ReGrow

Rebuilding Growth in Agriculture in
Post-Conflict Ukraine & Transitioning Georgia

D3.2: Professional/VET Precision Agriculture Landscape and Skills Gap Analysis Report

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Executive Summary

ReGrow is an initiative funded under the Erasmus+ Capacity Building in Higher Education Strand 2 Call, aiming to modernize higher education in Georgia and Ukraine by creating a joint Master of Science program in Precision Agriculture, while focusing on sustainable practices, advanced technologies, and digital transformation. The project aims to equip HEI staff, students, and agricultural professionals with the skills needed to lead in sustainable agriculture, aligning with EU priorities like the Green Deal.

This report presents a comprehensive analysis of skills mismatches in Precision Agriculture (PA) