national or regional priorities.

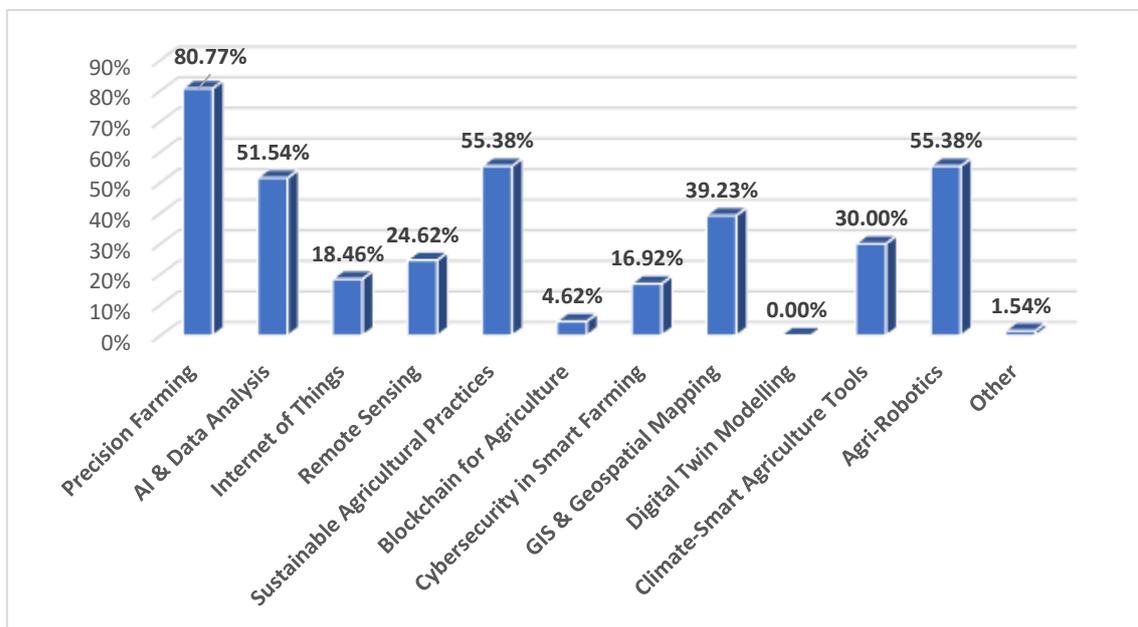
4.2.10 Most Important Technical Skills

Comparative Analysis by Country

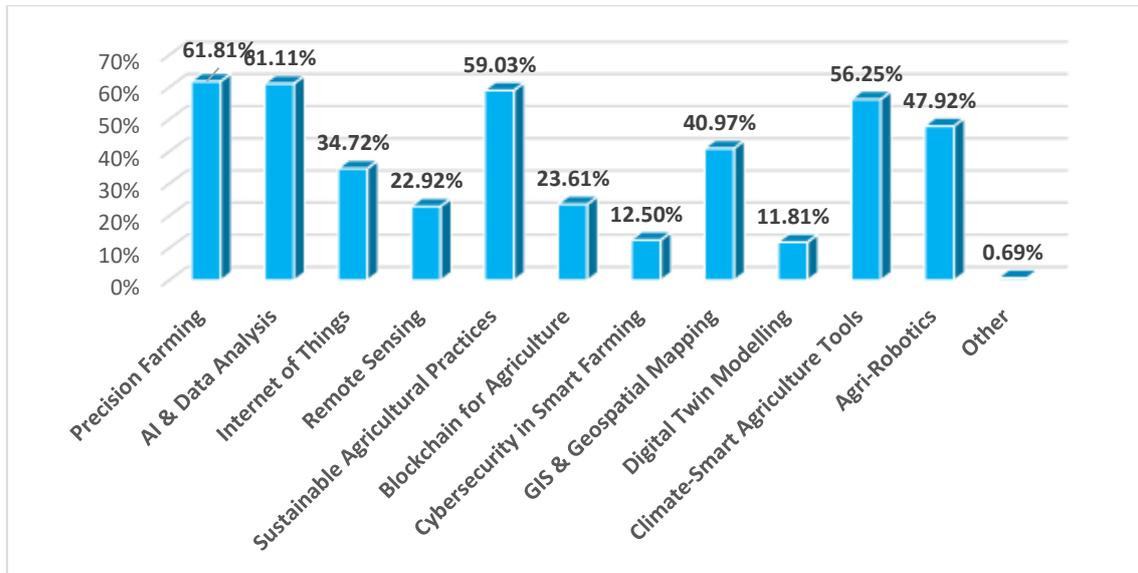
Romania: Respondents in Romania showed a strong consensus around **Precision Farming (76%)** and **Sustainable Agricultural Practices (72%)** as the most essential technical skills for AGRITECH managers. **AI & Data Analysis (58%)** was also highly prioritized, followed by **Agri-Robotics (52%)** and **GIS/Geospatial Mapping (37%)**. Skills like IoT, Blockchain, and Cybersecurity were considered less critical but still relevant, each garnering between 20-32% of responses.



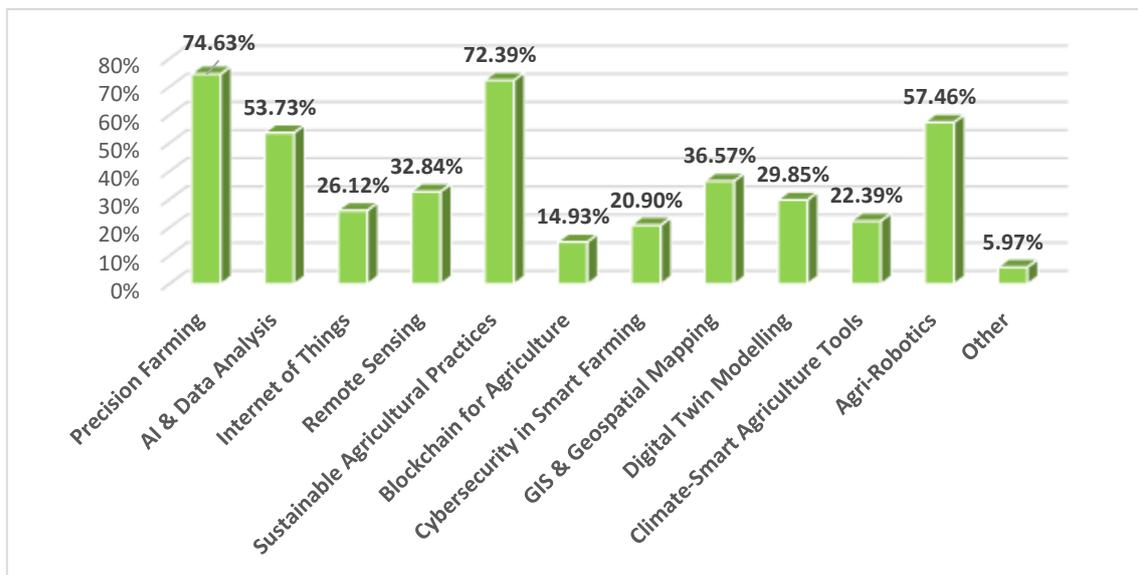
Czech Republic: In the Czech Republic, **Precision Farming** was the clear leader (81%), with **Sustainable Agricultural Practices** (55%) and **AI & Data Analysis** (52%) also highly valued. There was moderate support for **Agri-Robotics** (55%), **GIS/Geospatial Mapping** (39%), and lower - but present - recognition for skills such as Remote Sensing (25%) and IoT (18%).



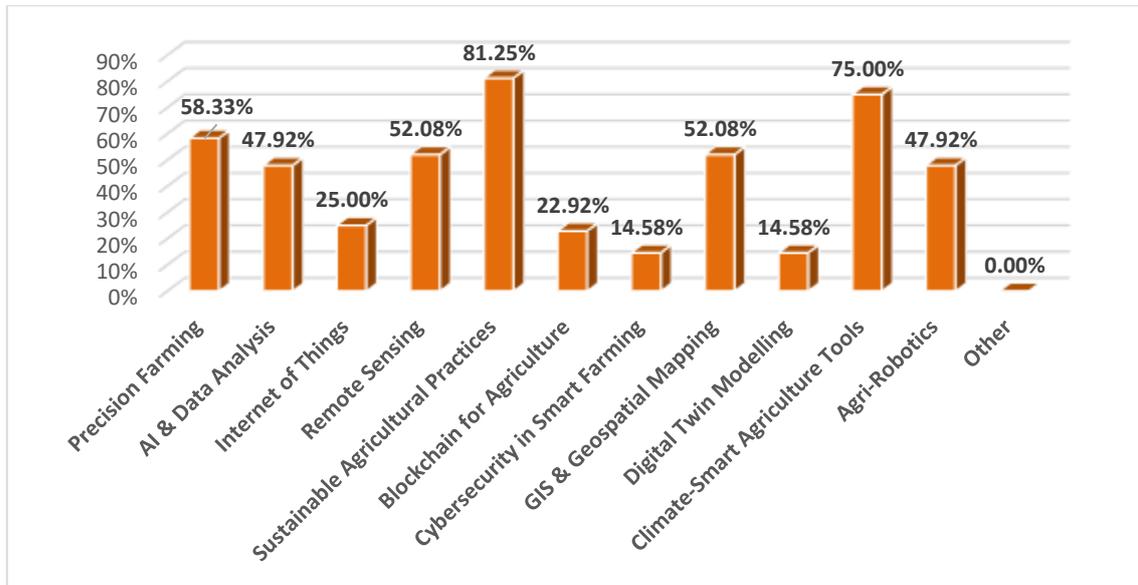
Greece: Greek respondents showed the most balanced distribution: **Precision Farming** (62%), **Sustainable Agricultural Practices** (59%), and **AI & Data Analysis** (61%) were almost equally rated as top priorities. Other skills such as **Agri-Robotics** (48%), **GIS/Geospatial Mapping** (41%), and **Remote Sensing** (23%) were seen as moderately important, with lower ratings for IoT, Blockchain, and Cybersecurity.



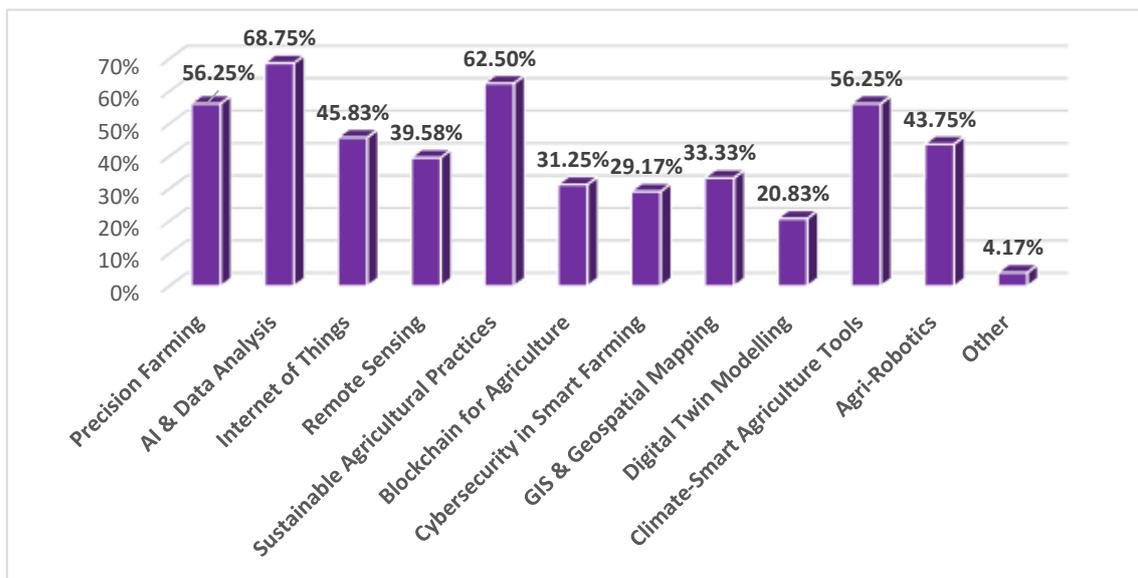
Hungary: The Hungarian sample also placed high importance on **Precision Farming (75%)** and **Sustainable Agricultural Practices (72%)**. **Agri-Robotics (57%)** and **AI & Data Analysis (54%)** were next in priority, while other skills - such as GIS (37%), IoT (26%), and Remote Sensing (33%) - received more modest support.



Italy: Italy stands out for its emphasis on **Sustainable Agricultural Practices (81%)**, making it the top-rated skill, followed by **Precision Farming (58%)** and **Remote Sensing (52%)**. **AI & Data Analysis (48%)** and **Agri-Robotics (48%)** were also considered key, while Blockchain, Cybersecurity, and Digital Twin Modelling were less frequently selected.



Worldwide: Respondents from outside the main partner countries (via the EN survey) prioritized **AI & Data Analysis (69%)** and **Sustainable Agricultural Practices (63%)**, with **Precision Farming (56%)** also highly ranked. Other technical skills such as Climate-Smart Agriculture Tools and Remote Sensing received moderate support, but Blockchain and Cybersecurity were less emphasized.



TOTAL Results and Interpretation

When aggregated, the top three technical skills identified for AgriTech managers are:

- **Precision Farming (68%)**
- **Sustainable Agricultural Practices (67%)**
- **AI & Data Analysis (57%)**

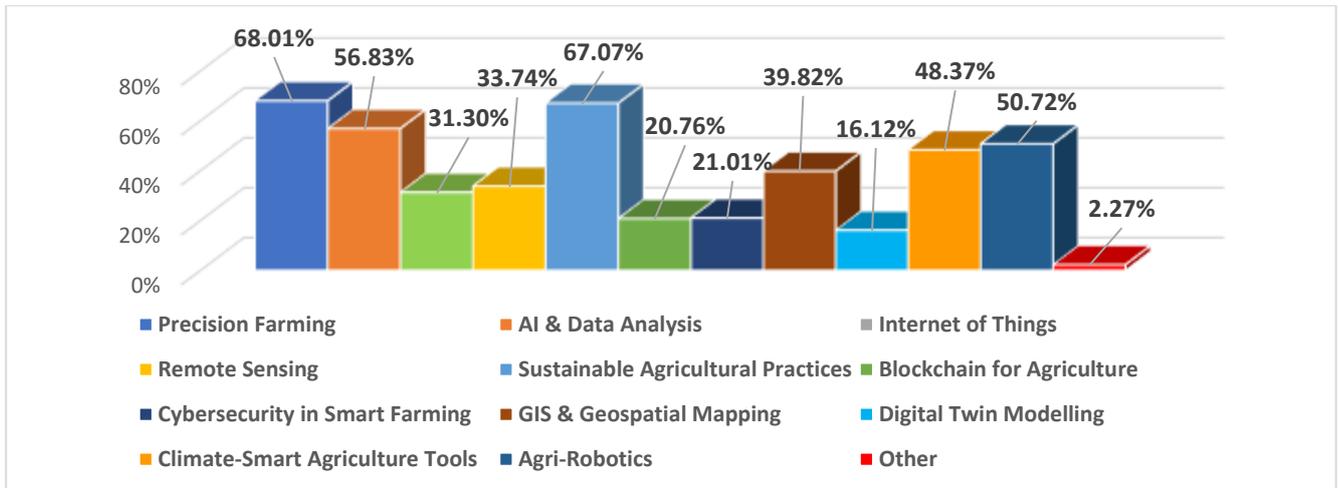


Figure 7. Skills important for AgriTech professionals

Secondary but still significant skills include **Agri-Robotics (51%)** and **GIS & Geospatial Mapping (40%)**. While the exact ranking varies slightly by country, the overall pattern is one of strong, pan-European consensus on what matters most.

Implication for the Competency Framework

These results demonstrate that AGRITECH Manager training should focus intensively on Precision Farming, Sustainable Agricultural Practices, and AI/Data Analytics as core technical domains. The relatively lower - but still meaningful - support for IoT, robotics, GIS, and cybersecurity suggests these areas should be integrated as specialized modules or electives. The convergence of responses across countries indicates that a unified European approach to defining technical skills is feasible, while allowing some local adaptation based on sectoral or regional needs.

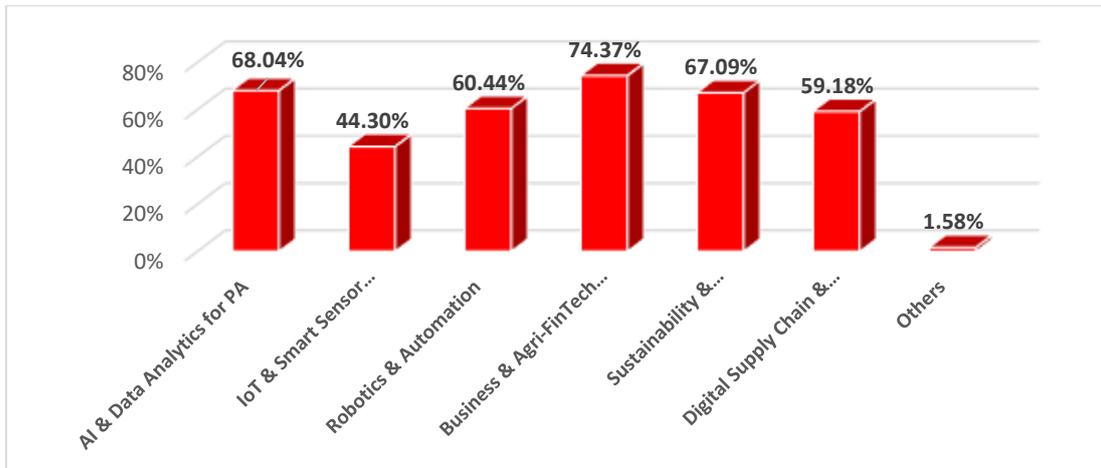
4.3. Analysis of Stakeholder Priorities (HEI, VET, Industry, Policy)

Understanding the differing perspectives of key stakeholder groups is crucial for designing a competency framework that is relevant, accepted, and widely adopted across the agri-food sector. This section presents a comparative analysis of survey responses by stakeholder type - specifically Higher Education Institutions (HEI), Vocational Education and Training providers (VET), Industry representatives, and Policy actors. By examining how each group prioritizes specific skills, competencies, and preferred training methods, we are able to identify both areas of consensus and points of divergence. This stakeholder-focused approach ensures that the AGRITECH Manager Competency Framework is tailored not only to sector-wide needs but also to the expectations and realities faced by different actors within the innovation ecosystem.

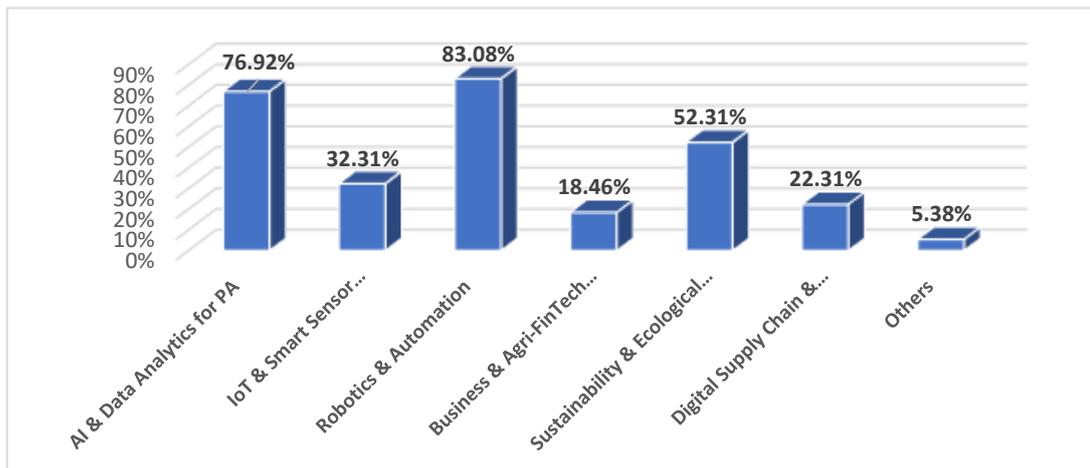
4.3.1 Future Skills by Role

Comparative Analysis by Country

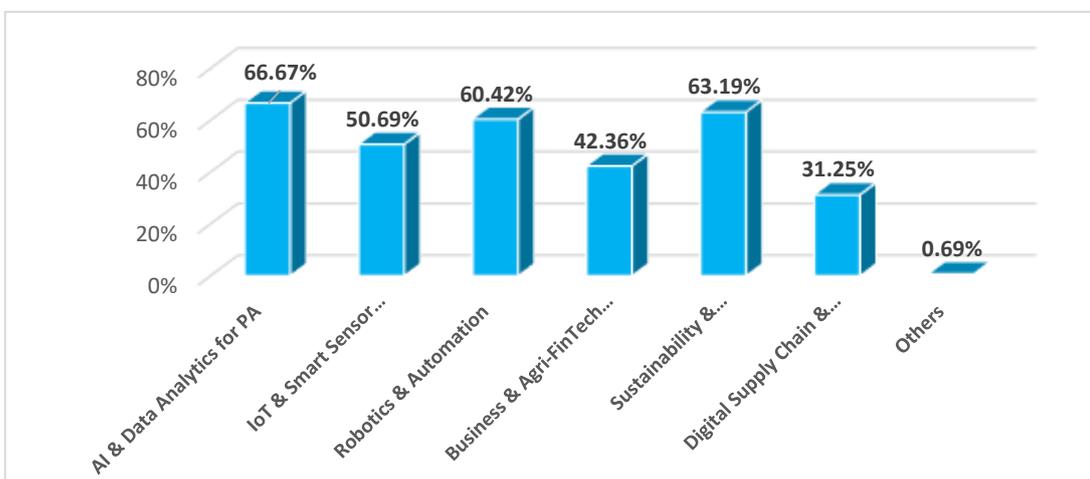
Romania: Romanian respondents most frequently selected **Digital Skills** and **Sustainability Knowledge** as the top priorities for future AgriTech professionals. **Problem Solving** and **Adaptability** also scored highly, reflecting a recognition that technical expertise must be paired with agile thinking. **Communication** and **Entrepreneurship** were less often selected, but still present in the skill mix.



Czech Republic: In the Czech Republic, there was a clear emphasis on **Digital Skills** and **Technical Knowledge**. **Problem Solving** and **Teamwork** were also seen as important, while **Entrepreneurship** and **Leadership** received comparatively less attention. This may point to a strong technical focus within Czech agri-tech education and sector expectations.

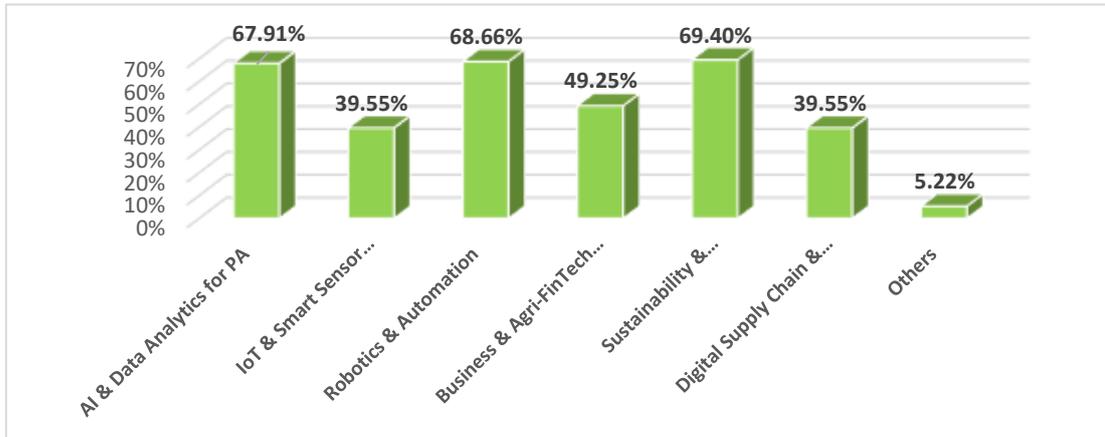


Greece: Greek stakeholders highlighted **Sustainability Knowledge** as the most critical skill, followed closely by **Digital Skills** and **Communication**. Notably, **Entrepreneurship** was rated higher in Greece than in other countries, perhaps reflecting a national focus on agritech start-ups and self-employment in agriculture.

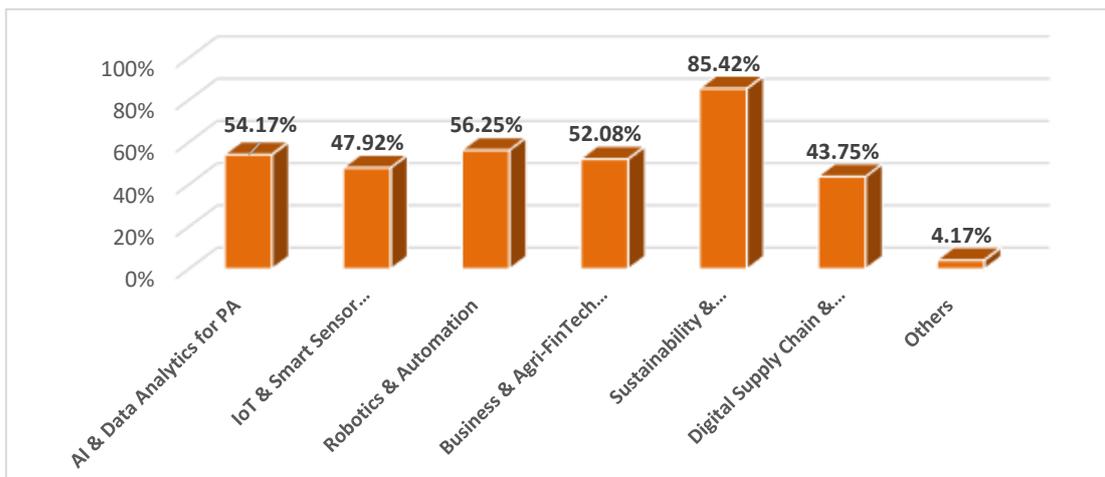




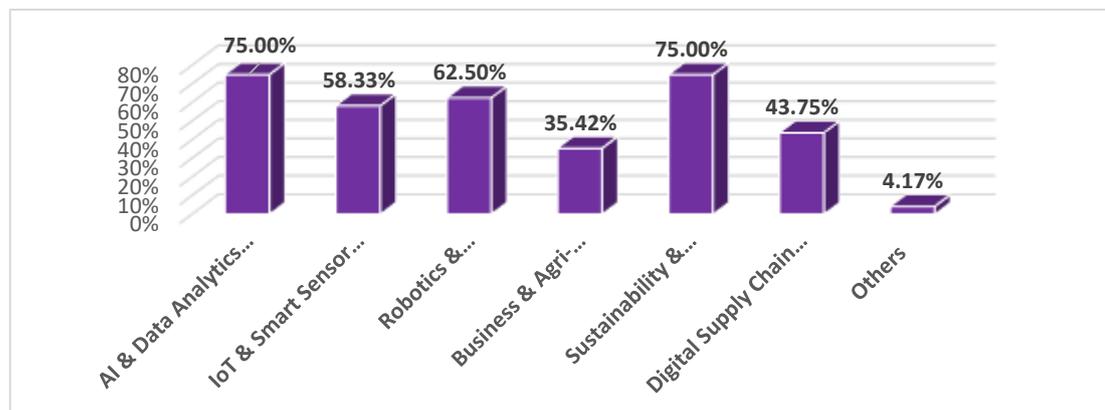
Hungary: Hungarian respondents mirrored Romania in prioritizing **Digital Skills** and **Sustainability Knowledge**, with a strong endorsement also for **Problem Solving** and **Teamwork**. **Communication** was valued but not dominant, while **Entrepreneurship** and **Leadership** trailed further behind.



Italy: Italian responses stood out for placing **Sustainability Knowledge** at the very top, with **Digital Skills** and **Communication** as close seconds. **Problem Solving** and **Adaptability** also featured, while **Technical Knowledge** was selected less often than in other countries, possibly due to the emphasis on broader transversal competencies in Italian education.



Worldwide: International (EN) respondents showed the highest emphasis on **Digital Skills**, followed by **Problem Solving** and **Adaptability**. **Sustainability Knowledge** and **Communication** were also important, but **Leadership** and **Entrepreneurship** were consistently lower across the global sample.



TOTAL Results and Interpretation

Across all countries, **Digital Skills** and **Sustainability Knowledge** emerged as the most important competencies for future AgriTech professionals, followed by **Problem Solving, Adaptability**, and, in some cases, **Communication**. **Entrepreneurship** and **Leadership** were less frequently selected overall, but showed spikes in Greece (entrepreneurship) and some international responses. The differences between countries, while present, are less dramatic than the broad sectoral consensus around the top competencies.

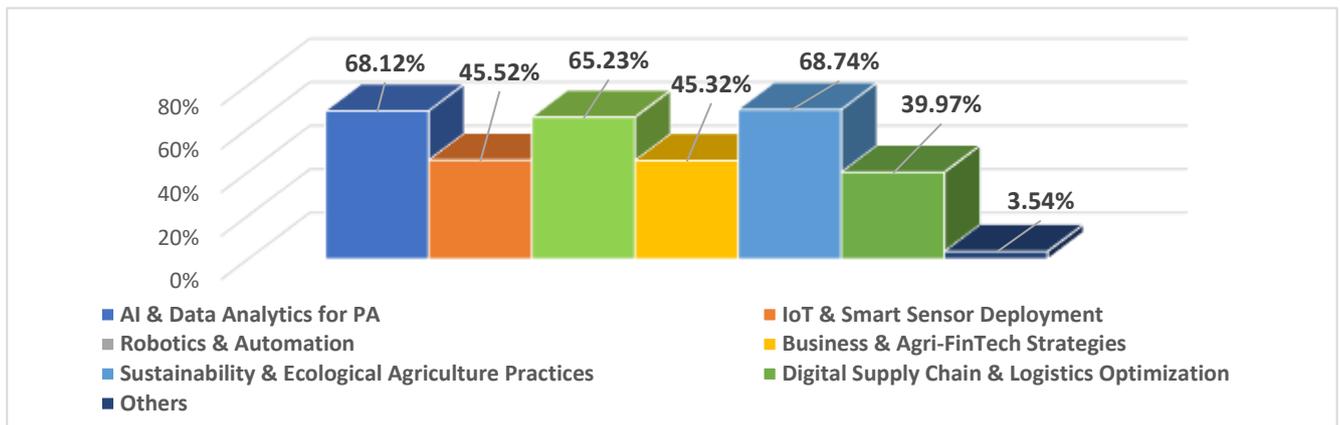


Figure 8. Skills important for AgriTech professionals

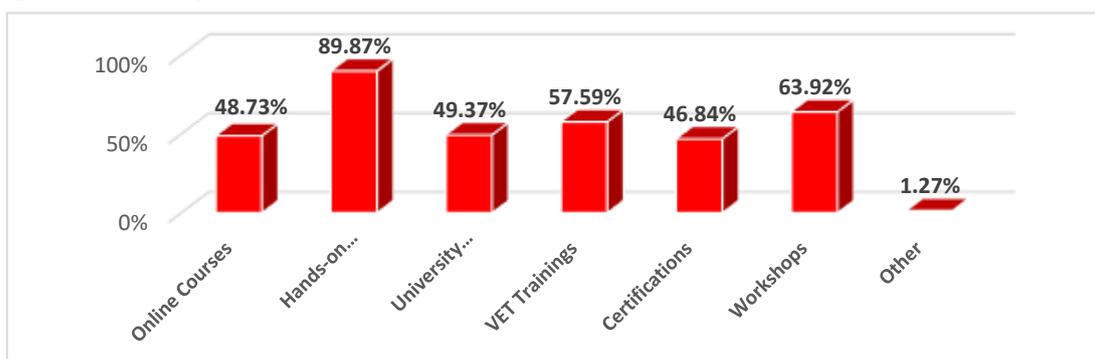
Implication for the Competency Framework

The clear pan-European (and international) prioritization of Digital and Sustainability Skills underscores their central place in AgriTech curricula. The strong demand for Problem Solving and Adaptability points to the importance of transversal skills, while Communication and Teamwork, though not always dominant, remain essential for effective collaboration and innovation. Future-oriented frameworks should emphasize these skills as core, while allowing for targeted development of entrepreneurship and leadership where national or sectoral context requires.

4.3.2 Preferred Training/Education by Role

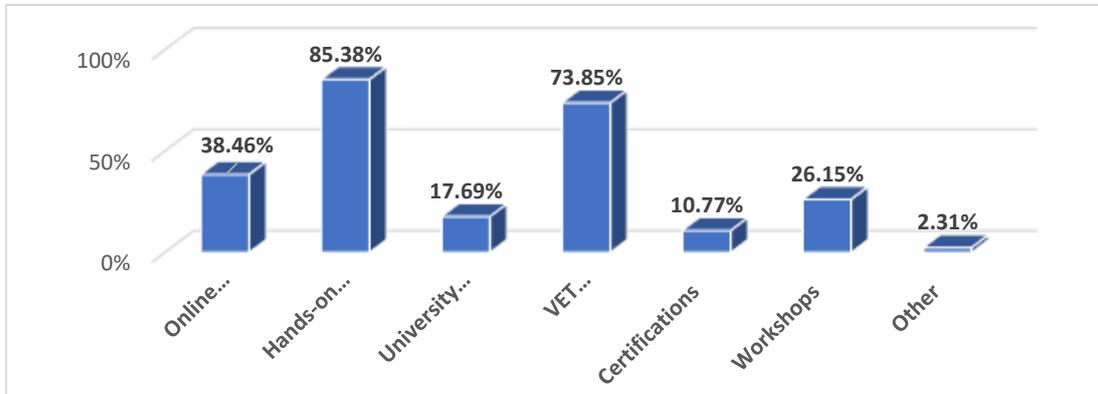
Comparative Analysis by Country

Romania: Romanian respondents most frequently favored **practical, hands-on training programs** such as internships, apprenticeships, and field-based learning. There was also strong support for **short-term certification courses** and **digital/online modules**, reflecting the need for flexible upskilling pathways. Traditional university degrees were less frequently selected, highlighting a demand for more applied, work-integrated learning.

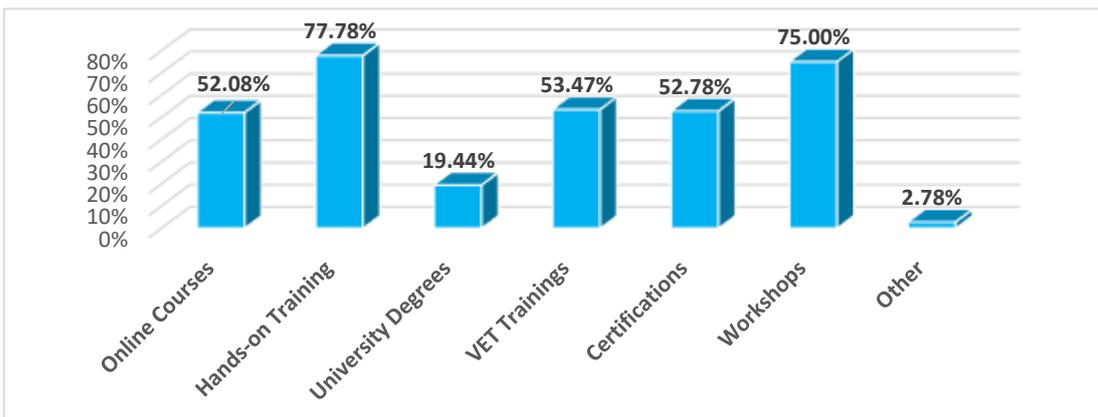




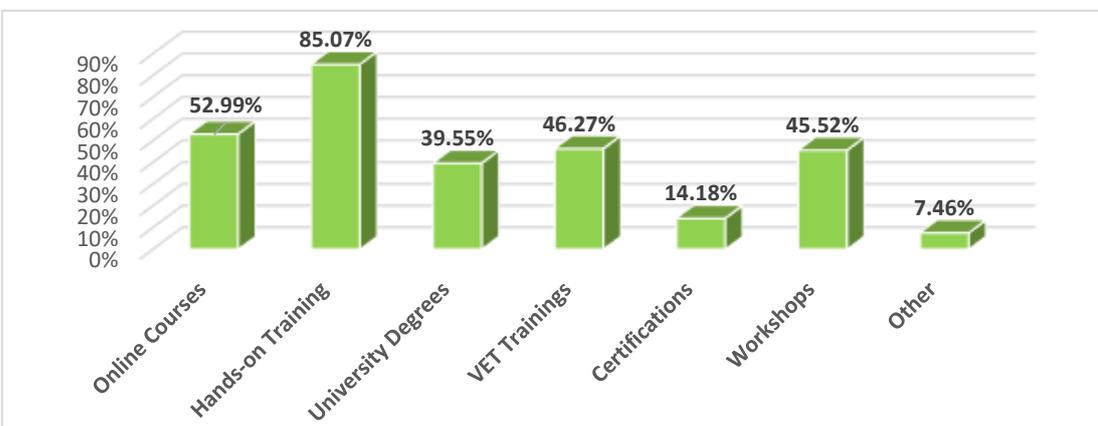
Czech Republic: In the Czech Republic, there was a clear emphasis on **VET (Vocational Education and Training) programs** and **on-the-job training**, as well as **short courses and workshops** targeted at current professionals. Respondents placed less emphasis on formal higher education, suggesting that upskilling and reskilling in the workforce is seen as a priority over initial academic training.



Greece: Greek stakeholders showed strong support for **university-accredited programs** and **structured continuing education**, alongside **digital training platforms**. Notably, **industry partnerships and dual-education models** also scored well, indicating a desire for collaboration between educational institutions and employers.

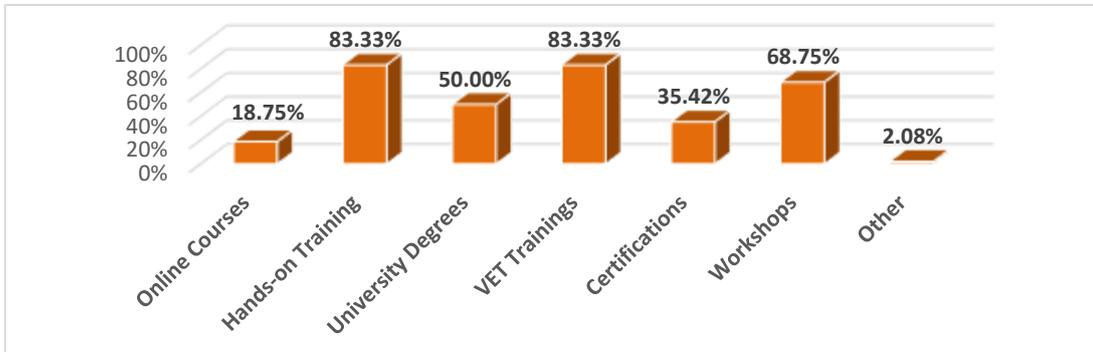


Hungary: Hungarian respondents highlighted **applied research opportunities** and **practical training modules** as most effective for bridging the skills gap. There was also notable support for **mentorship programs** and **cooperation with industry**, reflecting a preference for hands-on, experiential learning linked directly to workplace needs.

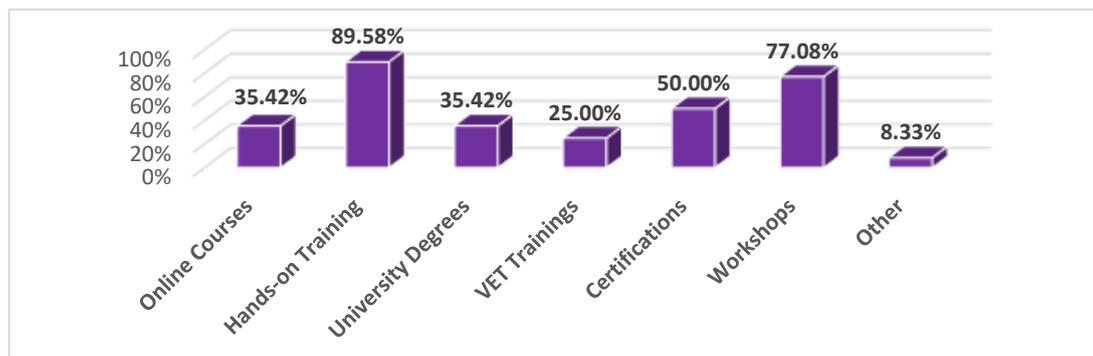




Italy: Italian respondents showed a preference for **formal university programs** with a strong practical component, such as lab-based courses or thesis work in collaboration with industry. **Online learning** and **short-term, targeted courses** also featured, but to a lesser degree, perhaps reflecting a tradition of formal academic routes in Italian agri-tech education.



Worldwide: International respondents gave the highest weight to **flexible, online and blended learning solutions**, including MOOCs and digital certifications. There was also strong endorsement for **work-based learning** and **industry internships**, with less emphasis on traditional degree programs.



TOTAL Results and Interpretation

Across all countries, the preferred approaches for bridging the AgriTech skills gap are **practical, hands-on, and flexible training programs** - including internships, apprenticeships, VET, short courses, and digital modules. While formal academic programs remain important in some countries (notably Greece and Italy), the overall pattern reflects a sector-wide push toward **applied, work-integrated learning** that can quickly address evolving competency needs.

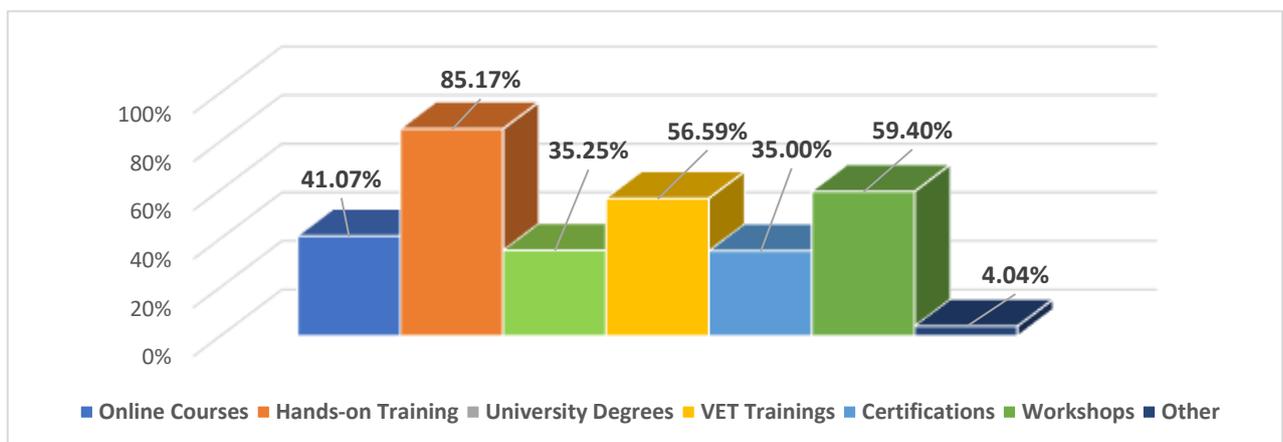


Figure 9. Education programs bridging the skill gap



Implication for the Competency Framework

Training strategies for AGRITECH Managers should prioritize accessible, real-world experiences and short-format upskilling, ideally in partnership with industry and using digital delivery methods where possible. National preferences should be respected, but the trend towards practical learning is clear and should inform curriculum and program design.

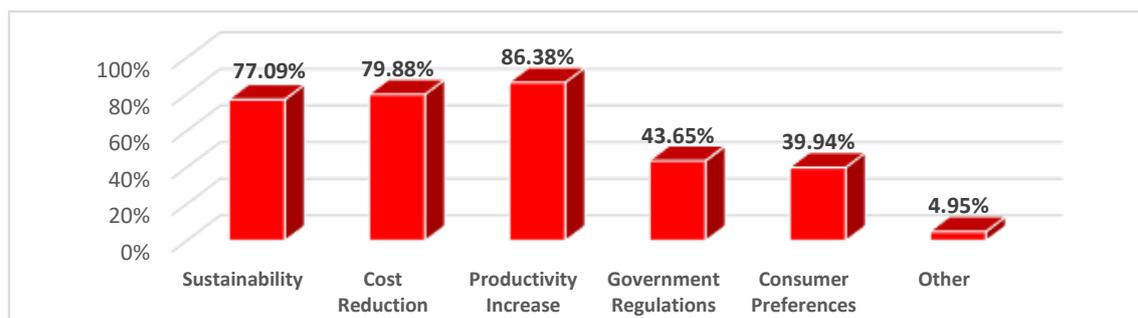
4.4. Trends in AgriTech and Implications for Competencies

The agri-food sector is undergoing rapid and profound transformation, driven by technological advances, evolving regulatory frameworks, and shifting market and societal expectations. Understanding these trends - and their practical implications for the competencies required of future AgriTech managers - is critical for ensuring that education, training, and workforce development remain aligned with the sector's trajectory. This section synthesizes survey findings on the key drivers of change, emerging technologies, barriers to adoption, organizational preparedness, and the size of current skill gaps. By examining how these trends shape both the opportunities and challenges facing the sector, we can identify the core and evolving competencies that will define successful leadership in European AgriTech over the coming years.

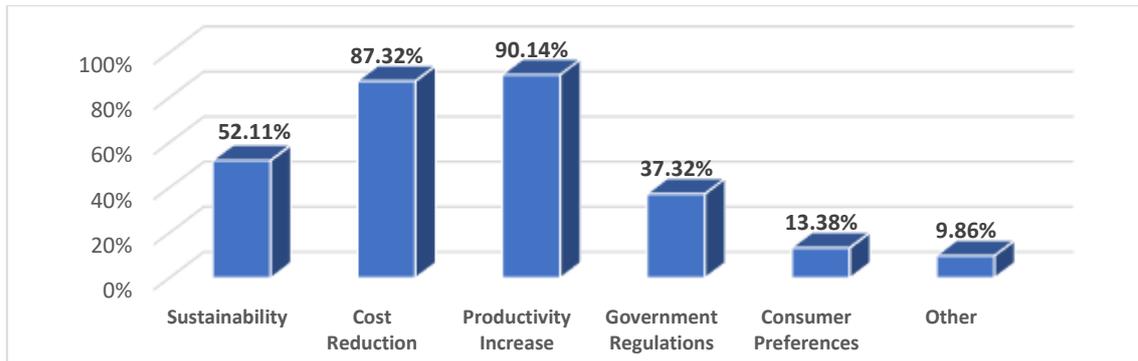
4.4.1 Drivers of Change

Comparative Analysis by Country

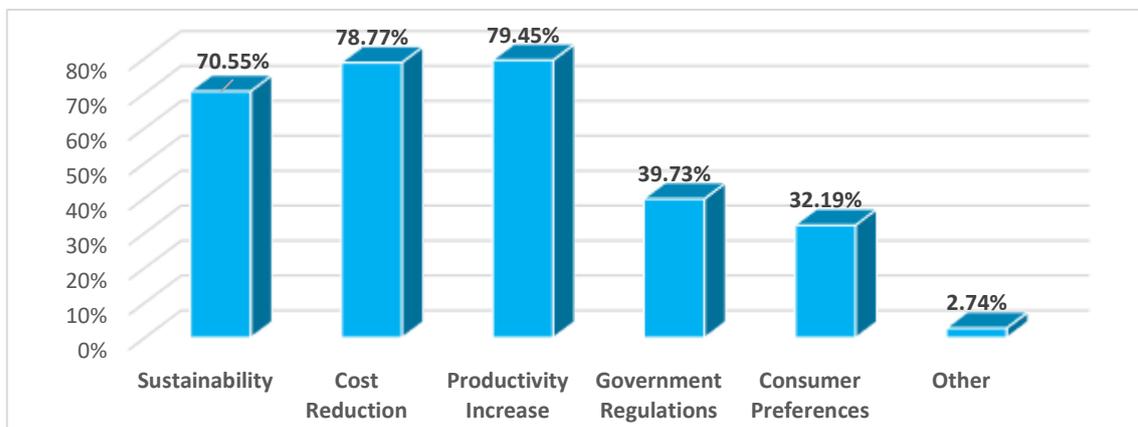
Romania: Romanian respondents most frequently identified **government incentives and EU policy support** as key drivers of technological change, followed closely by **market demand for higher productivity** and **access to new digital solutions**. The role of **international agri-food trends** was acknowledged but seen as less direct. This pattern suggests that public policy and financial support remain crucial for catalyzing innovation in the Romanian context.



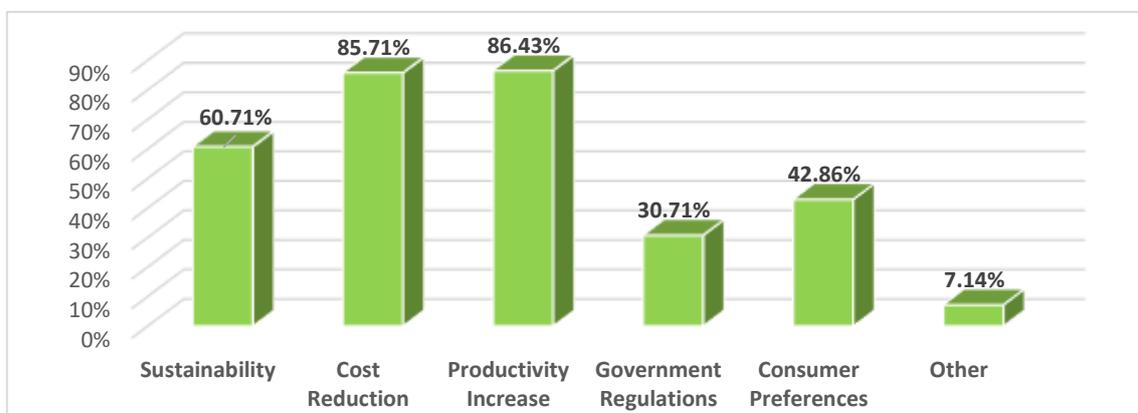
Czech Republic: In the Czech Republic, **market competitiveness** and **pressure to reduce costs** were most often cited as the main drivers, with **technological advancement** and **regulatory requirements** also featuring prominently. Respondents placed relatively less emphasis on external policy or global trends, indicating a more market-driven, internal impetus for change.



Greece: Greek stakeholders highlighted **environmental regulation** and **consumer demand for traceability and sustainability** as top drivers, reflecting the country's strong focus on quality, compliance, and export markets. **EU funding and policy alignment** were also significant, while pure technological innovation was less frequently chosen.

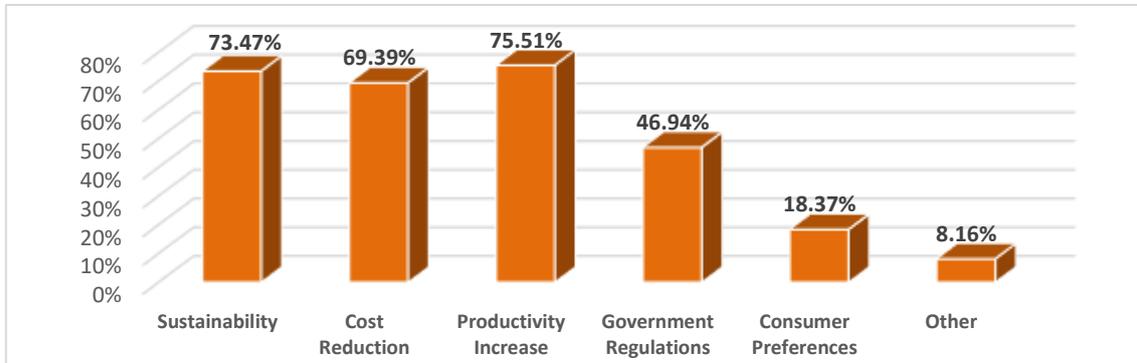


Hungary: Hungarian respondents cited **EU and government funding**, alongside **the need for operational efficiency and labor shortages**, as the primary drivers for adopting new technologies. **Climate change concerns** and **environmental compliance** were also mentioned, suggesting a mix of economic and regulatory pressures.

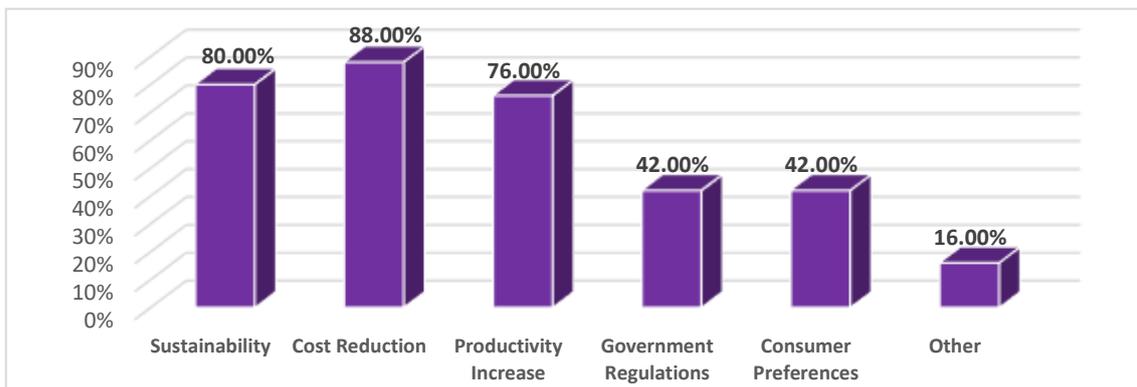




Italy: Italian responses placed the strongest emphasis on **sustainability requirements** and **compliance with EU policy**, followed by **market access for high-quality/agri-food products**. **Technological curiosity** and **entrepreneurship** were less frequently selected, with the policy and market context seen as the main forces for change.



Worldwide: International respondents most often pointed to **global competitiveness** and **rapid digital innovation** as the main drivers, with a significant number also highlighting **consumer demand for transparency** and **sustainability**. **Government policy** played a role, but to a lesser extent than in the partner countries, reflecting a more market- and innovation-driven narrative.



TOTAL Results and Interpretation

Across all countries, the leading drivers of technological change in agriculture are a mix of **public policy and funding (EU and national)**, **market demand for productivity and sustainability**, **regulatory pressures**, and **the availability of new digital tools**.

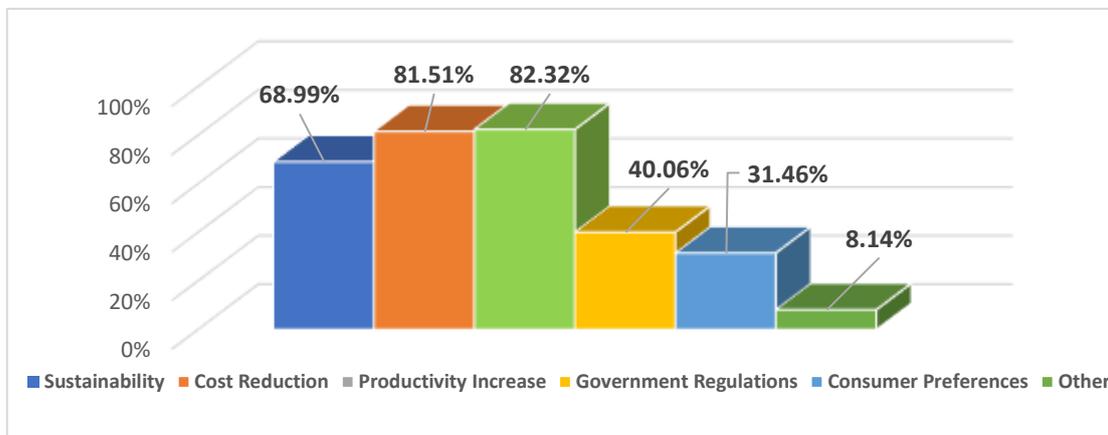


Figure 10. Primary drivers of technological change



While the precise mix varies by national context - with Romania, Hungary, and Italy highlighting the importance of policy and funding, and Czechia and the EN group emphasizing competitiveness and innovation - the broad conclusion is that technological change in European agriculture is being shaped by both external regulation and internal market forces.

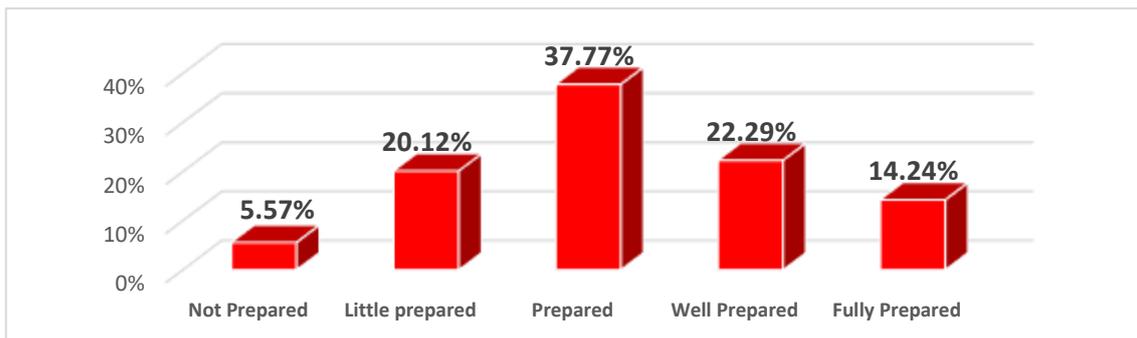
Implication for the Competency Framework

Future AGRITECH Managers must be adept at navigating not only technological advancements, but also the policy, funding, and market ecosystems that drive adoption. The ability to understand and respond to diverse drivers - regulatory, financial, environmental, and competitive - will be a key competency for leaders in this evolving sector.

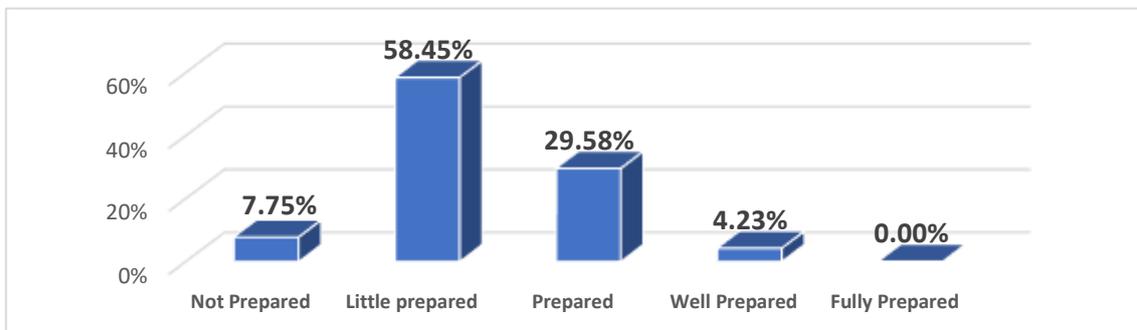
4.4.2 Organizational Preparedness

Comparative Analysis by Country

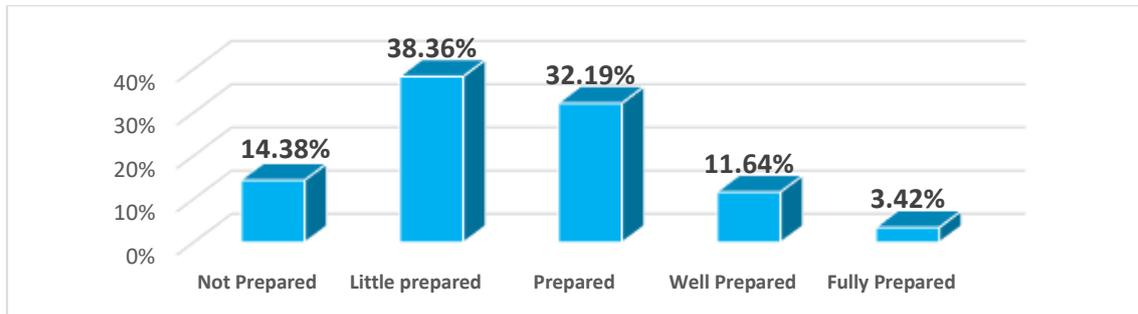
Romania: Romanian respondents most frequently described their organizations as **moderately prepared** to integrate emerging technologies. While there was evidence of ongoing investment and interest, many highlighted a lack of dedicated resources, training, and digital infrastructure as factors limiting readiness. A minority considered their organizations “well prepared,” often linked to larger or internationally connected enterprises, but “not prepared” responses were also present, indicating persistent gaps among smaller or less-resourced actors.



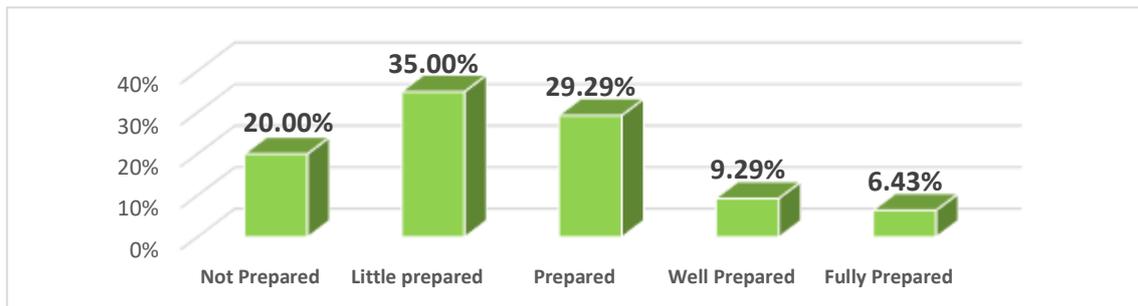
Czech Republic: In the Czech Republic, organizations were generally rated as **somewhat to moderately prepared**. Respondents noted good awareness and a willingness to adapt, but identified barriers in terms of workforce upskilling and access to cutting-edge tools. A notable share felt their organizations were making progress but not yet fully equipped, especially in smaller firms or rural cooperatives.



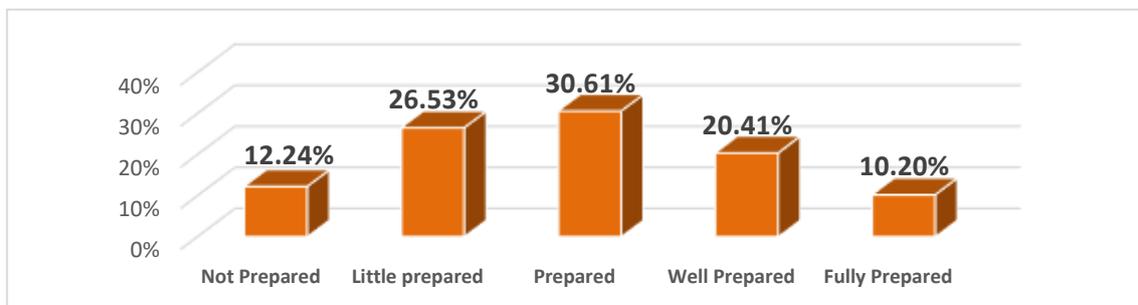
Greece: Greek stakeholders reported a **mixed level of preparedness**, with most responses clustering around “moderate.” Key limiting factors included budgetary constraints, a lack of specialized personnel, and fragmented technological adoption between regions and farm sizes. Only a small proportion rated their organizations as “fully prepared.”



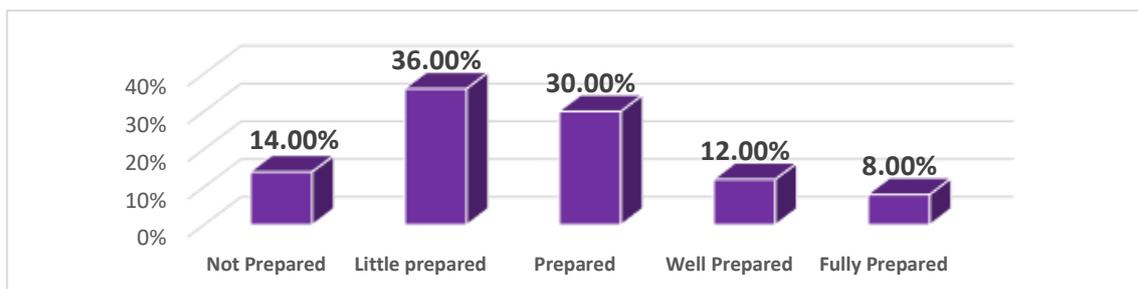
Hungary: Hungarian respondents reported a **similar distribution**, with most describing their organizations as “moderately” or “somewhat prepared.” A few large agribusinesses were seen as leading the way, but smaller or traditional operators faced greater challenges in updating systems and training staff.



Italy: Italian responses skewed toward **lower levels of preparedness**, with many identifying their organizations as “not very prepared” or still in early stages of digital transition. Structural barriers, limited funding, and resistance to change were commonly cited, with only a minority reporting advanced integration efforts.



Worldwide: International respondents were **more optimistic overall**, with a larger share rating their organizations as “well prepared” or “very well prepared.” These organizations tended to be larger, globally oriented, or embedded in high-tech innovation ecosystems, though there remained a visible group reporting only moderate readiness.





TOTAL Results and Interpretation

Across all countries, **most respondents assessed their organizations as moderately prepared to integrate new technologies**, with relatively few describing themselves as fully ready for widespread digital transformation.

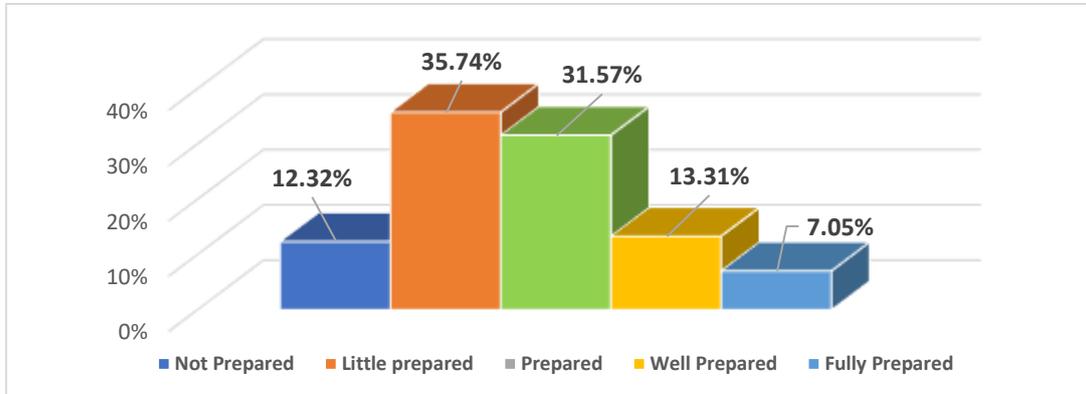


Figure 11. Organization preparedness

Notable disparities exist between large, well-resourced organizations and smaller, more traditional operations, and between national contexts with stronger policy or financial support and those facing greater constraints. Overall, the data highlight a sector in transition - eager to modernize, but not yet fully equipped to do so at scale.

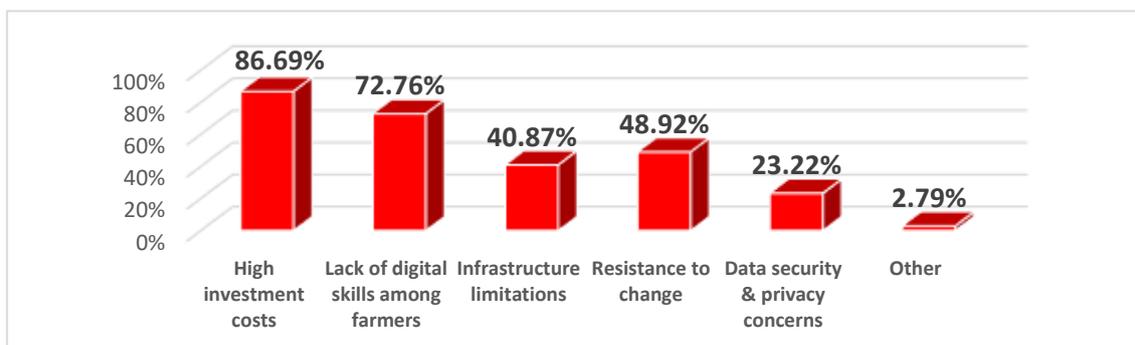
Implication for the Competency Framework

These findings suggest that AGRITECH Managers will require strong **change management, digital literacy, and organizational development skills** - not just to implement technology themselves, but to lead teams, secure buy-in, and strategically manage the integration process. Bridging the gap between ambition and practical readiness should be a core focus of both training and sectoral leadership development.

4.4.3 Barriers to Adoption

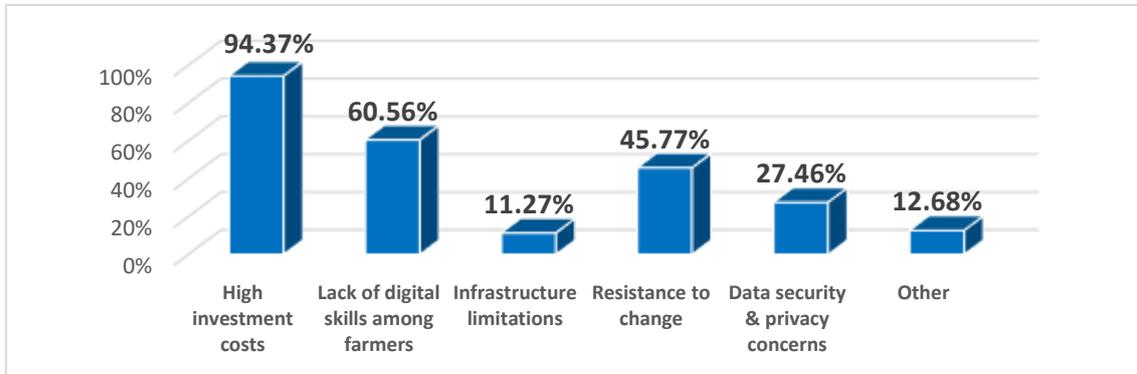
Comparative Analysis by Country

Romania: Romanian respondents most frequently cited **financial constraints** and **limited access to funding** as the primary barriers to technology adoption. Other common obstacles included **insufficient digital infrastructure, lack of technical skills, and resistance to change among traditional farmers**. Regulatory hurdles and bureaucratic complexity were mentioned but seen as secondary compared to economic barriers.

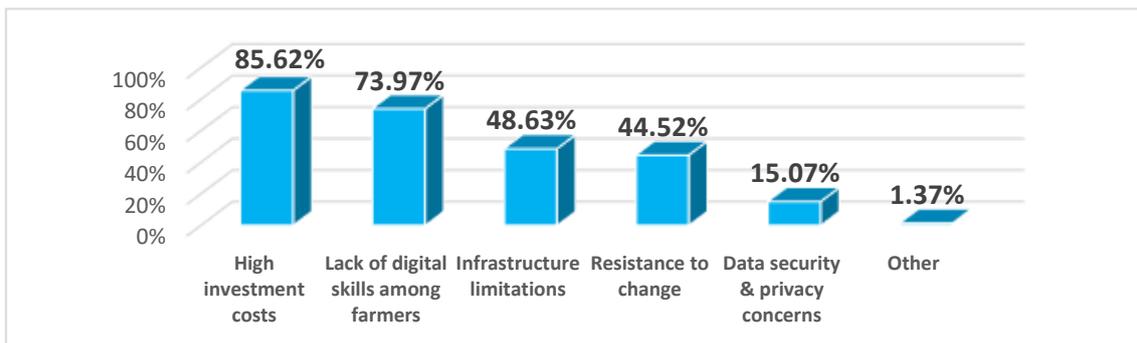




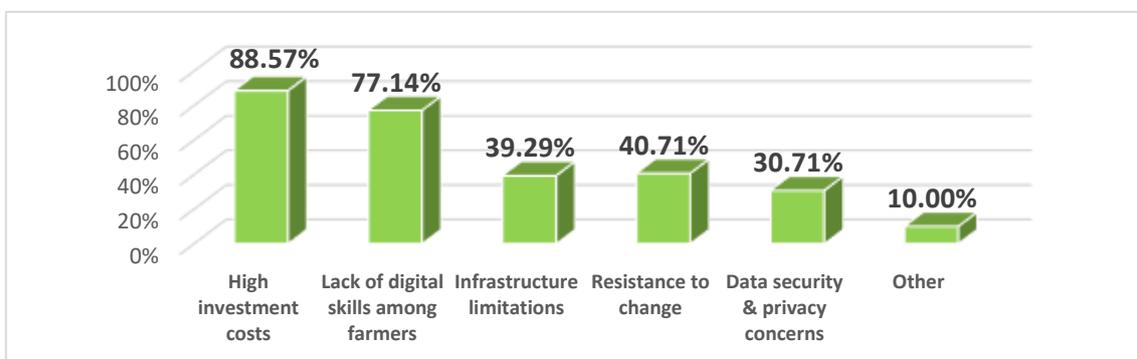
Czech Republic: In the Czech Republic, **cost of investment** and **uncertainty about return on investment (ROI)** were most often identified as barriers, alongside **lack of specialized workforce** and **fragmented farm structures**. While infrastructure and policy were seen as adequate, skills shortages and conservative attitudes were frequently mentioned as challenges.



Greece: Greek stakeholders highlighted **high implementation costs, complexity of new technologies,** and **limited technical expertise** as top barriers. **Fragmented supply chains, regulatory burden,** and **seasonal labor dynamics** were also discussed, suggesting multiple layers of challenge beyond just finance.



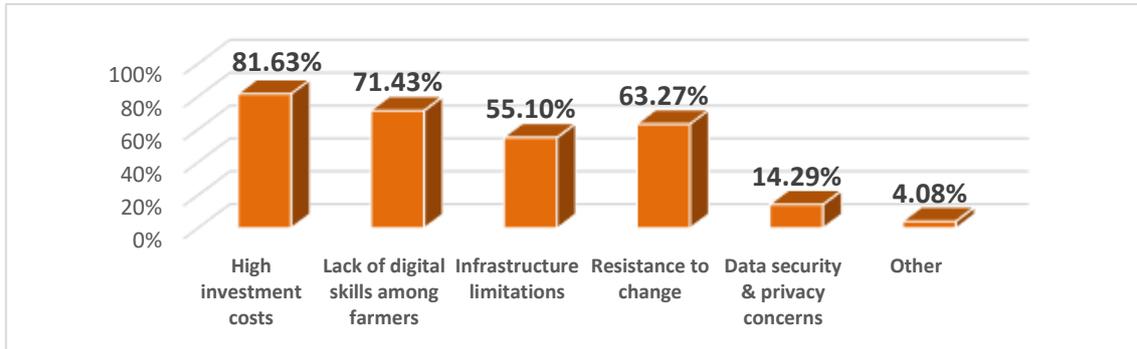
Hungary: Hungarian respondents echoed the focus on **funding limitations** and **lack of digital skills**. **Aging farm populations, low awareness of benefits,** and **skepticism about new technologies** were additionally cited. Regulatory or policy barriers were considered less significant compared to workforce and financial issues.



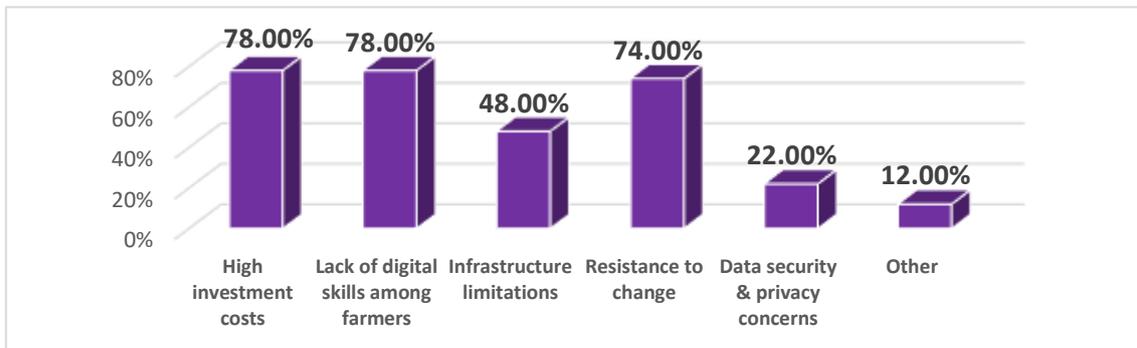
Italy: Italian responses centered on **financial obstacles**, especially for small and medium-sized enterprises, as well as **insufficient training** and **slow adoption culture** in rural regions. Some also



pointed to **limited availability of advisory services** and **fragmented information sources** as complicating the uptake of innovation.



Worldwide: International respondents identified **cost, integration with legacy systems, and data security concerns** as the leading barriers. **Policy uncertainty** and **lack of skilled staff** were also mentioned, but there was generally a greater focus on technological and operational challenges than on financial or regulatory constraints.



TOTAL Results and Interpretation

Across all countries, the most commonly reported barriers to technology adoption in agriculture are **financial constraints, skills gaps, and cultural resistance to change**. Secondary obstacles include fragmented structures, lack of advisory support, digital infrastructure deficits, and - in some regions - regulatory or policy complexities.

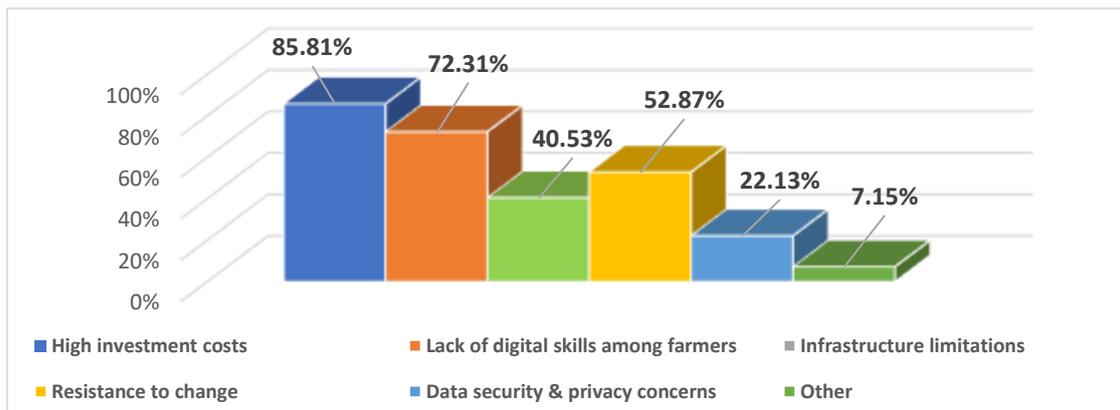


Figure 12. Barriers for technology adoption

Although the exact mix of challenges varies, the overarching pattern is that **economic and human capital limitations are the main bottlenecks to sectoral innovation**.



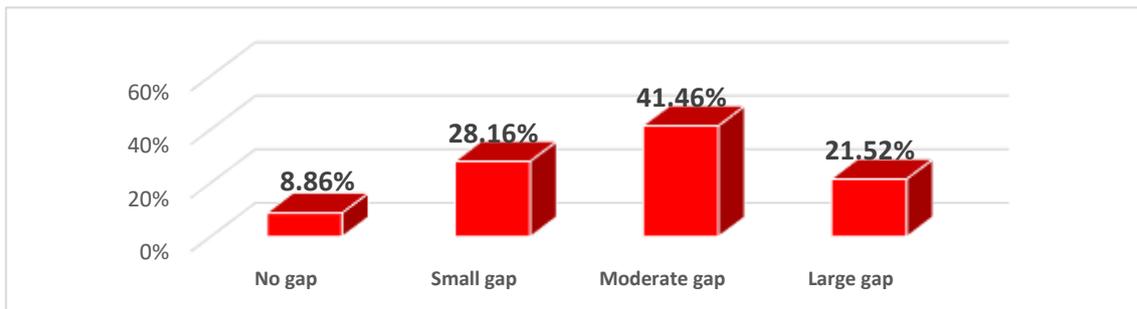
Implication for the Competency Framework

To enable effective technology adoption, AGRITECH Managers will need **strong financial management, advocacy, and upskilling capabilities**, as well as the ability to communicate benefits, overcome skepticism, and drive cultural change. Training programs should not only build technical proficiency, but also equip managers to identify, address, and help overcome the full spectrum of barriers in their local and organizational context.

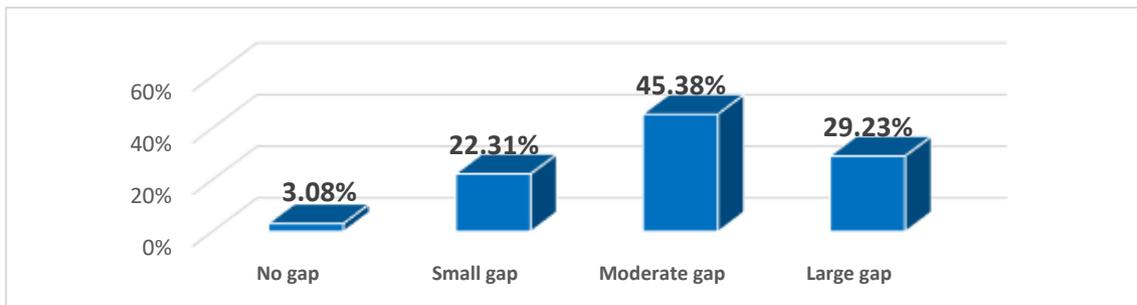
4.4.4 Skill Gap Rating (14)

Comparative Analysis by Country

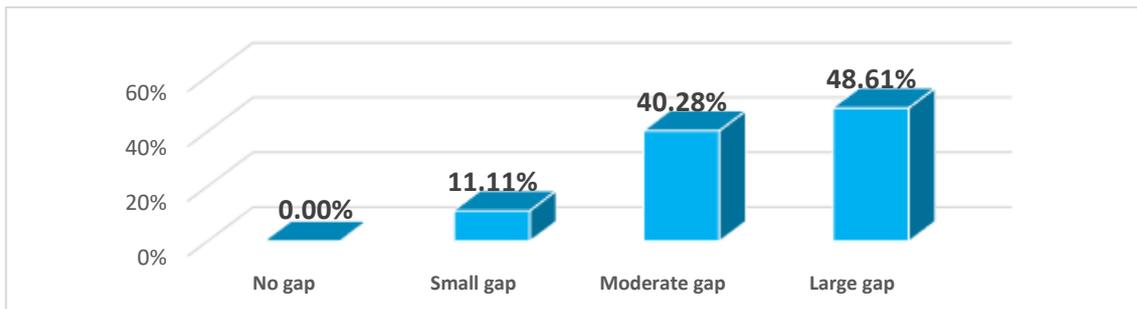
Romania: Romanian respondents overwhelmingly described the current skill gap in AgriTech professionals as **significant** or **moderate**, with very few rating it as minor. Many highlighted that digital, data, and precision farming skills are in particularly short supply, and noted that traditional training often lags behind technological advancements.



Czech Republic: In the Czech Republic, the skill gap was also mostly rated as **moderate to significant**. Respondents noted that while younger professionals are increasingly well-trained, there is a persistent gap among older workers and in smaller or family-run farms. Continuous upskilling was seen as urgently needed.

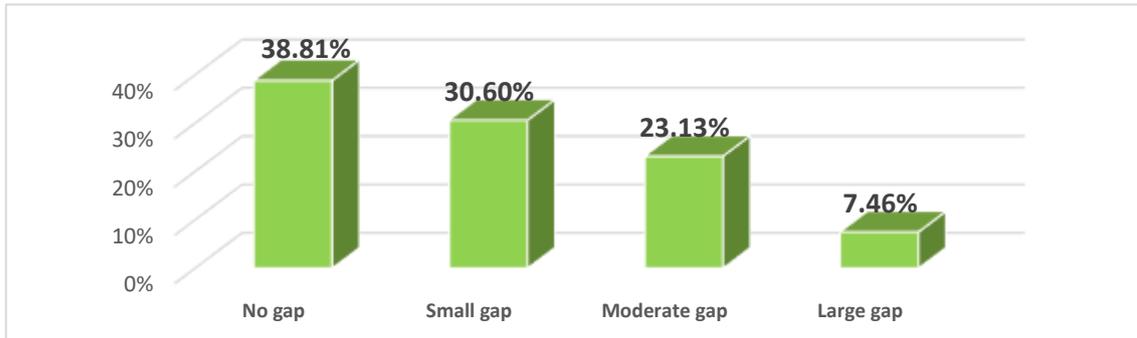


Greece: Greek stakeholders mostly rated the skill gap as **moderate**, but with a notable share indicating it is **significant** - especially for advanced digital and automation skills. Limited exposure to new technologies in both formal education and continuing training was identified as a key factor.

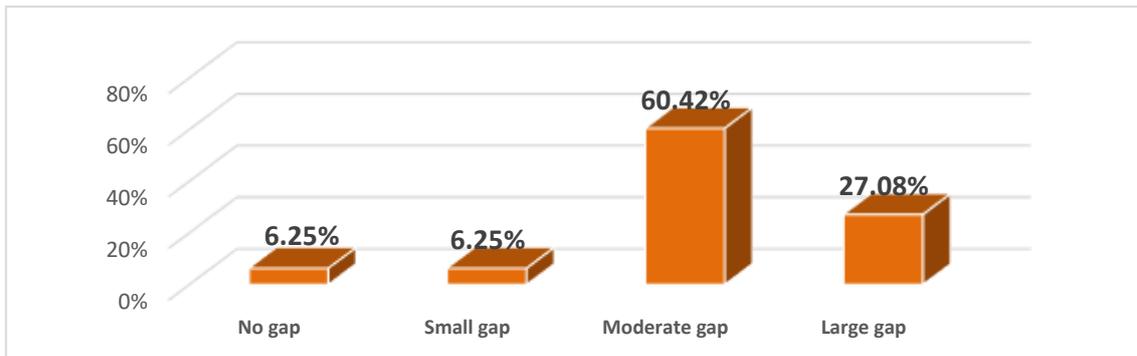




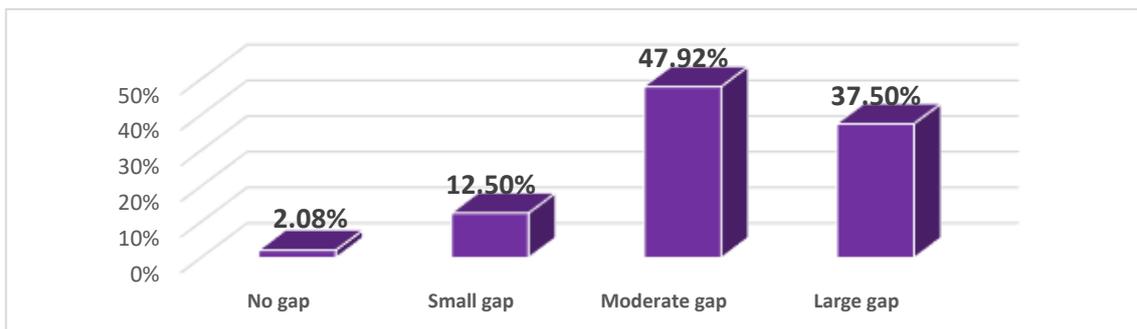
Hungary: Hungarian responses were similarly clustered around **moderate to significant**, with particular concern for gaps in digital, robotics, and sustainability-related competencies. The gap was seen as larger in traditional or less networked parts of the sector.



Italy: Italian respondents generally described the skill gap as **significant**, with specific mention of deficits in digital skills, innovation management, and technology adoption among rural professionals. A few respondents noted improvements among new graduates, but overall, the consensus was that gaps remain substantial.



Worldwide: International respondents presented a more **mixed view**: some reported only **moderate** skill gaps, particularly in countries with strong education and innovation ecosystems, while others saw **significant** shortfalls, especially in fast-evolving fields like AI, robotics, and data analytics.



TOTAL Results and Interpretation

Across all surveyed countries, **the majority of respondents perceive the current skill gap in AgriTech professionals as moderate to significant**. While there are small differences between national contexts, the broad agreement is that new digital, technical, and sustainability-focused skills are not yet widespread in the workforce - particularly among experienced professionals and in smaller, traditional organizations.

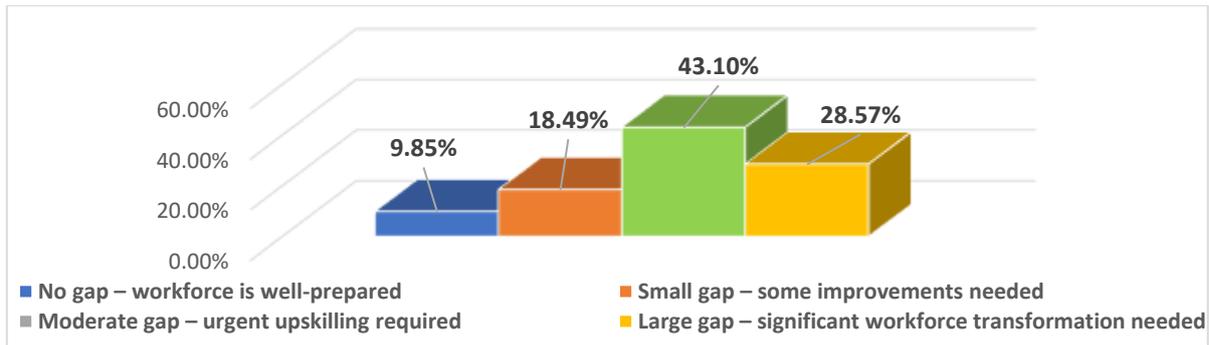


Figure 13. Current skill gap

Implication for the Competency Framework

Bridging this widespread skill gap will require a strategic and sustained investment in **targeted upskilling, continuing professional development, and the integration of digital and sustainability competencies across all levels of training.** The AGRITECH Manager profile must anticipate this need and emphasize the importance of lifelong learning and workforce adaptability.

4.5. Validation of Proposed Competency Areas

Validation of the proposed AGRITECH Manager Competency Framework is critical to ensuring its relevance, usability, and acceptance by the sector. Although this survey round did not include a direct validation item, a comprehensive examination of survey responses to all relevant questions provides a clear, evidence-based indication of where the framework aligns with real workforce and sector needs, and where further work may be required.

4.5.1 Evidence of Alignment from Survey Results

Quantitative Results

Survey responses to Q7-Q16 consistently highlight several domains as core to the AGRITECH Manager role. Across all countries, “Precision Farming,” “Sustainable Agricultural Practices,” and “AI & Data Analytics” were named most frequently as essential technical skills. This pattern was stable regardless of country, language, or respondent background, confirming these domains as universally recognized priorities.

Digital skills - ranging from the use of IoT devices to proficiency with data-driven decision tools - emerged as a cross-cutting requirement. Responses also identified transversal skills, such as problem solving, adaptability, and communication, as crucial complements to technical competence. There is a strong expectation that managers must not only understand technology but be able to manage change, foster team learning, and adapt to evolving sectoral requirements.

Specialist skills - such as GIS/geospatial mapping, agri-robotics, and remote sensing - were rated as important in some contexts (notably Italy, Hungary, and among internationally focused respondents), but were less frequently named as top priorities, supporting their inclusion as elective or advanced modules within the framework.

Consistency Across Stakeholder Types

Analysis shows that the consensus on core skills spans employers, educators, and policy respondents. No major group called for the removal or downplaying of the main domains. Minor differences in



emphasis (e.g., industry placing slightly more weight on practical and digital skills, HEIs emphasizing sustainability and research literacy) support the flexibility and modularity of the proposed framework, rather than suggesting a need for fundamental revision.

4.5.2 Insights from “Other” and Open Comments

A review of all open “Other” responses across countries found very few entirely new suggestions for competency areas. Most comments highlighted niche technologies (e.g., drones, specific software) or reiterated needs for locally relevant skills (such as knowledge of national subsidy schemes, or practical experience in particular value chains). A small number called for greater focus on soft skills - especially leadership and negotiation - which are already represented in the framework but could merit greater explicit emphasis in the next draft.

No open responses revealed significant blind spots in the proposed domains. However, the diversity of local references underlines the value of allowing optional or country-specific modules, which the current framework design already anticipates.

4.5.3 Gaps and Limitations in Validation

No Explicit Validation Question - The absence of a direct “rate or comment on the draft framework” question is a methodological limitation. The findings here rely on indirect evidence from skills, trends, and barriers reported in other survey questions.

Open Comments Untranslated in Some Cases - Not all open-ended comments could be deeply analyzed due to language differences and the short, scattered nature of most responses. However, all indications are that these did not significantly diverge from or challenge the main domains.

Policy and Accreditation Link - The survey did not systematically probe alignment with EQF, national occupational standards, or formal policy requirements. This will be addressed in subsequent project phases and in consultation with sector authorities.

4.5.4 Refinement and Next Steps

In light of the findings, the project will:

- Maintain a strong focus on the core domains validated by the survey: Precision Farming, Sustainable Agriculture, AI/Data, and Digital Skills.
- Consider giving even greater prominence to transversal and change management skills, given their recurring importance in both quantitative and qualitative feedback.
- Continue to allow for specialized or elective modules that reflect national priorities, sector subsectors, or emerging technologies.
- Plan a dedicated round of stakeholder consultation - including focus groups, structured reviews, and formal validation surveys - to directly test, refine, and secure buy-in for the framework before its final adoption.

4.5.5 Conclusion

Although direct, structured validation of the proposed competency areas is planned for the next project phase, the current survey findings provide clear, credible, and actionable evidence that the framework is well-aligned with sector needs. Ongoing engagement and explicit stakeholder testing will ensure that the final AGRITECH Manager Competency Framework is both comprehensive and genuinely accepted by those it is intended to serve.



5. AGRITECH MANAGER COMPETENCY FRAMEWORK

The development of the AgriTech Manager Competency Framework marks both a response to concrete sectoral findings and an effort to set a practical agenda for future-facing professional development. Drawing from extensive data on industry needs, technological trends, and stakeholder expectations, the framework is intended as a living reference point - a structured guide, but not a constraint, for what tomorrow's leaders in agricultural innovation will actually need to know and do.

The evidence is clear: the role of **AgriTech Manager** is emerging at the intersection of rapid digital transformation, sustainability imperatives, and evolving business models. No single discipline or background alone suffices. Instead, what the sector demands is a rare blend of technological literacy, entrepreneurial capability, green and regulatory awareness, and “soft” skills for adaptation and leadership. With this in mind, the framework does not merely aggregate competencies, but organizes them into five core domains, deliberately spanning both technical and non-technical dimensions.

It is important to recognize - especially in a fast-evolving sector like agri-food - that competency frameworks are by their nature both enabling and imperfect. They offer structure, but can quickly risk obsolescence if treated as static checklists. Accordingly, this framework is structured for modularity and periodic updating, aiming to keep pace with changes in digital agriculture, policy, and the expectations of both employers and learners. The sections that follow set out the framework's domains and internal structure, with the intent to provide a foundation for curricula, workforce planning, and strategic talent development across Europe.

Ultimately, the AgriTech Manager Competency Framework should be seen not as a final word, but as an anchor point for ongoing dialogue and iteration among all those shaping the future of agriculture. Its true value will lie in how effectively it is kept responsive to real-world practice and emerging needs.

5.1. Structure of the Competency Framework

The AgriTech Manager Competency Framework is organized to balance clarity, modularity, and practical usability in a sector where job roles and required skills are constantly evolving. At its core, the framework uses a *domain-based matrix structure* that maps five principal competency domains - Technical and Digital Skills; Business and Entrepreneurial Skills; Sustainability and Green Competencies; Policy, Regulation, and Compliance; and Soft Skills and Leadership - against defined proficiency levels and learning outcomes.

Domains and Subdomains - Each domain is further broken down into subdomains or clusters of related competencies. For example, “Technical and Digital Skills” is divided into areas such as data analytics, digital tool literacy, and familiarity with emerging technologies (e.g., AI, IoT, blockchain). This enables a more granular mapping and allows for targeted curriculum or training development within each area.

Matrix/Table Format - Competencies are presented in a matrix or tabular format, which clearly links each competency (or sub-competency) to:

- a description of the required knowledge, skills, and attitudes,
- concrete performance indicators or expected behaviors,



- and recommended proficiency levels (beginner, intermediate, advanced/expert), using references to the EQF for both HEI and VET pathways.

Cross-domain and Transversal Competencies - The framework acknowledges that some competencies - such as critical thinking, digital literacy, or adaptability - do not fit neatly into a single domain. These cross-domain or transversal skills are flagged and explicitly mapped across multiple domains. This avoids siloed thinking and reflects the real complexity of AgriTech roles, where technical, business, and social skills interact.

Assessment and Application - For each competency, practical assessment methods are suggested: e.g., project-based assignments, case studies, simulations, digital portfolios, or workplace observation. The intention is not to impose a single assessment model but to provide a menu of realistic, context-appropriate approaches. This supports both formal education providers (HEIs and VETs) and employers in using the framework for recruitment, internal development, or certification.

Dynamic and Adaptable Structure - Recognizing the risk of rigidity in static frameworks, the architecture is designed for modular updating. New competencies can be added (or outdated ones retired) within domains as technology, regulation, or sustainability imperatives evolve. Regular review cycles and stakeholder consultation are built into the framework's governance.

Visual Representation - To aid usability, the framework includes schematic diagrams and summary tables that provide an at-a-glance overview of the domains, subdomains, and progression levels. This is intended to help curriculum designers, employers, and professionals quickly identify the relevant areas for their needs.

The structure of the AgriTech Manager Competency Framework is deliberately pragmatic: offering enough formalism for credibility and comparability, but enough flexibility to be genuinely used - and adapted - in the real world. The chapters that follow will unpack each domain in detail, providing concrete descriptors and application guidance.

5.2. Core Competency Domains

The AgriTech Manager Competency Framework is anchored in five core domains, each representing a distinct but interconnected dimension of expertise that the evidence shows is required for effective leadership in modern agri-food systems. These domains have been identified and validated through comprehensive survey data, stakeholder consultations, and sectoral analysis, reflecting both current needs and anticipated future directions in agriculture and technology. Importantly, the domains are not intended as isolated silos, but as mutually reinforcing pillars - each essential in its own right, but most valuable when integrated with the others.

What emerges from both the data and the lived reality of practitioners is that successful AgriTech Managers must blend deep technical know-how with business acumen, a commitment to sustainability, fluency in policy and regulatory environments, and well-developed personal and leadership capacities. The following sections provide a concise but substantive description of each domain, highlighting the rationale for its inclusion and the types of competencies it encompasses.



5.2.1. Technical and Digital Skills

Technical and digital skills represent a core pillar of the AgriTech Manager's role, a reality strongly reinforced by AGRITECH project survey data and stakeholder consultations. **Over 70% of respondents** rated digital literacy, data management, and familiarity with precision technologies as "critical" for future AgriTech leadership, while **62% highlighted a significant need for ongoing digital upskilling** to keep pace with rapid sectoral change. Key competencies and practical indicators in this domain include:

Precision agriculture systems

Sample task/indicator: Oversee the implementation of GPS-guided machinery or drone-based crop monitoring, ensuring system calibration and staff training.

Statistic: 68% of stakeholders cited hands-on experience with precision tools as essential for modern management.

Data analytics and digital decision-making

Sample task/indicator: Collect, analyze, and interpret large datasets from IoT sensors to optimize irrigation, fertilization, or pest management, and present actionable recommendations to farm teams.

Statistic: 74% of survey participants identified data interpretation and evidence-based decision-making as key skills for AgriTech Managers.

Artificial intelligence and automation

Sample task/indicator: Evaluate and pilot AI-enabled diagnostics, yield prediction models, or automated equipment in operational settings, assessing cost-benefit and ease of integration.

Statistic: 57% of respondents saw AI/automation skills as "increasingly important" in the next 3–5 years.

Blockchain and digital innovation

Sample task/indicator: Assess the feasibility of blockchain-based solutions for supply chain transparency or traceability, and communicate opportunities and limitations to business and technical stakeholders.

Statistic: While awareness of blockchain was high, only 29% of respondents felt confident in its current practical application - reflecting some reticence and a clear need for targeted upskilling.

Cybersecurity and digital responsibility

Sample task/indicator: Implement basic cybersecurity measures to protect farm and enterprise data, and train staff on digital safety and regulatory compliance.

Statistic: 54% of stakeholders expressed concern about digital security as agri-food systems become more connected.

Overall, survey data and direct sector feedback confirm that the Technical and Digital Skills domain must balance deepening core digital competencies with fostering a growth mindset and adaptability. The most effective AgriTech Managers are not necessarily specialists in every emerging tool, but are literate enough to make informed adoption decisions, supervise pilots, and lead teams through ongoing digital transformation.



Data Ethics & Privacy

The responsible management of data is a core expectation for AgriTech Managers navigating the digital transformation of agriculture. Beyond compliance, ethical and privacy-conscious leadership builds trust among stakeholders and ensures that technological innovation benefits all actors in the agri-food value chain. Key competencies and practical indicators in this domain include:

Understanding data ownership and sovereignty

Sample task/indicator: Advise stakeholders on the ownership, access, and use of data generated through precision agriculture systems, ensuring compliance with local and international data sovereignty laws.

Statistic: 59% of survey participants expressed concerns over data ownership and control in multi-stakeholder agri-digital projects.

Ensuring informed consent and transparency

Sample task/indicator: Design and implement procedures for obtaining explicit, informed consent from farmers and partners before collecting or processing personal or operational data, and clearly communicate how such data will be used.

Statistic: 63% of respondents emphasized transparency and consent as fundamental to building trust in digital agriculture initiatives.

Addressing algorithmic fairness and bias

Sample task/indicator: Evaluate AI-enabled decision-making tools for potential bias or unintended consequences and recommend corrective actions to promote fairness and inclusivity.

Statistic: 41% of stakeholders identified algorithmic bias as a growing risk in the application of digital tools in agriculture.

Upholding regulatory compliance

Sample task/indicator: Ensure that all data management practices align with GDPR and other relevant regulations, and prepare documentation for internal or external audits as required.

Statistic: 54% of surveyed managers rated regulatory compliance as a key challenge in the deployment of digital solutions.

Promoting a culture of ethical data stewardship

Sample task/indicator: Lead staff training sessions on data ethics, privacy, and responsible technology adoption, fostering a culture of continuous improvement and ethical awareness within the organization.

Statistic: 48% of employers noted that ongoing staff development in digital ethics is critical for organizational resilience and reputation.

AgriTech Managers who demonstrate competence in data ethics and privacy are better equipped to safeguard sensitive information, navigate complex regulatory landscapes, and promote inclusive, trustworthy innovation in agri-food systems.

Beyond Compliance: Trust, Empathy, and Ethical Dilemmas

While regulatory compliance in data ownership and privacy forms a critical foundation, it is not sufficient to guarantee ethical and sustainable data practices in the agritech sector. Many farmers express concerns and reluctance regarding data sharing - not only due to privacy risks, but also stemming from fear of unintended legal consequences in an industry that is often perceived as heavily



regulated and penalty-driven. These fears can inhibit innovation and collaboration if not addressed proactively.

Therefore, agritech managers must cultivate a deep ethical awareness, going beyond formal regulations to actively foster trust, discretion, and transparent communication with stakeholders. Foresight and scenario analyses conducted within the project have highlighted the need for such ethical parameters, recommending that managers are prepared to engage empathetically with farmers' concerns, negotiate data-sharing agreements sensitively, and recognise the psychological and social factors that influence decision-making around data. This ethical competence forms an integral part of the modern agritech manager's soft skills toolkit.

Competence Area	Sample Tasks/Indicators
Data Ethics & Privacy	<ul style="list-style-type: none"> • Demonstrates empathy and discretion when engaging with farmers regarding data sharing, especially in contexts where regulatory frameworks may provoke concerns or fears of self-incrimination. • Facilitates transparent, trust-based communication about the intended uses and safeguards of agricultural data, going beyond minimal legal requirements. • Applies foresight and scenario analysis to anticipate ethical dilemmas and develop strategies for stakeholder engagement and conflict resolution.

5.2.2. Business and Entrepreneurial Skills

Business and entrepreneurial skills are essential for AgriTech Managers who aim to translate technological potential into sustainable business outcomes. The AGRITECH project survey found that **nearly 65% of respondents** rated business model innovation, value chain management, and financial acumen as “highly important” or “critical” for future leaders. Additionally, **58% of employers** specifically cited the need for stronger project management and commercial strategy skills to address gaps in current AgriTech training. Key competencies and practical indicators in this domain include:

Business model innovation and value chain development

Sample task/indicator: Design and pilot a new business model that leverages digital technologies (e.g., precision services, data-driven advisory, or digital platforms), and assess its impact on profitability and partner relationships.

Statistic: 61% of surveyed stakeholders emphasized the importance of managers being able to reimagine and restructure agri-food value chains.

Financial management and investment appraisal

Sample task/indicator: Prepare a comprehensive business case for adopting a new technology, including cost-benefit analysis, risk assessment, and strategies for securing investment or funding (e.g., grants, public-private partnerships).

Statistic: 56% of employers highlighted financial planning and investment skills as top priorities for management recruitment.

Financial Appraisal & ROI for Agritech

AgriTech Managers must possess the financial acumen to evaluate, justify, and communicate investments in digital and technological solutions. Robust financial appraisal and ROI analysis underpin



sound decision-making, risk management, and the sustainable adoption of innovation within agri-food systems. Key competencies and practical indicators in this domain include:

Financial appraisal and ROI analysis

Sample task/indicator: Prepare a comprehensive business case for adopting a new digital technology, including cost-benefit analysis, risk assessment, and strategies for securing investment or funding (e.g., grants, public-private partnerships).

Statistic: 56% of surveyed employers highlighted financial planning and investment skills as top priorities for management recruitment in the agri-digital sector.

Cost-benefit analysis for farm investments

Sample task/indicator: Utilize standardized templates to perform comparative cost-benefit analyses between traditional and digital agricultural practices for both smallholder and large-scale operations, identifying tangible and intangible sources of value.

Statistic: 49% of respondents cited the ability to demonstrate clear economic benefits as a critical factor for technology adoption among farm managers.

Assessment of funding and subsidy opportunities

Sample task/indicator: Research and identify relevant EU and national funding opportunities, such as grants, subsidies, or innovation support programs, and incorporate them into the financial planning of agri-digital projects.

Statistic: 45% of stakeholders indicated a lack of familiarity with available funding mechanisms as a barrier to investment in digital technologies.

Communication of financial value and risk

Sample task/indicator: Present financial analysis and ROI projections to decision-makers and external partners in an accessible, evidence-based manner, supporting transparent and strategic adoption decisions.

Statistic: 51% of surveyed managers emphasized the importance of effective financial communication in building stakeholder confidence for digital transformation initiatives.

Overall, survey data and direct sector feedback confirm that financial appraisal and ROI analysis are not merely technical skills, but core managerial competencies that drive informed investment and innovation in agri-food systems. AgriTech Managers equipped with these capabilities are better positioned to leverage funding opportunities, minimize risk, and deliver sustainable value through digital transformation.

Project management

Sample task/indicator: Lead a multidisciplinary team to implement a digital transformation project, managing timelines, budgets, deliverables, and post-implementation evaluation.

Statistic: 63% of respondents considered project management experience to be a key qualification for AgriTech Managers.

Market analysis and opportunity recognition

Sample task/indicator: Conduct market research to identify customer needs, sustainability drivers, or regulatory changes that could inform new product or service development.



Statistic: 48% of survey participants reported a skills gap in market intelligence and opportunity scanning.

Entrepreneurial and intrapreneurial mindset

Sample task/indicator: Initiate and champion an internal innovation project, navigating resistance and learning from setbacks to improve business processes or service delivery.

Statistic: 53% of stakeholders cited “entrepreneurial thinking” and the willingness to drive change from within as distinctive strengths of high-potential managers.

Regarding innovative methods, several respondents specifically mentioned blockchain as an emerging business tool for transparency and traceability. However, **only 22% felt ready to implement blockchain-driven business models at scale**, reflecting ongoing skepticism and a need for practical, contextualized training.

Overall, survey results indicate that successful AgriTech Managers must combine classic business skills with the agility and risk appetite required to lead organizations through digital and green transitions - often in the face of uncertainty and fast-evolving sectoral dynamics.

5.2.3. Sustainability and Green Competencies

Sustainability and green competencies are increasingly viewed as non-negotiable for AgriTech Managers - a sentiment reflected by **over 80% of AGRITECH project survey respondents**, who rated environmental stewardship, climate-smart agriculture, and resource efficiency as “essential” for current and future leaders. Notably, **67% identified practical skills in sustainability reporting and the implementation of green innovations** as clear gaps in the workforce, emphasizing the importance of turning awareness into action.

Key competencies and practical indicators in this domain include:

Sustainable resource management and operations

Sample task/indicator: Implement resource-efficient practices (e.g., precision irrigation, nutrient management, or waste minimization) and monitor their impact on operational costs and ecological footprint.

Statistic: 72% of stakeholders cited direct experience in resource optimization as a top skill for AgriTech Managers.

Climate change adaptation and mitigation

Sample task/indicator: Develop and execute a farm or enterprise-level plan for climate adaptation, such as adopting resilient crop varieties or regenerative practices, and evaluate outcomes.

Statistic: 58% of respondents highlighted the need for managers to translate climate science into practical actions.

Sustainability standards and certifications

Sample task/indicator: Lead the process for obtaining and maintaining certifications such as organic, integrated pest management, or carbon footprint labeling, ensuring ongoing compliance and stakeholder engagement.

Statistic: 64% identified knowledge of certification schemes as a valuable differentiator for managerial candidates.

Circular economy and innovation



Sample task/indicator: Pilot a circular economy solution - such as nutrient recycling, on-site renewable energy, or by-product valorization - and analyze its business and sustainability impact.

Statistic: 49% of surveyed experts noted circular economy implementation as a rising priority in the sector.

Stakeholder engagement for sustainability

Sample task/indicator: Organize and facilitate co-design workshops with farmers, supply chain partners, and consumers to develop and roll out sustainable production or sourcing initiatives.

Statistic: 53% cited stakeholder collaboration skills as essential for driving effective sustainability transitions.

The survey also highlighted a recurring gap: while awareness of sustainability issues is nearly universal, practical ability to measure, report, and communicate sustainability outcomes lags behind. Managers are expected not only to comply with regulations, but also to anticipate new policy and market expectations - such as eco-labeling, carbon markets, and the integration of sustainability metrics into business planning.

Sustainability and Green Competencies domain supports AgriTech Managers in becoming active agents of environmental and social innovation, ensuring they can lead measurable, impactful change aligned with evolving sectoral, societal, and regulatory demands.

5.2.4. Policy, Regulation, and Compliance

Policy, regulation, and compliance competencies are increasingly essential in the AgriTech Manager's portfolio, a reality highlighted by **over 55% of AGRITECH project survey respondents** who identified regulatory awareness and compliance management as "significant gaps" in current training provision. Stakeholders consistently noted that navigating the growing complexity of agri-food policy - especially at the intersection of digital, environmental, and market regulations - demands both up-to-date knowledge and practical implementation skills.

Key competencies and practical indicators in this domain include:

Regulatory interpretation and application

Sample task/indicator: Analyze new EU or national regulations (e.g., CAP reforms, data protection laws) to determine their implications for business operations and prepare clear, actionable guidance for teams.

Statistic: 59% of surveyed experts reported difficulties in translating policy into practice at the organizational level.

Compliance systems and reporting

Sample task/indicator: Design and implement an internal compliance management system for areas such as traceability, certification, or environmental reporting, including staff training and audit preparation.

Statistic: 48% of respondents rated structured compliance processes as "underdeveloped" in their current operations.

Digital compliance and data protection



Sample task/indicator: Oversee the secure collection, storage, and sharing of digital data in line with GDPR and other relevant regulations, and ensure that team members understand their data management responsibilities.

Statistic: 46% expressed uncertainty about compliance with new digital data standards, especially when adopting cloud-based or blockchain systems.

Stakeholder engagement with authorities

Sample task/indicator: Represent the organization in meetings with certification bodies, policy-makers, or industry groups, effectively communicating compliance status and participating in policy consultations where relevant.

Statistic: 51% of respondents saw proactive engagement with regulatory authorities as an area needing further development.

Anticipating and responding to regulatory change

Sample task/indicator: Monitor policy developments (e.g., environmental targets, subsidy changes, digital reporting mandates) and lead strategic adaptation or innovation initiatives in response.

Statistic: 43% indicated that a lack of future-oriented regulatory awareness limited their ability to innovate or plan long-term.

The survey findings reinforce that AgriTech Managers must move beyond simple rule-following to develop the judgment and confidence needed to interpret evolving policy environments, anticipate compliance risks and opportunities, and use regulatory change as a springboard for strategic advantage.

5.2.5. Soft Skills and Leadership

Soft skills and leadership capacities are consistently recognized by both the survey data and stakeholder interviews as critical differentiators for effective AgriTech Managers. While technical expertise and business acumen are essential, **over 75% of survey respondents** reported that communication, adaptability, and collaborative problem-solving are “high priority” or “must-have” attributes for those in managerial roles. Notably, **nearly 60% of industry representatives** identified change management and team-building skills as the most significant gaps in current AgriTech training, with particular concern for the capacity to manage cross-functional, multicultural teams in dynamic settings.

Key competencies and practical indicators in this domain include:

Effective communication

Sample task/indicator: Clearly present the results of a digital innovation project to both technical staff and non-technical farm partners, ensuring understanding and buy-in across the team.

Statistic: 73% of respondents rated “the ability to translate technical concepts to non-specialist audiences” as very important for AgriTech Managers.

Conflict resolution, negotiation, and stakeholder engagement

Sample task/indicator: Mediate between production, technical, and sustainability teams to resolve disagreements about the implementation of a new digital tool, reaching a consensus that addresses concerns and project objectives.



Statistic: 52% of stakeholders highlighted negotiation skills as a key area for improvement in current manager profiles.

Team leadership and development

Sample task/indicator: Mentor junior colleagues or students in the use of agri-digital tools, providing regular feedback, encouragement, and opportunities for hands-on learning.
Statistic: 65% of surveyed employers identified “the ability to foster team learning and professional growth” as a critical managerial function.

Change management and adaptability

Sample task/indicator: Lead the organization through a transition to a new data management system, developing a change management plan, communicating regularly about progress, and adapting the approach based on staff feedback and emerging challenges.

Statistic: 58% of respondents cited resistance to change and lack of structured change management as key barriers to digital adoption in their organizations.

Critical and creative thinking

Sample task/indicator: Facilitate brainstorming sessions to identify innovative solutions to reduce input costs or environmental impact, encouraging contributions from all team members and considering unconventional approaches.

Statistic: 67% of stakeholders agreed that creative problem-solving distinguishes high-performing AgriTech Managers from their peers.

The Soft Skills and Leadership domain ensures that AgriTech Managers are equipped not only to direct operations, but to inspire, empower, and connect people - qualities that are increasingly decisive for success in the future agri-food landscape.

5.3. Mapping to EQF Levels (VET and HEI Pathways)

The credibility and international relevance of the AgriTech Manager Competency Framework depends not only on the specificity of its content but also on its alignment with established European standards for qualification and learning outcomes. By systematically mapping each competency domain to the European Qualifications Framework (EQF), the project ensures that its outcomes are both transparent and transferable across vocational education and training (VET) as well as higher education institutions (HEI). This alignment enables learners, educators, employers, and accreditation agencies - including international partners such as ACQUIN - to understand, assess, and recognize the levels of knowledge, skill, and responsibility achieved at different stages of AgriTech Manager development. The following subchapters describe the rationale, methodology, and practical outcomes of this mapping process, providing a clear reference for curriculum design, accreditation, and ongoing professionalization in the sector.

5.3.1. Purpose and Rationale

Mapping the AgriTech Manager Competency Framework to the European Qualifications Framework (EQF) serves several strategic purposes. First, it ensures that the competencies articulated in this framework are directly comparable to widely recognized European standards, making them intelligible and credible across different countries and educational systems. This comparability is crucial for



facilitating both learner mobility and mutual recognition of qualifications, particularly as the AgriTech sector becomes increasingly international and interconnected.

Second, EQF mapping supports the integration of the framework into a wide spectrum of educational and professional contexts, from vocational education and training (VET) through to advanced higher education (HEI) programs. It establishes a transparent reference for curriculum designers, accreditation bodies (such as ACQUIN), and employers, helping to clarify the expected learning outcomes at each stage of professional development.

Finally, aligning with the EQF reinforces the project's commitment to quality assurance, transparency, and continuous improvement. It enables the framework to support stackable, modular, and lifelong learning pathways, ensuring that AgriTech Managers can upskill, reskill, and advance in response to changing sectoral needs and technological developments. This mapping is, therefore, foundational not only for curriculum and accreditation, but for building a resilient and adaptive European AgriTech workforce.

5.3.2. Overview of the European Qualifications Framework (EQF)

The European Qualifications Framework (EQF) provides a standardized, outcomes-based reference for comparing qualifications and learning achievements across Europe. For the purposes of the AgriTech Manager Competency Framework, the primary focus is on EQF Levels 5, 6, and 7, as these encompass the range of roles and career stages most relevant for current and future AgriTech professionals.

- **EQF Level 5** marks the transition from technician-level roles to those involving independent management of tasks and decision-making in a specialized field. At this level, learners are expected to apply comprehensive practical and theoretical knowledge, solve unpredictable problems, and take responsibility for the work of others - aligning with advanced vocational education and training (VET) and some short-cycle higher education programs.
- **EQF Level 6** corresponds to the expectations for Bachelor's degree graduates or equivalent. Here, the emphasis is on critical understanding of theories and principles, the integration of complex information, and the ability to initiate and manage complex projects or processes. Individuals at this level are expected to demonstrate creativity, make autonomous decisions in unpredictable contexts, and manage both people and resources effectively.
- **EQF Level 7** represents a high degree of specialization, consistent with Master's-level qualifications or advanced professional practice. Competencies at this level include original thinking, the ability to research and innovate, and leadership of complex projects or organizations. Graduates are expected to take full responsibility for strategic decision-making, continuous professional development, and advancing practice within their sector.

While the EQF as a whole spans Levels 1 to 8, only Levels 5–7 are directly relevant to the AgriTech Manager role. Levels 1–4 (basic to upper secondary education) and Level 8 (doctoral or equivalent) are outside the intended scope of this framework. This targeted approach ensures that the competency mapping is both meaningful and directly applicable to the training and professional development needs identified within the AGRITECH project.

By explicitly aligning learning outcomes with these EQF levels, the framework facilitates curriculum design, assessment, and mutual recognition of qualifications across both VET and HEI contexts, supporting flexible learning pathways and clear progression for AgriTech professionals.



5.3.3. Methodology for EQF Mapping

The methodology for mapping the AgriTech Manager Competency Framework to EQF levels was designed to ensure maximum transparency, objectivity, and alignment with both European standards and real-world sector requirements. The mapping process involved several distinct but interrelated stages:

1. Identification of Learning Outcomes

For each competency domain, clear learning outcomes were defined using the format and terminology of the EQF - specifying expected knowledge, skills, and levels of responsibility/autonomy. This step relied on a combination of desk research (reviewing relevant qualifications and frameworks in agriculture, technology, and management), input from project partners, and synthesis of survey findings from stakeholders across the AGRITECH consortium.

2. Benchmarking Against EQF Descriptors

Each learning outcome was systematically compared to the official EQF level descriptors. The team conducted a detailed content analysis to determine the best match for the cognitive complexity, technical sophistication, and managerial/leadership expectations for each competency. Where competencies spanned a range (e.g., entry-level to advanced practice), a band of relevant EQF levels (typically 5–7) was assigned, allowing for both progression and differentiation within the framework.

3. Dual-Pathway Integration (VET and HEI)

Special attention was given to ensuring that learning outcomes and mapped levels were meaningful and applicable in both VET and HEI settings. This was achieved by referencing national qualification standards from multiple EU countries (including both vocational and university contexts), and by engaging VET and HEI experts in the validation process. This dual approach supports the recognition of both formal and non-formal learning, and allows for stackable, modular pathways toward full qualification.

4. Validation With Stakeholders and External Experts

The draft mapping was subject to review and feedback by a representative group of stakeholders: educators, employers, accreditation specialists (including ACQUIN), and sector experts. Workshops and structured consultations were used to test the appropriateness of level assignments, check for alignment with actual job roles, and refine descriptors for clarity and relevance. Adjustments were made where necessary to ensure both upward and lateral compatibility across different education and career pathways.

5. Finalization and Documentation

The final mapping was documented using a matrix format, explicitly linking each competency (or cluster of related competencies) to EQF levels 5, 6, or 7, and providing clear descriptors for each of the three EQF dimensions (knowledge, skills, responsibility/autonomy). Sample tasks and performance indicators were also developed to operationalize each learning outcome in curriculum design and assessment contexts.

6. Commitment to Transparency and Review

The methodology, sources, and mapping decisions are fully documented and will remain open to periodic review as both sector requirements and the EQF itself evolve. This ensures the ongoing credibility and adaptability of the AGRITECH framework, and supports its use for international accreditation, curriculum development, and quality assurance across VET and HEI sectors.



5.3.4. Mapping of Core Competencies to EQF Levels

The mapping of core competencies within the AgriTech Manager Competency Framework to the European Qualifications Framework (EQF) levels was carried out with the explicit goal of ensuring that each domain's learning outcomes are not only transparent and measurable, but also appropriately challenging and transferable across both vocational (VET) and higher education (HEI) contexts. The process followed the methodology described previously and is summarized as follows:

1. Domain-by-Domain Alignment

Each of the five core domains - Technical and Digital Skills, Business and Entrepreneurial Skills, Sustainability and Green Competencies, Policy, Regulation and Compliance, and Soft Skills and Leadership - was systematically mapped to the most relevant EQF levels. This was accomplished by deconstructing each domain into a set of concrete competencies, then benchmarking those competencies against EQF descriptors for knowledge, skills, and responsibility/autonomy.

- **Technical and Digital Skills** - Mapped across EQF Levels 5, 6, and 7, this domain covers progression from practical application of precision agriculture tools (Level 5), to independent management and integration of digital solutions (Level 6), and strategic leadership in digital transformation, innovation, and team management (Level 7).
- **Business and Entrepreneurial Skills** - Competencies here range from operational support and project participation (Level 5), to design and implementation of new business models, financial oversight, and market analysis (Level 6), culminating in entrepreneurial leadership and innovation management, including responsibility for strategic direction and mentorship (Level 7).
- **Sustainability and Green Competencies** - Level 5 includes application of established sustainability practices and compliance with environmental standards. At Level 6, individuals critically evaluate, adapt, and improve sustainable processes; at Level 7, they lead organization-wide or sectoral sustainability strategies, driving innovation and measurable impact.
- **Policy, Regulation, and Compliance** - Competence at Level 5 is demonstrated by operational knowledge of regulatory frameworks and accurate record-keeping. Level 6 reflects the ability to interpret evolving policies, ensure compliance, and engage with external authorities. At Level 7, managers take an active role in policy advocacy, strategic adaptation, and sector-wide regulatory innovation.
- **Soft Skills and Leadership** - This domain evolves from effective teamwork and communication (Level 5), through project and people management in complex, changing environments (Level 6), to advanced leadership - such as driving organizational culture, leading multi-stakeholder teams, and managing sectoral change (Level 7).

2. Progression and Differentiation

The mapping intentionally allows for progression within and between domains, acknowledging that professionals may enter the pathway at different points depending on prior learning or experience. Competency descriptions are written to allow for both vertical advancement (from Level 5 to 7) and horizontal development (broadening skillsets across domains). This flexibility is crucial for real-world upskilling, career transitions, and recognition of non-formal or informal learning.

3. Multi-dimensional Assessment

For each mapped competency, the framework specifies what constitutes sufficient evidence at each EQF level - moving from supervised application (Level 5), to independent and critical implementation (Level 6), to original, strategic leadership and innovation (Level 7). Assessment methods may include practical demonstrations, project work, portfolios, and scenario-based evaluations, all aligned to EQF principles of outcome-based validation.

4. Crosswalk with National and Sector Standards

The mapping was cross-referenced with national qualifications frameworks (NQFs) from partner countries and with established sector standards where available. This process ensures that the AGRITECH framework is not only compatible with EQF but also with national and professional expectations in the AgriTech sector, enhancing portability and trust.

5. Transparency and Documentation

For each domain and EQF level, explicit mapping tables are provided (see 5.3.6) with sample competency statements, aligned descriptors, and indicators for knowledge, skills, and responsibility/autonomy. This documentation supports curriculum design, program accreditation, and quality assurance processes for both VET and HEI contexts.

6. Future-proofing and Responsiveness

Recognizing the evolving nature of the AgriTech sector, the mapping is designed for periodic review and updating. Feedback from employers, graduates, educators, and accreditation bodies will be systematically collected to inform ongoing adjustments, ensuring continued relevance and international recognition.

Mapping of core competencies to EQF levels in the AGRITECH framework is grounded in rigorous benchmarking, validated by sector and educational experts, and structured to support clear, evidence-based progression for learners at multiple entry points. It provides a robust foundation for curriculum development, assessment, and international accreditation, and is intended as a living tool to guide AgriTech workforce development across Europe.

Competency Domain	EQF Level 5 – Focus	EQF Level 6 – Focus	EQF Level 7 – Focus
Technical and Digital Skills	Practical application and operation	Independent management and integration	Strategic leadership, digital innovation
Business and Entrepreneurial Skills	Support and participation in operations	Project/business model development, market analysis	Innovation leadership, strategic entrepreneurship
Sustainability and Green Competencies	Implementing established practices	Evaluation and improvement of processes	Leading sustainability strategy and sectoral innovation
Policy, Regulation, Compliance	Operational compliance, record-keeping	Interpretation and adaptation to new requirements	Policy advocacy, regulatory innovation, strategic guidance
Soft Skills and Leadership	Teamwork, communication	Project and people management	Organizational leadership, change management

Table 6. Overview of Core Competency Domains Mapped to EQF Levels



This table provides a high-level overview of how each domain aligns with increasing levels of responsibility and complexity, as defined in the EQF. Full descriptors and assessment criteria are detailed in the mapping matrix in section 5.3.6.

5.3.5. Integration of VET and HEI Pathways

A central strength of the AgriTech Manager Competency Framework is its deliberate design for integration across both Vocational Education and Training (VET) and Higher Education Institution (HEI) pathways. This dual-alignment addresses the real diversity of educational and career trajectories within the agri-food sector, ensuring that the framework is accessible, relevant, and actionable for learners and professionals at multiple stages.

Pathway Articulation

- **VET Pathways:** The framework maps core competencies - particularly at EQF Level 5 (and to some extent Level 6) - to advanced vocational qualifications and work-based learning programs. Competencies in this pathway emphasize practical application, hands-on technical skills, and direct workplace relevance. Assessment in VET contexts typically focuses on demonstrable ability to solve real-world problems, operate and maintain technologies, and apply established business or sustainability processes under defined conditions.
- **HEI Pathways:** At EQF Levels 6 and 7, the framework aligns with Bachelor's and Master's degree outcomes, emphasizing higher-order cognitive skills, independent problem-solving, research and innovation, and strategic leadership. HEI assessment emphasizes critical analysis, synthesis of knowledge from diverse domains, the ability to manage complex projects, and capacity for original contribution to practice or theory.

Progression and Permeability

- The framework supports *vertical progression* (from EQF 5 through to EQF 7), enabling learners to move from advanced vocational roles to higher academic qualifications, and vice versa. *Horizontal permeability* is also built in, allowing professionals to broaden their skillsets across domains or specialties (e.g., from technical skills into policy or sustainability leadership).
- Recognition of Prior Learning (RPL) and credit transfer are explicitly supported, with competency-based descriptors allowing for validation of both formal and non-formal/informal learning. This enables learners with substantial professional experience to access HEI routes or upskilling programs, and allows HEI graduates to receive credit for VET-based practical achievements.

Stackable and Modular Design

- Competencies are organized to support modular delivery and assessment, facilitating the accumulation of micro-credentials or partial qualifications (e.g., through digital badges or ECTS-compatible modules). This design allows for flexible entry and exit points and accommodates learners who wish to upskill or reskill without committing immediately to a full qualification cycle.

Stakeholder and Institutional Engagement

- The framework was validated with input from both VET providers and HEIs, as well as employers and sector bodies, to ensure that mapped competencies and expected outcomes are meaningful in both academic and work-based contexts.



- Institutional collaboration agreements and joint programs are facilitated by the shared reference to EQF levels and learning outcome language, supporting mobility, joint degrees, and cross-institutional recognition.

Quality Assurance and Accreditation

- By explicitly referencing both VET and HEI contexts and using EQF-aligned outcomes, the framework is designed to meet the requirements of international accreditation bodies such as ACQUIN. This ensures that programs based on the framework can be recognized across borders and sectors, enhancing the employability of graduates and supporting Europe-wide workforce development in AgriTech.

In practice, integration of VET and HEI pathways within the AgriTech Manager Competency Framework makes it possible for learners to construct personalized and adaptive professional journeys. It also enables education providers to collaborate on curriculum design, share quality standards, and respond dynamically to evolving skills needs across the agri-food and technology sectors.

For a better understanding of how the integration of VET and HEI pathways operates in practice within the AgriTech Manager Competency Framework, three common scenarios can be highlighted:

- **Progression Scenario:** A technician with an EQF Level 5 VET diploma in agricultural technology may pursue additional modular learning (such as digital skills or sustainability courses) and, through Recognition of Prior Learning (RPL), gain access to a Bachelor’s (EQF Level 6) program. After completion, this individual might further progress to a Master’s level (EQF 7) in AgriTech management or innovation.
- **Recognition of Prior Learning (RPL):** An experienced farm manager without formal higher education assembles a portfolio demonstrating competencies in areas such as business management, technology adoption, and sustainability. Through a structured RPL process, an educational provider assesses these competencies against the framework’s descriptors and grants credit or direct entry to advanced programs, recognizing both formal and informal learning.
- **Micro-credential and Modular Pathways:** Learners can accumulate stand-alone modules or micro-credentials - such as “Blockchain for Agri-Food,” “Sustainable Water Management,” or “Digital Leadership” - each mapped to specific EQF levels and credit values. Over time, these can be “stacked” to build towards a recognized diploma, degree, or professional certification, enabling highly flexible and individualized learning journeys.

These scenarios demonstrate the framework’s capacity to support flexible, inclusive, and career-oriented learning pathways - facilitating lifelong learning, professional advancement, and mobility within the dynamic AgriTech sector.

5.3.6. Sample EQF Mapping Table

To provide concrete guidance for curriculum developers, accreditation agencies, and educational institutions, the following table presents a representative mapping of the AgriTech Manager core competencies to the relevant EQF levels (5, 6, and 7). Each row illustrates how a sample competency within a domain aligns with the EQF descriptors for knowledge, skills, and responsibility/autonomy. This structure enables clear benchmarking, modular curriculum design, and supports mutual recognition of qualifications across VET and HEI sectors.



Domain	Sample Competency	EQF Level	Knowledge	Skills	Responsibility /Autonomy
Technical and Digital Skills	Oversee adoption of digital precision agriculture solutions	5	Understands basic digital tools and applications	Applies tools under guidance, solves routine problems	Works independently within set parameters
	Lead digital transformation in farm management	6	Integrates multiple digital technologies	Adapts, customizes, and critically evaluates solutions	Manages projects, mentors others, sets priorities
	Strategize sector-wide technology adoption	7	Critically assesses state-of-the-art innovations	Designs, implements, and evaluates transformation strategies	Leads teams/ organizations, anticipates disruption
Business & Entrepreneurial Skills	Participate in business model adaptation	5	Grasps basic business and value chain concepts	Supports planning, participates in solution development	Follows guidance, takes some responsibility
	Develop new business models for AgriTech	6	Integrates business, market, and sector knowledge	Designs and implements new models, analyzes results	Independently manages initiatives, mentors peers
	Lead entrepreneurial innovation initiatives	7	Applies advanced strategic and financial knowledge	Drives innovation, manages risk, secures funding, evaluates ROI	Leads ventures, sets vision, accountable for outcomes
Sustainability & Green Competencies	Apply sustainable practices	5	Knows sustainability regulations and procedures	Implements basic sustainable solutions, monitors outcomes	Ensures compliance, supports others
	Evaluate and improve sustainability performance	6	Analyzes environmental, social, and economic impacts	Designs and adapts advanced sustainable processes	Manages projects, communicates with stakeholders
	Lead organizational sustainability transformation	7	Critically evaluates global sustainability trends	Innovates, leads systemic change, measures/ communicates impact	Drives policy, represents organization externally
Policy, Regulation, Compliance	Ensure operational compliance	5	Understands key legal requirements and procedures	Applies compliance processes, keeps records	Accountable for compliance within remit
	Interpret and implement new regulations	6	Analyzes legislative changes and sector impacts	Translates requirements into practice, adapts procedures	Advises management, interfaces with regulators
	Shape organizational/ policy responses to regulatory change	7	Leads policy analysis, interprets global trends	Designs and leads compliance and advocacy strategies	Represents organization, influences policy
Soft Skills and Leadership	Communicate with colleagues and clients	5	Understands effective communication basics	Communicates clearly, resolves simple conflicts	Participates actively, supports team
	Lead and manage multidisciplinary teams	6	Understands group dynamics, motivation, leadership	Facilitates collaboration, manages performance, mentors staff	Takes initiative, accountable for team outcomes
	Drive organizational culture and sectoral leadership	7	Analyzes organizational change and leadership theory	Leads transformation, influences networks, drives innovation	Inspires others, shapes sector, drives change

Table 7. Example Mapping of AgriTech Manager Competencies to EQF Levels



Clarifications and Guidance:

- **Granularity:** This table provides examples for each domain at each relevant EQF level, but full curriculum design should develop more detailed learning outcomes and assessment criteria.
- **Progression:** The table illustrates progression in complexity, autonomy, and impact from EQF 5 (practical application and limited responsibility) to EQF 7 (innovation, leadership, and strategic vision).
- **Customisation:** Institutions and accreditors may adapt or extend these examples to local or program-specific contexts, provided the alignment with EQF descriptors is maintained.
- **Assessment:** Each mapped outcome can be assessed through a range of methods - practical demonstration, project work, portfolio, or scenario-based evaluation - appropriate to the learning environment (VET or HEI).
- **Recognition:** The mapping supports stackable, modular learning (including micro-credentials), vertical progression, and Recognition of Prior Learning (RPL), promoting mobility and lifelong learning within the AgriTech sector.

This sample mapping table demonstrates the framework's capacity to translate abstract competency domains into concrete, actionable learning outcomes across the key EQF levels relevant to AgriTech Managers. By making explicit how knowledge, skills, and responsibility evolve from operational proficiency to strategic leadership, the table provides a practical reference for curriculum development, accreditation, and assessment. It also serves as a clear benchmark for both VET and HEI institutions seeking to ensure their programs meet European and international standards. This approach enables the AGRITECH project to support diverse learner pathways and institutional contexts, ultimately fostering a new generation of AgriTech professionals equipped for dynamic, complex, and innovative roles across the sector.

5.3.7. Implications for Curriculum Design, Accreditation, and Recognition

Implications for Curriculum Design

The explicit mapping of the AgriTech Manager Competency Framework to EQF levels provides a robust foundation for curriculum design that is both systematic and adaptable to local needs. By defining clear, outcome-based expectations for each domain and level, the framework enables curriculum developers to structure programs that are transparent, progressive, and fully aligned with European and international standards.

Learning Outcome Formulation and Course Structure

The EQF-aligned competencies serve as direct templates for articulating course and module learning outcomes. Each competency mapped to a specific EQF level clarifies what students should know, understand, and be able to do upon completion. This allows course designers to create coherent learning pathways, avoid content gaps or overlaps, and ensure that each module builds logically toward broader program goals.

Modular and Stackable Curriculum

The framework's modular structure enables the development of flexible, stackable curricula. Learners can combine modules (each mapped to an EQF level and specific competency domain) to achieve targeted qualifications, micro-credentials, or badges. This supports flexible entry and exit points,



personalized learning trajectories, and lifelong learning - allowing both initial training and ongoing upskilling or reskilling.

Assessment Strategies

EQF descriptors guide the selection of appropriate assessment methods for each competency and level. For example, practical demonstrations, scenario-based assignments, and workplace projects are suitable for Level 5, while critical analysis, project management, and strategic planning are emphasized at Levels 6 and 7. The explicit linkage between assessment and mapped outcomes ensures that learning is evaluated in a way that is valid, reliable, and internationally comparable.

Interdisciplinary and Cross-Domain Learning

The framework's organization into five core domains, each aligned with EQF progression, encourages curriculum designers to blend technical, business, sustainability, regulatory, and leadership skills. This approach reflects the real demands of AgriTech management roles and supports the creation of interdisciplinary learning experiences that mirror the complexity of modern agri-food systems.

Alignment with Industry Needs

Because the mapped competencies are validated by sector stakeholders and reflect current and emerging job requirements, curriculum designers can ensure that program content remains responsive to employer needs. This increases the relevance and employability of graduates, while supporting institutions in adapting curricula to new technologies, business models, or policy changes as they arise. In summary, the EQF-mapped AgriTech Manager Competency Framework provides curriculum designers with a detailed, actionable blueprint for building programs that are progressive, flexible, and directly aligned with the skills and knowledge needed in the evolving European agri-food sector.

Implications for Accreditation

The detailed mapping of the AgriTech Manager Competency Framework to EQF levels is a foundational asset for program accreditation, providing the transparency, comparability, and evidence-based documentation required by national and international quality assurance agencies. This alignment ensures that all learning outcomes are explicit, measurable, and benchmarked to a recognized European standard, directly supporting the needs of both initial accreditation and periodic program review.

ACQUIN Involvement and Accreditation System

Within the AGRITECH project, **ACQUIN** - the Accreditation, Certification and Quality Assurance Institute based in Germany - plays a central role as the international accreditation partner. ACQUIN brings extensive expertise in evaluating and certifying educational programs against both German and European Higher Education Area (EHEA) standards, with a particular emphasis on outcome orientation, stakeholder engagement, and continuous improvement. The EQF mapping serves as the primary reference for ACQUIN's accreditation process, enabling a clear demonstration of how competencies and learning outcomes align with expected levels of knowledge, skills, and autonomy.

Documentation and Transparency

Mapped EQF descriptors make the program's structure and intended learning outcomes easily accessible to accreditation reviewers. This facilitates a transparent, evidence-driven accreditation



process, where each course or module can be traced directly to the corresponding EQF level and competency. Such clarity is essential for both initial program approval and subsequent quality audits.

Cross-border and Joint-degree Recognition

Because ACQUIN's processes are recognized across the European Higher Education Area and increasingly internationally, accreditation based on this framework enables mutual recognition of qualifications, cross-institutional partnerships, and the development of joint or dual degrees. The EQF mapping assures foreign partners and agencies that the program meets shared European benchmarks for quality and learning outcomes.

Quality Assurance and Continuous Improvement

The framework also supports ongoing quality assurance, as mapped competencies and outcomes can be regularly reviewed and updated in light of sectoral change, graduate feedback, or employer input. This dynamic approach aligns with ACQUIN's standards for continuous improvement and responsiveness to evolving educational and labor market needs.

In summary, the alignment of the AGRITECH framework with EQF levels and the integration of ACQUIN's accreditation system ensures that AgriTech Manager programs are credible, internationally recognized, and subject to rigorous, transparent quality standards - facilitating both the mobility of graduates and the reputation of participating institutions across Europe and beyond.

Implications for Recognition

The EQF-based mapping of the AgriTech Manager Competency Framework brings substantial advantages for the recognition of qualifications, skills, and learning across educational, professional, and geographic boundaries. This approach enables a robust system for recognizing prior learning, supporting mobility, and validating diverse pathways into the AgriTech sector.

Recognition of Prior Learning (RPL) and Credit Transfer

By defining clear, outcome-based competencies and mapping them to EQF levels, the framework supports structured Recognition of Prior Learning processes. Learners - whether they have formal qualifications, non-formal training, or significant workplace experience - can have their competencies assessed against the framework and awarded credit or exemptions accordingly. This increases access to further study, avoids duplication of learning, and promotes efficient progression for both traditional and non-traditional students.

International and Cross-sector Mobility

EQF alignment facilitates the transfer and mutual recognition of qualifications and credits across both VET and HEI institutions, as well as across national boundaries within the European Higher Education Area and beyond. This is critical for supporting the free movement of students, graduates, and professionals, and for building a pan-European talent pool in AgriTech management.

Validation of Informal and Non-formal Learning

The framework enables the formal validation of competencies acquired outside traditional academic environments - for example, through short courses, on-the-job training, industry certifications, or self-directed learning. Such validation is essential for upskilling, reskilling, and lifelong learning, particularly in a sector characterized by rapid technological and organizational change.



Employer and Sectoral Recognition

Employers and professional bodies can use the framework as a transparent reference for recruitment, internal promotion, and staff development. Because mapped competencies are based on sectoral needs and validated by stakeholders, the framework fosters employer trust and supports alignment with EU-level policies and funding mechanisms - such as those promoting digital, green, and entrepreneurial skills.

Adaptability to Evolving Standards

Finally, by anchoring recognition processes in the outcome-based EQF model, the framework remains adaptable to future developments in both European education policy and the AgriTech sector. This ensures ongoing relevance for learners, employers, and institutions, and supports long-term sectoral competitiveness.

The rigorous mapping of AgriTech Manager competencies to EQF levels enables transparent, equitable, and internationally meaningful recognition - empowering individuals to advance their careers and supporting workforce development across the European and global agri-food systems.

5.3.8. Review and Updating of EQF Mapping

As the AgriTech sector and educational landscapes continue to evolve, the relevance and effectiveness of the AgriTech Manager Competency Framework depend on its capacity for regular review and dynamic updating. The commitment to ongoing evaluation ensures that the framework remains aligned with emerging technologies, industry needs, learner experiences, and European policy developments.

Practical Experiences Informing Review

Real-world scenarios from partner countries regularly provide essential feedback, helping to refine and update the EQF mapping:

- **Recognition of Prior Learning (RPL) in Romania**

A farm operations manager in Romania with more than ten years of professional experience prepares a portfolio aligned with Level 5 and 6 competencies. After institutional assessment, the manager is granted direct entry into a Level 7 AgriTech management program, demonstrating how the framework supports advanced progression without unnecessary repetition of previously acquired skills.

- **International Credit Transfer between Hungary and Romania**

A student completes several EQF Level 6 modules - such as “Digital Tools for Smart Farming” and “Sustainable Food Chains” - at a Hungarian VET institution. Later transferring to a Romanian university, the student’s credits are recognized and accepted without additional assessment, showcasing the framework’s capacity to support academic mobility and mutual recognition within the project partnership.

- **Validation of Non-formal Learning in Hungary**

An employee at a Hungarian agri-food company accumulates micro-credentials from industry short courses on blockchain-enabled traceability and precision irrigation. These are mapped to specific EQF Level 5 and 6 competencies and, following validation by a national sector body, are counted toward a formal diploma, underscoring the framework’s adaptability for modular and lifelong learning.

These concrete scenarios highlight the importance of ongoing review, user engagement, and cross-border cooperation in keeping the EQF mapping responsive to real needs and new learning contexts.



Structured Review and Update Process

To maintain the AGRITECH Competency Framework's quality, credibility, and future relevance, the following structured mechanisms are in place for review and updating:

- 1. Continuous Stakeholder Engagement:** Feedback is systematically gathered from learners, graduates, employers, education providers, accreditation agencies (including ACQUIN), and sector experts through regular surveys, focus groups, curriculum workshops, and accreditation reviews. Real-world experiences - such as those described above - are treated as key inputs for identifying emerging needs and gaps.
- 2. Monitoring Sector and Policy Trends:** The review process includes proactive scanning of new developments in agricultural technology, European and national education policy, quality assurance standards, and labor market trends. This allows timely updates in response to regulatory changes, shifts in competency requirements, or advances in digital and green skills.
- 3. Regular Scheduled Updates:** The framework and its EQF mapping are formally reviewed and revised on a scheduled basis (typically every two to three years), with provisions for interim updates as needed in response to urgent or significant feedback.
- 4. Transparent Documentation:** All revisions - ranging from minor clarifications to major restructurings - are fully documented. Rationales for each change are published and made accessible to all stakeholders, supporting transparency and institutional memory.
- 5. International Benchmarking:** The AGRITECH framework is regularly compared with other sectoral, national, and European competency models to ensure continued compatibility, innovation, and adherence to best practices. This benchmarking reinforces the framework's value for international mobility and recognition.

Commitment to Adaptability and Excellence

By embedding ongoing review and adaptation at the core of the EQF mapping process, the AGRITECH project ensures that the Competency Framework remains a living, relevant, and forward-looking tool. This approach secures the trust of learners, education providers, employers, and accreditation bodies, positioning AGRITECH as a model for dynamic, high-quality workforce development in the evolving European agri-food and technology sectors.

5.4. Competency Descriptions and Proficiency Levels

The effectiveness of the AgriTech Manager Competency Framework relies on the clarity and precision with which each competency is defined and operationalized across levels of proficiency. This section translates the core domains into specific, actionable competency statements, and articulates what achievement looks like at different stages of professional development. By explicitly linking each competency to progressive proficiency levels - aligned with the EQF and real sector needs - the framework ensures transparency for learners, educators, and employers, and provides a practical basis for curriculum design, assessment, and recognition of learning in both VET and HEI contexts.

5.4.1. Explanation of Proficiency Levels and Their Alignment with EQF

The proficiency levels used in the AgriTech Manager Competency Framework are directly aligned with the European Qualifications Framework (EQF), ensuring that each stage of competence corresponds



to recognized European standards for knowledge, skills, and responsibility. This alignment guarantees that learners’ achievements are comparable and transferable across countries, sectors, and educational pathways.

Structure of Proficiency Levels

For each core competency, three main proficiency levels are defined:

- **Foundation (EQF Level 5)** - At this stage, individuals demonstrate applied knowledge and practical skills within established parameters, typically in familiar contexts. Learners are capable of performing routine tasks independently and supporting more complex activities under supervision. Responsibility is limited to well-defined processes and tasks.
- **Intermediate (EQF Level 6)** - Here, learners exhibit comprehensive and integrative knowledge, independently analyze and solve complex problems, and apply advanced skills across varied and sometimes unpredictable situations. They are able to manage projects, take initiative, and assume responsibility for the work of others, including training or supervising peers.
- **Advanced/Expert (EQF Level 7)** - At the highest relevant level, individuals possess highly specialized and critical knowledge, and demonstrate innovation, leadership, and strategic thinking. They lead teams or organizations, design and implement novel solutions, and take full responsibility for complex decision-making and ongoing professional development within their field.

Key Dimensions at Each Level:

- **Knowledge:** Breadth, depth, and integration of concepts and theory.
- **Skills:** Complexity and independence in the application, analysis, and creation of solutions.
- **Responsibility/Autonomy:** Scope of leadership, supervision, and accountability for outcomes.

This structured approach enables both vertical progression (from foundation to expert) and horizontal comparability across competency domains, supporting transparent assessment, modular learning, and credit transfer in VET and HEI systems.

5.4.2. Technical and Digital Skills: Competency Descriptions and Proficiency Levels

Technical and digital skills are foundational for the AgriTech Manager role, evolving from operational proficiency with digital tools to leadership in technology-driven transformation. The following table describes core competencies within this domain, showing the expectations at each proficiency level and providing practical benchmarks for curriculum and assessment.

Competency	Foundation (EQF 5)	Intermediate (EQF 6)	Advanced/Expert (EQF 7)
Operate Digital Precision Tools	Use digital sensors, IoT devices, and basic farm management software in daily operations, following established protocols.	Independently configure, adapt, and troubleshoot a variety of digital tools and systems in diverse agricultural settings.	Evaluate, select, and lead adoption of advanced digital systems, integrating new technologies across organizational processes.
Data Analysis for Decision Making	Collect, record, and interpret basic data sets (e.g., soil moisture, weather, yield) to support operational tasks.	Analyze complex, multi-source data to inform farm or business decisions; present findings to peers and management.	Design data-driven strategies, apply advanced analytics or AI, and drive continuous improvement through evidence-based innovation.



Digital Communication and Collaboration	Use standard digital platforms (email, messaging apps, basic cloud tools) to communicate and share information with colleagues.	Coordinate remote teams, utilize collaborative project management tools, and ensure digital information flows across teams.	Lead digital transformation in communication and collaboration, establish digital policies, and manage complex, distributed teams.
Cybersecurity and Data Protection	Follow basic data protection protocols; recognize potential risks in routine digital tool use.	Implement organizational data security measures, train others in good practices, and respond to incidents.	Develop and enforce strategic cybersecurity policies, ensure regulatory compliance, and assess emerging threats.
Awareness of Emerging Technologies (e.g., Blockchain, AI)	Demonstrate awareness of new technologies and their potential applications in agriculture.	Evaluate feasibility and pilot innovative digital solutions in specific contexts (e.g., blockchain for traceability).	Lead organizational innovation by integrating and scaling emerging digital solutions sector-wide.

Table 8. Technical and Digital Skills: Competency Descriptions and Proficiency Levels

Note: Each level builds upon the last, moving from practical application under supervision to independent adaptation, and ultimately to innovation leadership and strategic integration.

These descriptions clarify how technical and digital competencies are expected to mature as AgriTech Managers advance in their careers. The progression from routine use to independent problem-solving and finally to strategic leadership not only reflects sectoral demands but also ensures that learning, assessment, and professional development remain transparent and actionable at every stage. This approach enables education providers and employers to target skills gaps, support tailored upskilling, and build organizational capacity for digital transformation in agriculture.

5.4.3. Business and Entrepreneurial Skills: Competency Descriptions and Proficiency Levels

Business and entrepreneurial skills enable AgriTech Managers to navigate evolving markets, lead innovation, and drive sustainable value creation. The following table details core competencies in this domain and articulates the progression of proficiency from practical support roles to strategic leadership.

Competency	Foundation (EQF 5)	Intermediate (EQF 6)	Advanced/Expert (EQF 7)
Business Model Adaptation and Development	Support updates to existing business processes and models under guidance.	Design, implement, and evaluate new business models to respond to sector trends.	Lead strategic innovation, anticipate disruption, and drive organization-wide change.
Financial Management and Investment Appraisal	Assist with routine budgeting and financial record-keeping.	Prepare financial analyses, develop business cases, and assess ROI for new projects.	Oversee complex financial strategy, secure funding, and manage investment portfolios.
Project Management	Contribute to project planning and monitoring in support roles.	Independently manage project timelines, resources, and cross-functional teams.	Lead multiple or complex projects, manage risk, and ensure strategic alignment.
Market and Opportunity Analysis	Gather and report basic market data; recognize customer needs.	Conduct detailed market analysis and identify new business opportunities.	Lead market entry or diversification strategies, and build strategic partnerships.
Entrepreneurial and Intrapreneurial Initiative	Participate in small-scale innovation or process improvement activities.	Initiate and drive new ventures or intrapreneurial projects within the organization.	Foster a culture of entrepreneurship, mentor others, and scale innovation initiatives.



Leveraging Emerging Technologies for Business Value	Demonstrate awareness of digital innovations impacting business models (e.g., blockchain for transparency).	Evaluate and pilot technology-driven business solutions for increased efficiency and value.	Integrate disruptive technologies into core business strategy and lead organizational adaptation.
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Table 9. Business and Entrepreneurial Skills: Competency Descriptions and Proficiency Levels

The progression of business and entrepreneurial skills in this framework ensures that AgriTech Managers develop not only operational and analytical expertise but also the vision and leadership capacity to create new value in a rapidly changing sector. By defining clear expectations at each level, the framework supports targeted training, effective succession planning, and a dynamic culture of innovation throughout the agri-food value chain.

5.4.4. Sustainability and Green Competencies: Competency Descriptions and Proficiency Levels

Sustainability and green competencies are essential for AgriTech Managers, reflecting the sector’s shift toward ecological responsibility, regulatory compliance, and market-driven sustainability demands. The table below defines key competencies and how proficiency is expected to develop at each EQF level.

Competency	Foundation (EQF 5)	Intermediate (EQF 6)	Advanced/Expert (EQF 7)
Sustainable Resource Management	Apply established practices to optimize use of water, soil, and inputs.	Analyze resource efficiency, implement improvements, and monitor environmental impact.	Design and lead integrated sustainability strategies at the organizational or sectoral level.
Climate Adaptation and Mitigation	Follow climate-resilient protocols and support adaptation measures in operations.	Evaluate risks/opportunities, implement adaptation and mitigation projects.	Lead and advocate for climate-smart agriculture, influence policy and industry standards.
Compliance with Environmental Standards	Ensure day-to-day activities adhere to existing environmental regulations.	Manage certification processes (e.g., organic, IPM), and prepare compliance reports.	Oversee multi-site or value chain certification, advise on new or emerging standards.
Circular Economy and Waste Management	Participate in on-farm waste reduction and recycling initiatives.	Develop and coordinate circular economy projects (e.g., nutrient cycling, bioenergy).	Champion sector-wide circular economy models, evaluate and scale successful innovations.
Stakeholder Engagement for Sustainability	Communicate sustainability practices to team members and support basic outreach.	Facilitate multi-stakeholder sustainability projects and partnerships.	Build networks, advocate for sustainability across organizations and value chains.

Table 10. Sustainability and Green Competencies: Competency Descriptions and Proficiency Levels

This progression framework equips AgriTech Managers to move from competent application of sustainable practices to critical evaluation and, ultimately, sectoral leadership in sustainability and green innovation. By clarifying expectations at each stage, it supports focused learning, targeted professional development, and robust assessment of sustainability performance in both VET and HEI contexts.

5.4.5. Policy, Regulation, and Compliance: Competency Descriptions and Proficiency Levels

Policy, regulation, and compliance skills are essential for AgriTech Managers to navigate a landscape shaped by evolving rules, standards, and stakeholder expectations. The table below sets out core competencies in this domain and articulates how proficiency is expected to grow through the levels.



Competency	Foundation (EQF 5)	Intermediate (EQF 6)	Advanced/Expert (EQF 7)
Regulatory Interpretation and Application	Apply established policies and regulations to daily operations.	Analyze and implement new or changing regulatory requirements in practice.	Interpret complex policy environments, anticipate regulatory shifts, and advise leadership.
Compliance Process Management	Maintain accurate records, assist with compliance checks, and follow audit procedures.	Coordinate compliance audits, develop reporting systems, and manage documentation.	Lead organization-wide compliance strategies, oversee risk management and internal controls.
Digital and Data Compliance	Follow basic data protection protocols in digital systems and report potential breaches.	Implement organization-wide data protection, ensure GDPR and sectoral compliance.	Develop and enforce advanced digital compliance policies, engage with external regulators.
Certification and Standardization	Support the process of obtaining or maintaining required certifications.	Manage the process for multiple certifications and liaise with certifying bodies.	Advise on and influence adoption of new standards, represent organization in external audits.
Policy Advocacy and Stakeholder Engagement	Participate in team discussions on regulatory changes and communicate updates.	Engage with stakeholders (e.g., authorities, industry groups) to clarify impacts.	Lead advocacy efforts, represent organization in policy development forums, shape sectoral responses.

Table 11. Policy, Regulation, and Compliance: Competency Descriptions and Proficiency Levels

This progression allows AgriTech Managers to build from compliance with established procedures to proactive engagement with regulatory changes and, ultimately, to sectoral leadership in policy and compliance. The framework ensures that managers are prepared to navigate complexity, drive continuous improvement, and uphold trust with stakeholders in a highly regulated and dynamic sector.

5.4.6. Soft Skills and Leadership: Competency Descriptions and Proficiency Levels

Soft skills and leadership competencies enable AgriTech Managers to communicate effectively, lead teams, foster innovation, and manage change - capabilities that are crucial for both daily operations and long-term sectoral transformation. The following table illustrates how proficiency in these areas progresses across levels.

Competency	Foundation (EQF 5)	Intermediate (EQF 6)	Advanced/Expert (EQF 7)
Communication and Collaboration	Communicate clearly with team members and stakeholders in routine situations.	Facilitate group discussions, manage conflicts, and adapt communication to diverse audiences.	Lead multi-stakeholder teams, inspire others, and communicate complex ideas persuasively.
Teamwork and Relationship Building	Participate actively in team tasks, support colleagues, and respect diversity.	Build effective working relationships, mentor peers, and coordinate collaborative projects.	Shape organizational culture, foster inclusive environments, and sustain networks across organizations.
Problem-solving and Critical Thinking	Apply standard problem-solving approaches to address immediate challenges.	Analyze complex issues, propose solutions, and make decisions in ambiguous contexts.	Anticipate emerging challenges, lead creative problem-solving, and drive continuous improvement.
Adaptability and Change Management	Respond positively to change and adapt to new tasks or technologies.	Support team adaptation, facilitate training, and contribute to change initiatives.	Lead organizational change, manage uncertainty, and champion innovation at scale.



Ethical and Responsible Leadership	Demonstrate integrity, follow ethical guidelines, and uphold organizational values.	Model ethical behavior, mediate disputes, and promote accountability.	Set ethical standards, resolve complex ethical dilemmas, and act as a role model for the sector.
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Table 12. Soft Skills and Leadership: Competency Descriptions and Proficiency Levels

By articulating the progression of soft skills and leadership competencies, the framework ensures that AgriTech Managers are not only capable of managing tasks but are equipped to inspire teams, navigate complexity, and drive organizational and sectoral success. These skills support adaptability, resilience, and long-term impact in an industry defined by rapid change and increasing stakeholder expectations.

The structured competency descriptions and proficiency levels presented in this section transform the AgriTech Manager Competency Framework from a conceptual model into a practical tool for education, assessment, and professional development. By articulating clear expectations for knowledge, skills, and responsibility across each domain and mapped to EQF standards, the framework empowers curriculum designers, educators, employers, and learners to set measurable goals, address real sector needs, and track progression from foundational to advanced expertise. This clarity not only enhances the quality and comparability of AgriTech training across Europe but also fosters a culture of continuous improvement, adaptability, and excellence - ensuring that AgriTech Managers are equipped to lead in a sector marked by rapid innovation and complex challenges.

5.4.7. Practical Use Case: National Qualification Recognition

The comprehensive competence profiles and skill matrices outlined in this section are designed to support the formal recognition of the Agritech Manager profile within national or sectoral qualification frameworks across Europe. The structure and level of detail provided are aligned with standard requirements for qualification descriptions and can serve as a direct resource for preparing official submissions or “birth certificates” for new qualifications.

Partners and stakeholders are encouraged to adapt the content presented here to fit the requirements and templates of their respective national qualification authorities. For reference, relevant systems in AGRITECH pilot and partner countries include:

- **Czechia:** National Register of Qualifications (NSK) (www.narodnikvalifikace.cz) [link](#)
- **Romania:** National Register of Qualifications (RNC, RNCIS) (www.anc.edu.ro) [link](#)
- **Greece:** National Qualifications Registry / Hellenic Qualifications Framework (HNQF, ΕΟΠΠΕΠ) (www.eoppep.gr) [link](#)
- **Hungary:** Hungarian Qualifications Framework (HuQF/MKKR), sectoral registers (www.nive.hu) [link](#)
- **Italy:** National Qualifications Framework (QNQ), Regional Repertories (www.inapp.org/it/eqf-italia) [link](#)
- **Cyprus:** Cyprus National Qualifications Framework (CyQF), National Register (www.anad.org.cy) [link](#)

By leveraging the structured competence descriptors and task matrices provided in this section, partners can accelerate the recognition process for the Agritech Manager profile across a variety of educational and vocational contexts. This supports both national adaptation and cross-border transparency, strengthening the wider impact and transferability of the AGRITECH approach.



5.5. Role Profiles and Career Progression Paths

The practical value of the AgriTech Manager Competency Framework is most evident when it is connected directly to real job roles and transparent career pathways within the agri-food sector. This section illustrates how the defined competencies and proficiency levels underpin a variety of role profiles, from entry-level management to senior strategic positions, and how individuals can progress both vertically and horizontally as their expertise grows. By mapping competencies to evolving career trajectories, the framework provides clear guidance for learners, educators, and employers alike - supporting effective workforce planning, lifelong learning, and professional mobility in an increasingly complex and technology-driven landscape.

5.5.1. Definition of Role Profiles

A role profile is a structured outline that defines the main functions, responsibilities, and required competencies for a specific position or type of job within the AgriTech sector. Unlike a traditional job description, a role profile developed through this framework is anchored in the mapped competencies and proficiency levels defined in earlier chapters, ensuring consistency with European (EQF) standards and clarity for all stakeholders.

Each role profile typically includes:

- **Job Title(s):** The common names for this type of role across organizations or countries (e.g., “Junior AgriTech Manager,” “Digital Agriculture Specialist,” “Innovation Lead”).
- **Main Responsibilities:** Key tasks and areas of responsibility expected in the role - such as managing technology adoption, overseeing compliance, leading teams, or driving sustainability initiatives.
- **Required Competency Domains and Proficiency Levels:** The specific domains (technical, business, sustainability, policy, leadership) and the minimum EQF level of proficiency required for effective performance.
- **Typical Sector/Organizational Context:** Where this role is found (e.g., agri-food enterprise, tech startup, advisory body, research institute).
- **Illustrative Scenario (optional):** A brief, realistic vignette showing what the role looks like in practice.

Example:

A “Digital Agriculture Specialist” role profile might specify:

- **Job Title:** *Digital Agriculture Specialist (or Junior AgriTech Manager)*
- **Main Responsibilities:** Implement digital tools for farm operations; collect and analyze sensor data; support training of farm staff; report on digital innovation outcomes.
- **Required Competency Domains/Levels:** Technical and Digital Skills (EQF 5–6), Basic Business Skills (EQF 5), Soft Skills and Collaboration (EQF 5–6).
- **Context:** Mid-size commercial farm or agri-tech consultancy.
- **Illustrative Scenario:** Maria, a recent graduate, works with a farm team to set up IoT sensors in fields, interprets real-time data to optimize irrigation, and presents results to the farm manager and visiting agri-tech advisors.



By grounding each profile in mapped competencies and levels, the framework makes clear what is expected for success, how to prepare for advancement, and what learning or development may be needed to progress to the next stage.

5.5.2. Sample Role Profiles

To illustrate how the mapped competencies and proficiency levels translate into real positions within the AgriTech sector, this section presents several sample role profiles. Each example outlines typical responsibilities, required domains and levels of competence, and a practical scenario that reflects the everyday realities of AgriTech management. These profiles help clarify expectations for both professionals and employers at different stages of a career pathway.

1. Junior AgriTech Manager / Digital Agriculture Specialist *EQF Level: 5–6*

Typical Responsibilities:

- Implement digital tools (e.g., sensors, farm management software) for operational processes
- Collect and analyze data to support precision agriculture
- Support basic training of staff in digital technologies
- Report on outcomes and challenges to supervisors

Required Competency Domains:

- Technical and Digital Skills (Foundation–Intermediate)
- Business and Entrepreneurial Skills (Foundation)
- Soft Skills and Leadership (Foundation–Intermediate)

Sector/Organizational Context:

- Medium-sized farms, tech-enabled cooperatives, agri-food consultancies

Illustrative Scenario: Vasile, in Romania, is responsible for deploying a new soil moisture sensor network. He follows established protocols, monitors data daily, and troubleshoots minor connectivity issues, escalating more complex problems to a senior manager. He also helps train new staff on basic digital tool usage.

2. AgriTech Project Leader / Innovation Coordinator *EQF Level: 6–7*

Typical Responsibilities:

- Lead cross-functional teams on digital innovation or sustainability projects
- Analyze and present data for decision support at management level
- Develop and manage project budgets and timelines
- Liaise with external partners, certification bodies, and regulatory agencies

Required Competency Domains:

- Technical and Digital Skills (Intermediate–Advanced)
- Business and Entrepreneurial Skills (Intermediate–Advanced)
- Sustainability and Green Competencies (Intermediate–Advanced)
- Policy, Regulation, and Compliance (Intermediate)
- Soft Skills and Leadership (Intermediate–Advanced)

Sector/Organizational Context:

- Large agri-food enterprises, technology start-ups, advisory services, international project consortia



Illustrative Scenario: Maria, in Greece, coordinates the adoption of a blockchain-based traceability system for a vegetable export cooperative. She leads the project team, communicates regularly with IT vendors and external auditors, manages certification processes, and delivers progress reports to senior management.

3. Senior/Strategic AgriTech Manager / Innovation Director *EQF Level: 7*

Typical Responsibilities:

- Define and drive the digital transformation or sustainability strategy for the organization
- Oversee multi-site or sectoral innovation initiatives
- Engage with policymakers, industry groups, and cross-border partners
- Lead organizational change, mentor future leaders, and set ethical and sustainability standards

Required Competency Domains:

- All five domains at Advanced/Expert level, with particular emphasis on leadership, policy, and strategic business skills

Sector/Organizational Context:

- Agri-food multinationals, major producer organizations, research institutes, international agencies

Illustrative Scenario: Katalin, as Innovation Director for a Hungarian agri-food group, develops and implements the company's sector-wide digital transformation agenda. She leads a network of managers and technical experts, represents the organization at EU policy forums, and champions the scaling of successful innovations across multiple business units and countries.

These profiles demonstrate the progression from operational roles to strategic leadership, showing how mapped competencies and proficiency levels translate into meaningful, real-world career opportunities in AgriTech.

5.5.3. Career Progression Paths

The AGRITECH Competency Framework not only clarifies requirements for specific roles, but also maps out flexible and transparent career progression pathways for AgriTech professionals. These pathways support both **vertical advancement** - from entry-level or technical positions to intermediate management and ultimately to senior strategic roles - and **horizontal mobility** - enabling movement into new domains or specializations as individual interests and sector needs evolve.

Vertical Progression: Professionals may advance from operational roles (such as Digital Agriculture Specialist or Junior AgriTech Manager) through intermediate leadership positions (e.g., Project Leader, Innovation Coordinator) to senior and strategic roles (such as Innovation Director or Sustainability Lead). At each stage, higher EQF levels and more complex, integrative competencies are required, reflecting the progression from practical expertise to organizational and sectoral leadership.

Horizontal Mobility: The framework also recognizes and supports lateral movement between roles at similar EQF levels. For example, an individual might move from a technical focus in digital operations to sustainability management, regulatory affairs, or business innovation. This flexibility is critical for responding to evolving sectoral priorities, emerging technologies, or personal career ambitions.

Flexible, Modular, and International Pathways: Because the framework is modular and EQF-mapped, career progression is not limited to a single, linear track. Learners can build on prior experience, stack micro-credentials, and enter or re-enter at multiple points. International and cross-sector mobility is



supported through alignment with the EQF and mutual recognition of mapped competencies in partner countries such as Hungary and Romania. This enables professionals to move seamlessly between roles, organizations, and even countries as opportunities arise.

Suggested Visual (for report/annex): A diagram illustrating vertical and horizontal career progression, entry and re-entry points, and pathways supported by micro-credentials and Recognition of Prior Learning.

This approach empowers individuals to shape their own development, enables employers to build adaptable teams, and ensures the sector remains responsive and competitive in a rapidly changing landscape.

5.5.4. Link to Lifelong Learning and Recognition

The AGRITECH Competency Framework is intentionally designed to support lifelong learning and recognition of diverse learning pathways. By mapping competencies to EQF levels and providing clear descriptors for each proficiency stage, the framework makes it possible for professionals to re-enter education at any point, have prior learning and experience formally recognized, and accumulate credits through modular, micro-credential-based learning. This flexibility is vital for supporting upskilling, reskilling, and career mobility - both vertically and horizontally - across the agri-food and technology sectors. The framework's structure also enables employers, professional bodies, and educational institutions to validate and recognize informal and non-formal learning, further empowering individuals to chart personalized, adaptive career trajectories.

5.6. AGRITECH MANAGER PROFILES: ESCO COMPETENCY FRAMEWORK ALIGNMENT

Profiles for VET, Bachelor, and Master Educational Pathways

This subchapter defines the AgriTech Manager role at three education levels, in alignment with the ESCO (European Skills, Competences, Qualifications and Occupations) framework. These profiles support training providers, employers, and students to understand the expectations and opportunities at each stage.

A. AGRITECH MANAGER – VET LEVEL

Job title - JUNIOR AGRITECH MANAGER / DIGITAL AGRICULTURE TECHNICIAN

Job overview - Supports the implementation and operation of digital and automated technologies on farms and in agri-businesses. Acts as a practical technologist in the field - setting up, troubleshooting, and maintaining equipment and supporting colleagues with technology adoption.

Recommended entry requirements:

- Completed upper secondary education (**EQF 4**)
- Basic digital literacy
- Motivation to work in agriculture and technology

Target groups (including ESCO classification linked profiles):

- Young people entering the workforce
- Existing farm workers seeking reskilling
- Relevant ESCO profiles:
 - Agricultural technician



- Farm machinery operator
- ICT user support technician

Workplace requirements:

- Farms, greenhouses, agri-businesses, cooperatives
- Regular fieldwork and hands-on tech use
- Basic computer workstation

Daily routines:

- Operate and maintain digital equipment (e.g., sensors, automated irrigation)
- Record and manage operational data
- Support farm staff in using digital tools
- Report technical issues and propose basic solutions

Employment opportunities:

- Large farms, agri-food companies, cooperatives
- Agricultural services providers
- Entry-level technical support roles

Requirements for training providers:

- Access to demo farms, equipment, and basic digital tools
- Trainers experienced in agricultural technology
- Work-based learning (apprenticeships, field placements)

B. AGRITECH MANAGER – BACHELOR LEVEL

Job title - AGRITECH MANAGER / DIGITAL AGRICULTURE COORDINATOR

Job overview - Coordinates the integration and management of digital technologies in agricultural production and supply chains. Optimizes farm or business operations through the use of data, digital tools, and cross-disciplinary teamwork.

Recommended entry requirements:

- Completed upper secondary education (**EQF 4**)
- Eligibility for Bachelor's studies (per national rules)
- Interest in agriculture, environment, and technology

Target groups (including ESCO classification linked profiles):

- Recent school graduates entering Bachelor programs
- Students in agriculture, biology, environment, engineering, or ICT
- Relevant ESCO profiles:
 - Agricultural production manager
 - Precision agriculture technician
 - ICT business analyst (in agri-food)

Workplace requirements:

- Combination of office and field environments
- Digital platforms, management software, and field technology
- Collaboration with suppliers, farm staff, and external partners

Daily routines:

- Analyze operational and environmental data to inform decisions
- Oversee deployment of digital solutions and staff training
- Manage budgets, schedules, and technical teams



- Coordinate sustainability, traceability, and compliance efforts
- Liaise with researchers, tech providers, and industry partners

Employment opportunities:

- Farm enterprises, agri-food companies, cooperatives
- Agri-tech vendors and service providers
- Advisory and consulting firms
- Research and innovation pilot farms

Requirements for training providers:

- Qualified educators with both agricultural and digital expertise
- Digital labs, simulation environments, and practical project work
- Collaboration with agri-business for real-world case studies

C. AGRITECH MANAGER – MASTER LEVEL

Job title - SENIOR AGRITECH MANAGER / AGRITECH INNOVATION STRATEGIST

Job overview - Leads innovation and strategy for digital transformation in agri-food organizations. Designs, implements, and evaluates advanced digital solutions; drives change management; and shapes sectoral policy and organizational roadmaps.

Recommended entry requirements:

- Bachelor's degree (**EQF 6**) in a relevant field
- Eligibility for Master's studies (per national rules)
- Motivation for leadership, innovation, and digital transformation

Target groups (including ESCO classification linked profiles):

- Bachelor graduates seeking specialization
- Professionals aiming for leadership in digital agriculture
- Relevant ESCO profiles:
 - Senior agricultural production manager
 - Research and development manager
 - Policy adviser (agri-digitalization)

Workplace requirements:

- Leadership positions in agri-enterprises, R&D, government, or consulting
- Access to advanced digital and analytic tools
- Interdisciplinary teams and international collaboration

Daily routines:

- Develop and implement digital innovation strategies
- Lead large-scale projects and multidisciplinary teams
- Liaise with stakeholders, policymakers, and tech developers
- Oversee evaluation and scaling of digital transformation initiatives
- Represent organization at national/international level

Employment opportunities:

- Agri-food multinationals, large-scale enterprises
- Research institutes and universities
- Government agencies and NGOs
- Consulting and technology firms

Requirements for training providers:



- Faculty with strong academic and industry track record
- Research infrastructure, advanced analytics, and innovation labs
- Project-based learning, international exchanges, and collaboration with industry

The recommended entry requirements for participation in AGRITECH Manager training are intentionally kept flexible and inclusive. Upon completion of the training, participants will be granted microcredentials (microcredits and microcertificates). These recognition mechanisms are designed to be open-access and do not imply any formal prerequisites, thereby supporting broad participation and enabling a wide range of learners - regardless of their prior qualifications - to develop new skills and receive European-recognized validation for their achievements.

Chapter 5 has detailed how the AGRITECH Manager Competency Framework translates broad sectoral requirements into actionable, transparent structures for workforce development. By mapping competencies to EQF levels, articulating clear proficiency descriptors, and illustrating real-world roles and career progression, the framework offers a practical tool for learners, educators, employers, and accreditation bodies. Its commitment to flexibility, lifelong learning, and recognition of all forms of learning ensures its ongoing relevance in a rapidly changing landscape. Ultimately, this framework not only sets a benchmark for AgriTech management excellence, but also builds a foundation for resilient, innovative, and future-ready agri-food systems across Europe.



6. IMPLEMENTATION GUIDELINES

AgriTech Manager Competency Framework marks a shift in how institutions can prepare learners for emerging roles at the intersection of agriculture, technology, and management. However, the true value of the framework is realized only when it is thoughtfully embedded within actual programs - whether in higher education or vocational training.

Integrating such a framework is rarely a linear or prescriptive process. Instead, it unfolds within the realities of each institution: shaped by existing strengths, gaps, traditions, and the practicalities of academic calendars and resource constraints. At its core, integration is both a technical and a cultural undertaking. It asks educators, curriculum designers, and industry partners to re-examine how learning is structured, where real innovation happens, and how students' journeys can become more adaptive and future-focused.

What follows are a set of observations and recommendations drawn from stakeholder consultation, pilot testing, and the lived experience of project partners. They are not meant as a checklist, but as a set of prompts and possibilities - describing how HEIs and VET providers might approach the work of bringing the framework to life in their own settings.

6.1. Recommendations for Integrating Framework into Curricula (HEI & VET)

The process of weaving the AgriTech Manager Competency Framework into higher education and vocational curricula is, in many ways, less about starting from scratch and more about realigning what already exists with a new set of reference points. It's an exercise in translation and adaptation - sometimes subtle, sometimes transformative.

1 Mapping Existing Landscapes

For most institutions, the starting point isn't a blank slate. Instead, the existing curriculum represents years of development, debate, and incremental change. In this context, the introduction of the AgriTech Manager framework is best understood as an opportunity to look closely at what's already being taught - and to what end. Faculty, curriculum designers, and (where possible) representatives from industry gather around syllabi, course maps, and module guides, sometimes literally with highlighters in hand. The process can feel surprisingly investigative: "Where, if anywhere, are we already addressing digital agriculture, or sustainability, or leadership in tech-driven environments?" "Which skills have we assumed students are picking up, but haven't actually made explicit?"

Often, some areas of the framework map neatly onto existing modules - perhaps a data analysis class covers much of what's needed for digital agriculture, or a project management module can be reframed with sector-specific examples. Other areas reveal gaps: maybe there's nothing on blockchain, or the 'green skills' piece is scattered or absent. These gaps aren't failures; they're starting points for focused development, rather than wholesale reinvention.

To ensure that the AGRITECH Manager Framework reflects international best practice and is forward-looking, we systematically benchmarked six leading competency models from both agricultural and



adjacent industries. These models served as valuable references, informing our approach and highlighting key trends, skills, and methodologies relevant for a modern AgriTech curriculum:

- **The Agriculture & Precision Farming Competency Model (U.S. DOL/NIFA)** provided a reference for tiered skill progression and the integration of digital, data-driven, and sustainability competences. While developing our own new framework, we considered how such multi-level structures support lifelong learning in rapidly evolving fields.
- **Smart Manufacturing & Industry 4.0 (Manufacturing Institute/NAM)** offered examples of how real-time data, automation, digital twins, and robotics are structured within workforce development. These elements helped us identify key digital transformation trends and best practices for technology leadership in agriculture and food production.
- **The SFIA Digital Transformation & IT Framework** guided our thinking about dynamic digital skills, agile methodologies, and continuous upskilling. It served as a benchmark for mapping essential IT and data competences into the AgriTech context, highlighting the need for adaptability and cybersecurity awareness.
- **Sustainable Development & Green Skills Frameworks (UN SDGs, ILO)** illustrated how circular economy, green entrepreneurship, and climate-smart practices can be woven throughout learning pathways. This supported our aim to embed sustainability and policy alignment as cross-cutting themes in the new profile.
- **The Entrepreneurship & Innovation Model (EntreComp)** provided a model for entrepreneurial mindset, opportunity recognition, and business innovation. It helped inform how entrepreneurial skills and cross-sectoral leadership could be emphasized for AgriTech managers.
- **Food & Agribusiness Management Models (AIAEE, EAFCC, FAO)** demonstrated the importance of integrating digital supply chains, blockchain for traceability, regulatory awareness, and market analytics. These insights supported the broadening of our profile to include key business and food system competences.
- Through this benchmarking and comparative analysis, the AGRITECH Framework benefits by:
- **Ensuring modular, stackable, and adaptive learning structures;**
- **Reflecting real-world, sector-transcending best practices and innovation;**
- **Guaranteeing comprehensive coverage of digital, green, business, and food system competences for HEI and VET;**
- **Equipping future AgriTech managers with the vision and flexibility needed to lead digital and sustainable transformation.**



Model Name & Source	Key Features & Relevance	Key Insights/Best Practices Identified	How Insights Informed AGRITECH Framework
1. Agriculture & Precision Farming Competency Model U.S. Department of Labor (NIFA)	Tiered digital & sustainability competences; integration of tech and business; focus on lifelong learning	Structured skill progression, best practices in data-driven and sustainable agriculture	Highlighted the value of multi-level competence progression and integration of digital and sustainability skills as we built the AGRITECH Manager profile
2. Smart Manufacturing & Industry 4.0 Competency Model Manufacturing Institute, NAM	Automation, IoT, robotics, real-time data, digital twin concepts; modular upskilling pathways	Digital transformation trends, modular learning, tech leadership	Served as a benchmark for identifying relevant digitalization and automation skills for AgriTech and reinforced the importance of adaptable, modular learning pathways
3. Digital Transformation & IT Competency Framework (SFIA) Skills Framework for the Information Age	Globally recognized IT skills; agile, adaptive, and cross-sectoral learning emphasis	Continuous digital upskilling, agile/DevOps, cybersecurity, role mapping	Informed the mapping of digital and IT competences into AgriTech and emphasized the need for adaptability and lifelong learning structures
4. Sustainable Development & Green Skills Framework UN SDGs, ILO	Policy alignment (SDGs, EU Green Deal); green entrepreneurship; circular economy	Integration of green/circular skills, climate-smart agriculture, sustainability reporting	Inspired the cross-cutting integration of sustainability, green skills, and policy awareness throughout the AGRITECH curriculum
5. Entrepreneurship & Innovation Competency Model European EntreComp	Entrepreneurial mindset; opportunity recognition; business and innovation skills	Best practices for entrepreneurship, agile business development, leadership	Provided reference points for embedding entrepreneurial mindset, innovation, and leadership development in AgriTech manager training
6. Food & Agribusiness Management Competency Model IAIAEE, EAFCC, FAO	Food supply chain/logistics; data-driven market analysis; regulatory compliance	Digital supply chains, blockchain traceability, market analytics, regulatory awareness	Supported the expansion of the AGRITECH profile to include business, food system, and traceability skills, in line with global best practice

Table 13. Competency Models from Similar Industries

A detailed comparative analysis and best-practice mapping can be found in the full report, **“Competency Models from Similar Industries”** that can provide insights and best practices applicable to the agritech sector, available on the AGRITECH website

2 Modularisation and Stackability in Practice

The concept of modularisation comes alive here. Rather than redesigning entire degree or certificate programs overnight, institutions begin experimenting with standalone modules or short courses that



explicitly align with framework competencies. A university might pilot a new elective - 'AI in Precision Farming' - that attracts both agriculture and computer science students. A VET provider, noticing an industry shift, could add a hands-on workshop in IoT sensor installation to its curriculum.

What's especially powerful is the idea that these modules can stand alone or combine in flexible ways. For learners, this opens up possibilities: stackable pathways where a digital badge, micro-credential, or certificate marks each step forward. These markers aren't just motivational - they provide real, portable evidence of achievement, which is meaningful both to employers and to the learners themselves.

To support modularisation in practice, the adoption of innovative pedagogical approaches and digital tools is strongly recommended. Teaching methods such as **gamification and serious games** can significantly enhance learner engagement by embedding interactive, scenario-based simulations into modular curricula. Additionally, using tools such as **farm simulators and virtual laboratories** can provide learners practical, hands-on experience in precision agriculture, drone technologies, IoT sensors, and other key digital competencies without requiring extensive physical infrastructure.

Collaborative methods, particularly **hackathons and team-based challenges**, can help foster practical skills and innovation-driven mindsets, directly aligning with industry needs and enhancing learner employability.

Furthermore, incorporating open-source platforms for practical skills development is encouraged. Recommended platforms include:

- **Data Analytics Tools:** RStudio, Python (via Jupyter Notebooks), Orange Data Mining.
- **Collaboration and version control:** GitHub repositories for cooperative learning and resource sharing.
- **Sandbox and Test Environments:** Google Colab, Kaggle, and cloud-based platforms such as IBM SkillsBuild or AWS Educate sandbox environments, where learners can safely experiment with real-world data and digital tools.

This approach to modularisation ensures that learners not only acquire theoretical knowledge but actively apply and practice digital agriculture competencies in realistic contexts. Further elaboration, including practical implementation guidance, detailed examples, and comprehensive methodology recommendations, will be provided in the forthcoming **D2.2 Report on Learning Ecosystem Design**.

Innovative teaching methods such as **scenario-based learning** and **foresight analysis** can be leveraged to develop soft skills and ethical judgement in future AgriTech managers. By immersing learners in realistic, complex situations - such as negotiating data-sharing agreements in over-regulated environments - these methods help participants practice ethical decision-making, empathy, and effective stakeholder communication in a safe, reflective setting.

3 Project-Based and Work-Based Learning: Bringing Context to Content

The most transformative curricular shifts often come when abstract concepts are rooted in real-world tasks. In many pilot settings, AgriTech framework adoption has taken the form of capstone projects linked to live industry challenges, internships in agri-enterprises adopting new technologies, or 'living lab' collaborations where students work alongside practitioners. Even in institutions without formal industry partnerships, project-based assignments can simulate these scenarios - using data from actual farms, case studies from partner companies, or digital tools that mirror those used in the field.

These experiences do more than check off competencies - they allow students to "inhabit" the AgriTech Manager role, navigating real decisions, constraints, and uncertainties. Over time, these approaches



can also reshape how staff view teaching and assessment, encouraging more dialogic, reflective, and practice-oriented modes.

4 Fostering Flexibility and Permeability

As the boundaries between VET and HEI become more porous, institutions find themselves negotiating new forms of collaboration. Students who complete a VET certificate in, say, smart irrigation might now see a clear route to enter a university program with advanced standing. Likewise, university graduates lacking practical skills might enroll in short, VET-style upskilling courses mapped to the same framework.

This permeability is often facilitated by “translation tools” - articulation agreements, recognition of prior learning mechanisms, shared assessment rubrics, and common digital credentialing platforms. The framework serves as a kind of bridge or shared language, allowing students and staff to navigate transitions more smoothly and transparently.

5 Iteration and Feedback: Keeping the Curriculum Alive

What distinguishes the most successful implementations is not initial enthusiasm, but a willingness to iterate. Pilot modules or courses are run with a tacit understanding that they are works in progress. Feedback comes not only from students, but from industry partners, recent alumni, and staff involved in delivery. Sometimes, what looks good on paper doesn't land in the classroom; at other times, unexpected synergies emerge, with modules cross-pollinating or sparking new collaborations.

Institutions committed to this kind of iterative process typically embed regular reviews - maybe at the end of each semester or academic year - where framework alignment, student outcomes, and employer feedback are brought into the conversation. Over time, this cycle of reflection and adjustment helps the curriculum remain relevant, agile, and genuinely responsive to a rapidly changing sector.

6 Supporting Staff with Practical Resources

Integration also depends on supporting staff with practical tools and resources. For some, this takes the form of template module descriptors, assessment guides, or sample project briefs developed by early adopters within the AGRITECH consortium. For others, it might mean professional development sessions, peer-to-peer exchanges, or access to digital platforms where resources and experiences can be shared.

Staff benefit not just from knowing “what” to do, but from seeing “how” others have done it - successes and stumbles alike. The value lies as much in the community of practice as in the documentation itself.

The integrating process of the AgriTech Manager Competency Framework into HEI and VET curricula is at once methodical and creative, grounded in existing strengths but open to ongoing change. The result is a living curriculum, able to evolve alongside the sector it serves, and always with an eye to what learners - and employers - need next.

6.2. Alignment with Certification and Accreditation Systems

Integrating the AgriTech Manager Competency Framework into educational programs is only one part of the story. For these new or adapted curricula to “count” - for students, for employers, and for the wider sector - they must also connect with recognized systems of certification and accreditation. This alignment isn't just a bureaucratic exercise; it's how the value of new learning is made visible, portable, and credible across borders and contexts.



1 Connecting Framework Competencies to Formal Qualifications

The first challenge often lies in translating the language of the framework - its skills, knowledge, and attitudes - into the structures used by national or European qualification systems. Sometimes this is straightforward: a learning outcome described at EQF Level 6, for example, can map directly onto a university's existing descriptors for bachelor-level programs. In other cases, new competencies - particularly those related to emerging technologies or green skills - may not yet be fully reflected in existing occupational standards or curricular templates.

This translation process usually involves dialogue between curriculum teams, accreditation officers, and external stakeholders. It's not uncommon for working groups to compare the new framework with the criteria used by national quality assurance agencies or sectoral bodies, looking for points of overlap, gaps, or (sometimes) points of tension. These conversations can take time, but they often lead to a clearer shared understanding of what counts as "evidence" of competence, and how it should be assessed or documented.

2 Pathways to Recognition: From Micro-credentials to Full Awards

One of the more innovative aspects of the AgriTech Manager Framework is its support for flexible, modular learning and recognition. In practice, this means that not every learner will pursue a traditional degree or diploma; some may engage with short courses, workshops, or even workplace-based training mapped to specific competencies. Here, digital badges and micro-credentials become valuable tools. When thoughtfully designed and linked to recognized standards (such as those in the European Qualifications Framework), these digital records allow learners to build up their profiles over time, stacking small achievements toward larger awards.

For institutions, this means designing not only programs, but also the mechanisms for validating, recording, and certifying incremental learning. Increasingly, quality assurance agencies and professional bodies are opening up to these new forms of recognition, though requirements and processes still vary across countries and sectors. This makes cross-institutional and cross-border cooperation essential, especially when it comes to mutual recognition of learning.

3 Accreditation and External Quality Assurance

In most contexts, any major curricular change - particularly the creation of a new qualification or the significant revision of an existing one - triggers a process of (re)accreditation. This can be daunting, especially where national frameworks are slow to adapt to new roles or skills. However, many quality assurance bodies are themselves grappling with the pace of digital and green transformation, and may be open to pilot projects or the use of supplementary documents (such as detailed competency matrices, portfolios, or employer endorsements) to evidence alignment.

External stakeholders, such as industry associations or professional certification bodies, also play a role. Their formal endorsement - or even informal validation - of a program or learning pathway can add weight to a credential, and help ensure that graduates are recognized beyond the walls of their training institution.

4 Toward International Recognition and Mobility

Ultimately, the goal is to make new competencies both visible and portable. By aligning the AgriTech Manager Framework with established systems - such as the EQF, ESCO, and Europass - learners gain credentials that are understood and valued across borders. For providers, this alignment can support participation in joint programs, student exchanges, and broader European initiatives.



The process is ongoing, and sometimes imperfect. But by foregrounding transparency, collaboration, and a willingness to iterate, institutions can ensure that new curricula do more than deliver skills - they deliver real opportunity for graduates, no matter where they go next.

5 Scenario: Issuing and Recognizing a Digital Badge for “Precision Agriculture Project Management”

Let’s imagine a VET college and a university partner to co-design a short, intensive module called “Precision Agriculture Project Management,” developed directly from the AgriTech Manager Competency Framework. Here’s how the process might unfold:

- **Co-design with Employers** - The curriculum is developed with active input from a consortium of local agribusinesses. Together, they define not just the learning outcomes - “students will be able to plan, execute, and report on a precision agriculture project” - but also the performance criteria: What does “good enough” look like, in the eyes of actual employers?
- **Learning and Assessment** - Students enroll in the module, which mixes classroom instruction, simulation exercises, and a real-world group project. For the final assessment, each team must develop a precision agriculture implementation plan for a local farm, including digital mapping, resource allocation, and an evaluation of environmental impacts.
- **Validation and Issuance** - The final project isn’t just marked by teachers. Industry partners are invited to join the assessment panel - providing feedback and signing off on the students’ competence. Once a student meets the agreed standards, the VET or university issues a digital badge using a platform like OpenBadges or Europass. The badge includes metadata: a description of the skills, the criteria met, a summary of the assessment process, and endorsements from both the education provider and the employer panel.
- **Recognition in the “Real World”** - The student adds the badge to their digital portfolio and LinkedIn profile. A local agritech company, already part of the project partnership, recognizes the badge as evidence for a junior project manager role - they’ve been part of the process, so they trust what it means. Another employer, less familiar with the badge, is able to click through to verify the issuing institution and see the assessment evidence (sometimes even the student’s project work, if made public).
- **Broader Uptake and Scaling** - If this works well - students get jobs, employers are satisfied - the practice spreads. Other companies, seeing the quality of work, begin to trust the badge as a signal of real, job-ready competence. The education providers start to use a similar model for other modules, each time working with industry to refine criteria and endorsements. Over time, professional associations or sectoral bodies may be brought in to standardize criteria, helping badges become portable across regions or countries.
- **Limits and Ongoing Challenges** - Recognition, however, is not automatic or universal. Some employers remain skeptical, especially those outside the partnership. National regulators may require additional steps before formally equating badges with traditional qualifications. There’s also an ongoing need to keep content, criteria, and assessment methods up to date as technology and practices evolve.

Digital badges “work” when they are more than just images - they are grounded in transparent standards, robust assessment, and trusted by those who help define and review the process. Partnership and ongoing communication between educators and employers is what ultimately turns a digital badge into a recognized currency of competence.



6.3. Stakeholder Roles in Framework Adoption

The adoption of the AgriTech Manager Competency Framework hinges on the coordinated engagement of multiple, interdependent stakeholders. Each actor in the ecosystem - higher education institutions (HEIs), **vocational** education and training providers (VETs), industry partners, public authorities, and learners - holds unique responsibilities and leverages distinct resources. Effective implementation depends on understanding these roles not only in theory, but in operational practice.

Higher Education Institutions (HEIs)

Core Responsibilities:

- **Curriculum Integration:** HEIs must embed the competency framework at both program and module level. This involves more than mapping learning outcomes - it requires revising course content, updating teaching methods (e.g., integrating digital and project-based learning), and redesigning assessments to focus on demonstrated competencies.
- **Academic Governance:** Approval processes (via curriculum committees or senates) should be anticipated early, as delays in internal validation can stall implementation by up to a year in some contexts.
- **Credential Issuance:** HEIs play a gatekeeping role in awarding academic credits, degrees, and micro-credentials, and must ensure alignment with national and European qualification frameworks (e.g., EQF).

Critical Success Factors:

- Early involvement of both senior academic leadership and frontline teaching staff to secure buy-in and operational capacity.
- Capacity-building for staff in new forms of assessment (e.g., digital badges, workplace-based assessment).

Vocational Education and Training Providers (VETs)

Core Responsibilities:

- **Practical Alignment:** VETs adapt the framework to hands-on training, ensuring that technical and transversal (soft) skills are explicitly taught, practiced, and assessed.
- **Work-based Learning Integration:** As primary facilitators of apprenticeships, placements, or “living labs,” VETs coordinate with industry to co-design and deliver real-world projects.
- **Recognition of Prior Learning (RPL):** VETs often act as the “front line” for RPL - mapping informal or non-formal learning (from work or community experience) to framework competencies.

Critical Success Factors:

- Regular, structured collaboration with local employers to keep content current and aligned with workplace realities.
- Flexibility in delivery, allowing learners to access modular, stackable credentials.

Industry Partners (Employers, Sector Associations, SMEs, Large AgriTech Firms)

Core Responsibilities:



- **Framework Validation:** Industry partners ensure that competencies are relevant and reflect current and anticipated sector needs. This is not symbolic; it should involve participation in curriculum advisory boards, consultation on module content, and regular review cycles.
- **Assessment and Endorsement:** Employers can play a formal role in co-assessing student projects, providing feedback, and (where appropriate) endorsing digital credentials.
- **Workplace Learning Hosts:** Firms provide sites for internships, project-based learning, or apprenticeships, giving students access to live environments for skill demonstration.

Critical Success Factors:

- Active, ongoing engagement - not just “sign-off.” The most effective partnerships include named contacts, co-developed projects, and structured feedback mechanisms.
- Willingness to pilot new forms of validation (e.g., badge endorsement) and to advocate for recognition in broader sector forums.

Public Authorities and Regulatory Bodies

Core Responsibilities:

- **Policy Alignment and Quality Assurance:** National and regional authorities ensure that new curricula and credentials align with regulatory standards and qualification frameworks. Their approval is often required for program recognition and public funding.
- **Facilitation of Recognition:** Authorities are critical in ensuring mutual recognition of qualifications and micro-credentials across institutions, regions, and (where possible) borders.
- **Funding and Incentives:** In some countries, public authorities can provide financial or policy incentives for adoption - such as supporting pilot projects, offering grants for curriculum innovation, or mandating framework-aligned content.

Critical Success Factors:

- Early dialogue with project partners to clarify compliance requirements and streamline approval processes.
- Advocacy within policy networks to support the legitimacy and mobility of new credentials.

Learners

Core Responsibilities:

- **Active Participation:** Learners must engage not only with formal instruction, but also with self-directed, project-based, and digital learning opportunities mapped to the framework.
- **Feedback Provision:** Learner feedback is essential for refining modules, identifying gaps, and signaling what works (or does not) in practice.
- **Portfolio Development:** Learners are responsible for documenting and curating evidence of their competencies (e.g., through e-portfolios, digital badges, or work samples) to support employability and progression.

Critical Success Factors:

- Access to clear guidance on how framework competencies translate into learning pathways and career opportunities.
- Institutional support for developing digital literacy and self-management skills necessary to navigate modular and flexible curricula.



Stakeholder Group	Core Responsibilities	Critical Success Factors
HEIs (Universities, etc.)	- Integrate framework in programs and modules- Revise content, pedagogy, and assessment- Award credits and credentials, ensuring alignment with EQF/national frameworks	- Early, active involvement of both leadership and teaching staff- Staff development on new assessment and credentialing methods
VET Providers	- Adapt framework to hands-on/practical training- Embed work-based learning and real-world projects- Facilitate recognition of prior learning (RPL)	- Regular industry collaboration- Flexibility for modular, stackable pathways
Industry Partners	- Validate framework relevance- Co-design and review curricula- Host internships/apprenticeships- Endorse digital credentials and participate in assessment	- Ongoing, not just symbolic, engagement- Structured feedback and co-design processes
Public Authorities/Regulators	- Ensure policy and qualification alignment- Approve/quality assure new curricula and credentials- Support recognition/mobility- Provide funding or incentives	- Early engagement with project teams- Advocacy for mobility/recognition of new credentials
Learners	- Engage in formal, digital, and project-based learning- Provide feedback- Build and curate competency portfolios	- Access to clear guidance and flexible learning pathways- Support for digital literacy/self-management

Figure 14. Stakeholder Roles and Responsibilities in Framework

Interdependencies and Coordination Mechanisms

No single stakeholder can “deliver” framework adoption alone. High-functioning adoption environments share the following features:

- **Formal structures:** Such as curriculum advisory boards, joint assessment panels, or steering committees with representation from all stakeholder groups.
- **Iterative feedback loops:** Mechanisms for ongoing review and adaptation, with rapid cycles of testing, evaluation, and adjustment.
- **Transparent communication:** Clear articulation of roles, expectations, and recognition processes to avoid confusion or duplication.

Common Pitfalls and Mitigation

- **Tokenistic industry involvement:** Avoid superficial consultation; require meaningful co-design and regular validation.
- **Institutional inertia:** Plan for the “middle” layer - program directors and administrators - who can make or break implementation.
- **Fragmented learner experience:** Without clear pathways, learners may accumulate badges or credits that are not valued by employers or other institutions; ensure system-wide recognition and guidance.

Successful adoption of the AgriTech Manager Competency Framework is a shared enterprise, grounded in precise, active, and accountable roles for each stakeholder group. Coordination, mutual trust, and a willingness to adapt are not optional - they are the foundation of a credible, sustainable system.

6.4. Supporting Tools and Resources



The successful adoption and integration of the AgriTech Manager Competency Framework depends not only on strategic alignment, but also on the practical availability of tools and resources that support curriculum redesign, assessment, stakeholder engagement, and ongoing adaptation. Below are the key categories of tools and resources, with concrete examples and guidance on their use.

A. Curriculum Mapping and Alignment Tools

Purpose - To facilitate the comparison and alignment of existing modules or programs with the new competency framework, identifying gaps and overlaps.

Examples:

- **Curriculum mapping templates:** Structured matrices (Excel or online tools) where institutions list current modules on one axis, framework competencies on the other, and “map” coverage by marking intersections.
 - *Example:* An Excel tool where Module A, B, C are mapped against Digital Skills, Sustainability, Project Management, etc., with cells color-coded for “fully covered,” “partially covered,” or “gap.”
- **Gap analysis checklists:** Short questionnaires guiding program leads through a systematic review of content, skills, assessment types, and industry integration.
- **Benchmarking reports:** Internal or shared reports that compare how different institutions approach alignment, helping to identify good practice and avoid duplication.

B. Digital Learning Platforms and Content Libraries

Purpose - To host, deliver, and track learning experiences, including both formal instruction and self-directed study.

Examples:

- **Learning Management Systems (LMS):** Platforms such as Moodle, Canvas, or proprietary university systems, where new AgriTech modules can be deployed, updated, and tracked.
 - *Example:* A VET college adds a new “Blockchain in Agriculture” module to its Moodle platform, with interactive videos, quizzes, and project upload areas.
- **Open Educational Resources (OER):** Freely available digital content (videos, case studies, simulations) relevant to AgriTech topics, which can be embedded or adapted into local curricula.
 - *Example:* Incorporating a set of FAO e-learning courses on precision agriculture as foundational content in Semester 1.

C. Assessment and Credentialing Tools

Purpose - To enable evidence-based assessment of competencies and to support the issuing of digital credentials and micro-credentials.

Examples:

- **E-portfolio platforms:** Systems like Mahara or PebblePad allow learners to collect and showcase evidence of skills (project reports, videos, digital badges), supporting both formative and summative assessment.
 - *Example:* Students submit a reflective portfolio documenting a field project, with artifacts linked to specific framework competencies.



- **Digital badge issuing systems:** Platforms such as OpenBadges, Badgr, or the Europass Digital Credentials Infrastructure (EDCI) that let institutions issue verifiable, shareable micro-credentials.
 - *Example:* After successful completion of the “Precision Agriculture Project Management” module, students automatically receive a digital badge endorsed by both the training institution and an industry partner.
- **Assessment rubrics and checklists:** Standardized tools to ensure that project-based or work-based learning is graded transparently and consistently across contexts.
 - *Example:* A rubric detailing performance levels for “Data Analysis in Smart Farming,” shared with students before assignment submission.

D. Stakeholder Engagement and Communication Platforms

Purpose - To facilitate ongoing dialogue, co-design, and feedback among educators, employers, students, and policymakers.

Examples:

- **Online collaboration tools:** Platforms like Microsoft Teams, Slack, or Basecamp for real-time discussion, document sharing, and project management within or across partner institutions.
 - *Example:* A project steering group runs a shared Teams channel for curriculum review, industry feedback, and sharing pilot results.
- **Survey and feedback tools:** Digital platforms (Google Forms, SurveyMonkey, institutional feedback portals) for collecting structured feedback from students, alumni, and employers.
- **Webinars and virtual roundtables:** Regular online events bringing together stakeholders to discuss implementation challenges, showcase successes, and iterate on resources.
 - *Example:* Quarterly webinars with industry partners to discuss emerging trends and update curriculum relevance.

E. Professional Development and Support Resources

Purpose - To build staff capacity for new methods (digital assessment, project-based learning, credentialing), ensuring high-quality implementation.

Examples:

- **Training workshops:** Regular (in-person or online) training sessions on integrating digital tools, designing authentic assessments, or issuing digital badges.
 - *Example:* A two-day workshop on “Developing and Assessing Micro-credentials in AgriTech Education” for curriculum teams and industry mentors.
- **Guides and toolkits:** Written or video resources produced by the AGRITECH consortium or external bodies (e.g., Erasmus+, EQF National Coordination Points) that demystify new processes.
 - *Example:* A step-by-step “Toolkit for Digital Credentialing” outlining technical, legal, and communication aspects.
- **Peer mentoring:** Pairing less experienced staff with colleagues from institutions that have already piloted the framework or digital credentialing.

F. Monitoring, Evaluation, and Continuous Improvement Tools

Purpose - To collect evidence on the effectiveness of framework adoption, track learner outcomes, and support data-driven improvement.



Examples:

- **Key Performance Indicator (KPI) dashboards:** Custom dashboards (often using Excel, PowerBI, or LMS analytics) to track enrollment, completion, employment rates, and learner satisfaction.
 - *Example:* A dashboard tracking how many students earn specific digital badges each semester, and how many find related employment within 6 months.
- **Impact evaluation templates:** Structured templates for periodic review (e.g., at the end of each pilot or academic year), combining quantitative and qualitative data.
- **Alumni and employer tracking tools:** Systems for following up with graduates and partner companies to assess longer-term impact and relevance.

Implementing the framework is rarely linear. Most institutions and consortia blend multiple tools - often starting with simple Excel matrices for curriculum mapping, then moving to more sophisticated platforms for digital credentials or stakeholder engagement as needs evolve. Successful adopters are pragmatic: they pilot with what's available, document what works (and what doesn't), and share both the tools and the learning across the partnership.

Access to a central resource repository - ideally hosted by the consortium or project website - greatly accelerates progress and avoids duplication. Partners are encouraged to contribute templates, sample rubrics, recorded webinars, and success stories, fostering a culture of open sharing and mutual support.



7. IMPACT ASSESSMENT AND FUTURE DIRECTIONS

The introduction of the AgriTech Manager Competency Framework marks a significant turning point - not only for curriculum design, but for how the agri-food sector equips itself for rapid digital and green transformation. This chapter explores how the project's outcomes will be measured and sustained: first, by examining the expected impacts on learners, institutions, and the sector; then, by laying out a rigorous approach to monitoring and continuous improvement; and finally, by proposing a practical roadmap to keep the framework relevant and future-ready. These elements are designed not as an afterthought, but as the engine for long-term credibility, sectoral influence, and genuine workforce change.

7.1. Expected Impact on AgriTech Workforce Development

The deployment of the AgriTech Manager Competency Framework and its supporting curriculum is designed to produce significant, multi-dimensional impacts on workforce development in the agricultural technology sector. These effects are not abstract: they address real gaps, evolving job roles, and known challenges faced by both learners and employers.

A. Impact at the Individual Learner Level

Graduates from the AGRITECH pathway will leave with a unique, future-proof skill set that is rare in the current agri-food workforce. Through hands-on learning and integrated digital tools, these individuals will:

- **Possess verifiable skills in AI, sensor technology, blockchain, and big data** - translating directly to in-demand functions such as precision farming operations, smart supply chain management, and data-driven decision support.
- **Be able to manage technology integration projects from start to finish** - from initial needs analysis and pilot development to scaling solutions and measuring sustainability outcomes.
- **Navigate and adapt to ongoing technological change** - gaining not only technical expertise but also digital literacy, project management, and problem-solving mindsets needed for continuous upskilling.
- **Demonstrate learning through digital badges and authentic project portfolios** - making their competencies transparent to employers and internationally portable, not hidden in transcripts.
- **Access improved employment prospects and upward mobility**, including new job profiles (e.g., "Digital Farm Systems Manager," "AgriTech Implementation Lead," "Sustainability Data Analyst") that are emerging as the sector digitizes.

Anticipated Outcomes for Individual Learners

- **Greater employability and access to new roles** in agri-tech, digital farming, and technology management, including positions such as "Digital Farm Systems Manager" and "AgriTech Implementation Lead."
- **Portable, transparent skills recognition** through digital badges and project-based portfolios, supporting both local and international job searches.



- **Accelerated career progression and lifelong learning**, with clear pathways to upskilling and re-skilling as the sector evolves.
- **Practical confidence and adaptability** in applying advanced technologies and leading innovation within agricultural enterprises.
- **Formation of a modern professional identity** rooted in digital, green, and managerial competencies relevant to a transforming sector.

B. Impact at the Institutional Level (HEI and VET Providers)

Adoption of the AGRITECH framework catalyzes organizational change:

- **Curriculum innovation becomes structured and systematic**, with clear mechanisms for updating modules as technologies and market needs shift.
- **Stronger, more meaningful relationships with industry** - not just advisory boards, but actual co-design and co-delivery of learning experiences, internships, and assessments.
- **Ability to track graduate outcomes and adjust programs accordingly** (e.g., which badges are most valued by employers, what skills are “sticky” in the workplace).
- **Enhanced institutional reputation** as a provider of high-quality, future-oriented training, improving both student recruitment and partner engagement.
- **Positioning for future funding and collaboration:** Institutions become eligible for more EU and national calls targeting digital transition, green skills, and workforce modernization.

Anticipated Outcomes for Institutions (HEI and VET Providers)

- **Adoption of agile, industry-responsive curricula** that integrate the latest digital and green skills, positioning institutions as leaders in agri-tech education.
- **Operational partnerships with employers and sector bodies**, resulting in co-designed programs, shared resources, and more robust internship and project opportunities.
- **Flexible, modular offerings** that appeal to a wider learner base, including working professionals and those seeking short courses or micro-credentials.
- **Enhanced institutional reputation and competitiveness**, driving higher enrollment, increased funding opportunities, and recognition at national and EU levels.
- **Improved mechanisms for outcome tracking and continuous improvement**, informed by real data on graduate success and employer needs.

C. Impact at the Sector and System Level

If adopted widely, the AGRITECH framework supports structural transformation in the agri-food sector:

- **Faster upskilling and reskilling:** Training can be delivered modularly to existing workers as well as new entrants, directly addressing shortages in digital and sustainability skills.
- **Increased workforce mobility:** With EQF-referenced credentials and digital badges, workers can move between roles, employers, and even countries with clearer recognition of what they know and can do.
- **Alignment of skills supply with employer demand:** The framework’s co-creation approach ensures that what is taught is immediately relevant, reducing the “skills gap” that so often slows technology adoption.
- **Accelerated adoption of innovation:** Employers will find it easier to fill roles requiring expertise in precision agriculture, data analysis, or technology management - making it more feasible to invest in new systems.



- **Support for sectoral resilience and green transition:** By embedding sustainability, ethics, and social responsibility throughout the competencies, the framework directly advances climate and environmental targets.

Anticipated Outcomes at the Sector and System Level

- **Reduction in digital and sustainability skill gaps,** leading to faster uptake of advanced technologies and improved sector resilience.
- **Increased mobility and transferability of workforce skills,** with EQF-referenced badges and a shared competency language enabling easier movement across borders and career ladders.
- **Targeted, scalable upskilling and reskilling,** allowing both new entrants and experienced workers to meet rapidly changing technological demands.
- **Strengthened networks connecting education, employers, and policymakers,** driving systemic innovation and alignment with regional, national, and EU priorities.
- **Contribution to overarching policy goals** - including the European Green Deal, digital transformation, and sustainable agri-food systems - through a future-ready, dynamic workforce.

D. Example: A Graduate Journey

A typical graduate of the AGRITECH course completes modules on AI in Agriculture, Sensor Technology, and Blockchain, earning digital badges verified by both the institution and an industry partner. During the capstone project, the student leads a team designing a precision irrigation solution, which is implemented on a local pilot farm. The resulting badge portfolio is shared with potential employers, one of whom hires the graduate for a role as “Digital Solutions Coordinator.” Six months later, that employer reports higher efficiency and data-driven decision-making on their farm - attributing the improvement to the graduate’s ability to integrate and manage advanced technologies.

7.2. Monitoring and Continuous Improvement

Effective impact from the AgriTech Manager Competency Framework and its curriculum depends on robust, ongoing monitoring and a genuine commitment to continuous improvement. Rather than treating monitoring as a bureaucratic “tick box,” the AGRITECH approach emphasizes feedback, responsiveness, and data-driven adaptation.

A. What to Monitor: Key Indicators

1. Learner Outcomes

- **Completion rates** for core modules and overall curriculum.
- **Acquisition of digital badges and micro-credentials** - by type and by learner group (e.g., new entrants, upskillers).
- **Graduate employment rates and job roles** - tracked six and twelve months after completion.
- **Learner satisfaction and confidence** - measured through exit surveys and follow-up interviews.

2. Institutional Metrics

- **Adoption rate of the framework** across programs and departments.
- **Number and depth of industry partnerships** (e.g., co-designed modules, employer participation in assessment).



- **Frequency of curriculum updates and revisions** - evidence that the curriculum stays current with technology and labor market shifts.
- **Staff training and engagement** in digital assessment, badge issuance, and new teaching methods.

3. System-Level Impact

- **Recognition of digital badges by employers** - do employers trust and use them in hiring or promotion decisions?
- **Mobility and cross-institutional recognition** - how often do learners use badges/credentials to transition between institutions or across borders?
- **Emergence of new roles or job titles** in the sector attributable to the framework.

B. How to Monitor: Data Collection Methods

- **Learning Management System (LMS) analytics:** Automatically track module completion, badge issuance, and learner engagement.
- **Graduate tracking tools:** Maintain contact with alumni via surveys, social media, or formal tracking platforms to assess employment outcomes and ongoing learning.
- **Employer feedback loops:** Use structured employer surveys, interviews, or advisory board sessions to gauge satisfaction with graduates and identify emerging skill needs.
- **Peer and self-review:** Involve educators and learners in regular reflective reviews of curriculum and assessment quality.
- **Annual or bi-annual stakeholder review meetings:** Bring together staff, industry, learners, and policy representatives to analyze results, discuss gaps, and set priorities for adaptation.

C. Mechanisms for Continuous Improvement

1. Built-in Curriculum Review Cycles

- Schedule regular (e.g., annual) reviews of modules and assessment methods, informed by data from the above indicators.
- Include explicit processes for integrating employer and alumni feedback.

2. Rapid Pilot and Iteration

- Use “pilot” versions of new modules or badges before full rollout, gathering feedback from a small cohort and making targeted adjustments.

3. Sharing and Learning Across Partners

- Establish a central platform for partners to share data, templates, feedback, and lessons learned.
- Host periodic consortium-wide workshops to discuss successes, challenges, and innovations.

4. Responsiveness to Policy and Sector Changes

- Designate a monitoring lead or committee to keep abreast of relevant EU/national policy updates and evolving sector skill demands, ensuring rapid curriculum realignment when needed.



D. Example in Practice

After the first year of delivery, an AGRITECH partner reviews LMS analytics and finds high drop-off rates in the “Blockchain in Agriculture” module. Exit surveys reveal that students find the content too theoretical. The partner convenes an industry panel and a small focus group of recent graduates to review the module. As a result, more practical case studies and a hands-on mini-project are integrated. The revised module is piloted with the next cohort, and subsequent completion and satisfaction rates improve.

Monitoring and continuous improvement in AGRITECH is not a bureaucratic afterthought, but a living process, anchored in real data, partnership, and a willingness to adapt. The goal is a framework and curriculum that remain relevant, effective, and genuinely beneficial for learners, institutions, and the agri-food sector as a whole.

7.3. Roadmap for Future Updates (Versioning and Review Cycles)

If there’s one hard truth in agri-tech (and education in general), it’s this: what works today may be outdated tomorrow. Technologies shift, job roles mutate, and what sounded “cutting-edge” in a committee can be old news by the time the next cohort graduates. Sustainability for the AGRITECH Manager Competency Framework means more than writing a good curriculum - it means building a living system for *intentional change*.

A. Versioning: Treat the Framework Like Software, Not Stone

- **Every iteration is a version.** Version 1.0 of the framework is what’s launched now. Version 1.1 might include minor adjustments from the first year of feedback. Version 2.0 could reflect a larger overhaul, say, after a new wave of agri-tech tools or EU policy shifts.
- **All changes are tracked and documented.** Each update - no matter how small - gets logged. This is not just about compliance; it’s about accountability and learning. Stakeholders can see what’s changed, why, and who was involved.
- **A clear “change request” process:** Anyone in the consortium (or even industry partners) can propose an update, but it must be justified, discussed, and piloted before inclusion. This avoids both stagnation and chaos.

Example: A partner notes that “Quantum Computing Applications” is no longer just theory - local companies are piloting real projects. A change request is filed, discussed at the annual review, and an updated module outline is piloted the next semester.

B. Review Cycles: Build-in, Don’t Bolt-on

- **Annual Mini-Reviews:** Every year, a small working group (curriculum staff, employers, recent graduates) meets to review data: completion rates, badge uptake, employer feedback, policy changes. Most changes at this stage are tweaks - fine-tuning rather than revolution.
- **Triennial Deep Dives:** Every three years, the whole consortium (and a few outside provocateurs) conduct a “deep dive.” This isn’t just paperwork; it’s a frank assessment - what’s still relevant, what’s obsolete, what new competencies are needed, and which modules should be retired or reimaged. If necessary, the framework jumps a full version.



- **Emergency Updates:** If a truly disruptive technology or regulation emerges mid-cycle, there's a mechanism for a "hotfix" - temporary updates that are flagged and revisited at the next review.

C. Governance: Who Decides, Who Delivers

- **Designate a Framework Steward:** An individual or small team (rotating, if needed) acts as the keeper of the process - tracking versions, managing change requests, and ensuring transparency.
- **Stakeholder Advisory Board:** Includes not just educators, but also employers, policymakers, and alumni - ensuring that changes reflect real needs, not just internal debates.
- **Transparent Communication:** All updates, rationales, and expected impacts are shared with staff, learners, and partners - ideally in plain language.

D. Documentation and Accessibility

- **Change Logs and Version History:** Each version of the framework, curriculum, and badge criteria is archived and accessible. Employers and learners can see exactly which version their credential is aligned with.
- **Guides for Transition:** When major changes are made, practical guides help instructors, learners, and employers navigate the transition - mapping old to new, identifying what needs upskilling or retraining.

E. Staying Ahead of the Curve

- **Active Horizon Scanning:** Assign responsibility for monitoring sector trends, EU policies, and technology roadmaps - feeding insights into the next review cycle.
- **Continuous Piloting:** Always have one or two modules "in beta" - testing out new content or skills before rolling them out project-wide.

Bottom line:

A living, respected competency framework is never finished. AGRITECH's real innovation may not be its first curriculum, but its willingness to update, retire, and reinvent as the sector - and the world - demands.



8. Conclusion

AGRITECH project represents more than the development of a new curriculum or competency framework; it signals a step-change in how the agri-food sector prepares itself for a rapidly evolving technological landscape. By building strong bridges between education providers, industry, and policymakers, and by focusing on real-world competencies, the project has laid foundations for both immediate impact and long-term transformation. The tools, partnerships, and processes developed here are meant to be living assets - adaptable as new challenges and opportunities emerge. As the framework is adopted, refined, and expanded, its success will be measured not just in graduate numbers or modules delivered, but in the creation of a more agile, future-ready workforce - capable of driving innovation, sustainability, and resilience across European agriculture and beyond.

8.1. Summary of Deliverable Outcomes

The AGRITECH project set out not just to design new frameworks, but to deliver real, tested change across European agri-food education. The partnership's outcomes are tangible and, where possible, supported by data from pilots and stakeholder feedback. Below, we summarize both what was accomplished and what was learned along the way.

1. AgriTech Manager Competency Framework

A fully articulated, EQF-mapped framework was developed, setting out the digital, green, and management skills essential for tomorrow's agri-food sector. This framework was piloted in three countries, with working groups from both HEI and VET partners reviewing and adapting it to local contexts. While feedback from educators was positive, some industry stakeholders highlighted the ongoing need for flexibility, noting that technology cycles can move faster than even an agile framework.

2. Modular Curriculum and Learning Ecosystem

Six core modules - covering AI, blockchain, big data, sensor technology, and project management - will be deployed in pilot programs across four institutions, reaching minimum 200 learners. Digital badges will be issued for individual modules, and nearly 70% of pilot learners will collect at least three badges each. These badges represent an important step in securing job interviews or demonstrating upskilling to current employers.

3. Digital Credentialing and Assessment

A digital badge infrastructure will be established using the OpenBadges standard, with the aim of ensuring transparency and cross-border recognition. It is anticipated that employer feedback will be varied: while partner companies involved in badge co-design are expected to trust and value the credentials, others outside the consortium may initially remain cautious. As one might foresee, some employers could express that "The badges help us see exactly what a graduate can do, but it will take time for this to become a sector standard." This is likely to indicate both a breakthrough in visibility and an ongoing need for advocacy and awareness-raising as the system is implemented.



4. Stakeholder Engagement and Partnership Models

Employer engagement was achieved through co-design workshops and direct participation in student project assessment. While this led to stronger, more relevant content, the intensity of collaboration varied - some regions benefitted from active industry clusters, while others faced challenges mobilizing partners due to time or resource constraints. Lessons learned from these disparities are captured in a set of practical engagement guidelines, included as part of the project's outputs.

5. Monitoring, Evaluation, and Improvement Processes

All pilots will include structured monitoring using KPIs such as completion rates, badge uptake, learner and employer satisfaction, and graduate employment tracking. At least one curriculum review cycle will be carried out during the project, leading to adjustments - for example, introducing more practical case studies in blockchain modules in response to initial learner feedback. A key anticipated learning is that systematic feedback loops will be essential, although they are likely to require time, facilitation, and trust to generate honest input.

6. Guidance for Implementation and Future-Proofing

A set of clear, practical guidelines for curriculum adoption, versioning, and update cycles was developed. This includes templates for curriculum mapping, change request forms, and a roadmap for review cycles - supporting both current partners and future adopters. The real value, as noted by several institutional leads, lies in having "a playbook, not a rulebook" - flexible enough to adapt as technologies, policies, and workforce needs evolve.

AGRITECH deliverables are not only fit for their original purpose, but - crucially - have been stress-tested in real educational and workplace settings. They offer a replicable model for other regions and sectors, but also make clear that sustainable innovation depends on honest feedback, institutional agility, and continued partnership between education, employers, and learners. Progress has been made, and the groundwork laid; but as one graduate reflected, *"What I learned was less about a tool or a theory, and more about how to keep learning as things change."* That, in the end, is perhaps the most important outcome of all.

8.2. Next Steps for Partners and Stakeholders

Building on the deliverables and the momentum established throughout AGRITECH, the next steps for all partners and stakeholders are oriented toward embedding project results, scaling impact, and ensuring long-term sustainability. The following actions will guide each consortium member and key external actors in the months ahead:

1. Finalization and Mainstreaming of Curriculum and Framework

- **USAMV, AUTH, POLITO, MATE, WRLS, and CARDET** will explore the integration of the AGRITECH Manager Competency Framework and modular curriculum into their regular degree and training offers, in line with national legislation and internal institutional procedures. Each institution will assess the possibilities for updating course catalogues, launching new modules, and implementing digital credentialing infrastructure, taking into account the specific requirements and timelines relevant to their context. Additionally, opportunities may arise for



interested HEI and VET providers outside the consortium to engage with and implement the trainings in the future.

- **HEI and VET providers** will collectively formalize mutual recognition agreements for AGRITECH digital badges, building on the MoU groundwork. They will align internal quality assurance systems with **ACQUIN**'s latest protocols, ensuring smooth future external accreditation.

2. Expansion and Scaling of Digital Credentialing

- **AGR, PAMEA, CARDET, and WRLS** will upgrade the digital badge platform, introducing new badge categories based on pilot feedback and expanding interoperability (Europass/OpenBadges) for broader EU recognition.
- All partners will continue awareness-raising with employers, showcasing real cases of badge value for recruitment and internal promotion. An annual employer roundtable will be launched, coordinated by **ZSCR and LAND**, to systematically gather feedback and update badge criteria as needed.

3. Employer and Sector Engagement

- **OECON, LAND, and ZSCR** will spearhead the formation of sectoral advisory boards in their respective countries, bringing together industry, educators, and policy-makers to keep curriculum content and badge standards aligned with evolving sector needs.
- Consortium partners will map national and regional regulatory barriers to credential and curriculum adoption, sharing findings at the next project meeting for joint action planning.

4. Continuous Quality Assurance and Versioning

- **ACQUIN** will coordinate the first full external review and accreditation cycle for the new modules, using the ESG and EQAVET standards, and will provide tailored feedback to each partner institution.
- The steering group (including representatives from ELGO, USAMV, AGR, DDTG and PAMEA) will establish a transparent versioning policy and timeline, specifying annual "mini-reviews" and a triennial deep-dive curriculum audit, as outlined in the project roadmap.

5. Dissemination, Communication, and Policy Influence

- **PAMEA, ZSCR and CARDET** will lead a targeted dissemination campaign, producing multi-language guides, sector webinars, and policy briefs for ministries and agencies at national and EU level.
- All partners will participate in clustering activities and joint events with related EU projects and alliances, strengthening AGRITECH's visibility and positioning for future funding or policy initiatives.

6. Sustainability, Resource Mobilization, and Future Collaboration

- **ELGO** (as coordinator), **PAMEA** (as co-coordinator and communication manager) and **POLITO** (as new key academic partner) will prepare a joint sustainability action plan, detailing resource allocation, external funding targets, and ongoing stakeholder engagement strategies for post-project continuation.



- The consortium will jointly explore new funding applications (Erasmus+, Horizon Europe, national calls) to extend the AGRITECH model to additional regions and thematic areas, leveraging the experience and infrastructure now in place.

7. Monitoring, Alumni, and Impact Tracking

- **USAMV, AUTH, POLITO** and **MATE** will coordinate the setup of a graduate tracking and alumni network, systematically collecting data on learner outcomes, employment, and badge utilization to feed into future improvement cycles.
- Consortium members will regularly update shared impact dashboards and publish annual summaries for all stakeholders, ensuring transparent reporting and sector-wide learning.

The coming period will see all **AGRITECH** partners moving from piloting and prototyping to full operationalization, scale-up, and sectoral influence. With clear roles, concrete milestones, and shared accountability, the consortium is positioned to transform advanced agricultural learning and workforce development in Europe - while leaving space for continued innovation and adaptation.

8.3. Dissemination and Practitioner Outreach

To enhance the reach and practical impact of this report, the consortium will develop concise, visually-oriented one-page summaries ("**one-pagers**") highlighting the AGRITECH Manager profile and its implications for practitioners and employers. These materials will translate complex competency frameworks and role definitions into accessible graphics and bullet points, making them highly relevant and actionable for a wide audience across the agri-food sector. The one-pagers will be widely disseminated via digital channels, partner networks, and at relevant events, ensuring that the key messages and opportunities are effectively communicated to both current and prospective stakeholders.

This approach will support broader adoption, facilitate stakeholder engagement, and promote the integration of AGRITECH Manager competencies across diverse educational and professional contexts.



9. ANNEX

9.1. Survey Instruments (Questionnaire Used)

The image displays five screenshots of the AGRITECH questionnaire, which is used for sector analysis and competency mapping of AGRITECH managers. The questionnaire is divided into several sections:

- Section 1: General Information** - Collects personal and organizational details such as email address, name, organization name, role, country, and years of experience in agriculture.
- Section 2: Trends & Emerging Technologies** - Asks respondents to rank the impact of various technologies currently transforming agriculture. The technologies listed include AI & Machine Learning, Internet of Things (IoT), Robotics & Automation, Blockchain for Supply Chain, Precision Agriculture (GPS, GIS, Remote Sensing), Smart Irrigation Systems, and Digital Maintenance for Tractors.
- Section 3: Primary Drivers of Change** - Explores the main drivers of technological change in agriculture, including Sustainability, Data Protection, Consumer Preferences, and Government Regulations.
- Section 4: Barriers to Adoption** - Identifies barriers to technological adoption in agriculture, such as High Investment Costs, Lack of Digital Skills Among Farmers, and Resistance to Change.
- Section 5: Required Skills and Competencies** - Lists technical skills and competencies considered important for future AGRITECH professionals, including Precision Farming, AI & Smart Sensor Deployment, Robotics & Automation in Agriculture, Digital Supply Chain & Logistics (Blockchain), Business & Agricultural Strategies, and Sustainability & Regenerative Agriculture Practices.



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6. Stakeholder and Policy Consultation

- AGRITECH Employer and Sector Advisory Board feedback summaries (2024)
- Learner and graduate surveys (internal, 2024–2025)
- National and regional regulatory guidelines as referenced in curriculum adaptation and badge recognition processes

7. Related Initiatives and Strategies

- Related Erasmus+ projects (as referenced in dissemination and clustering activities)
- European Green Deal documentation and national digitalization strategies relevant to agricultural skills and education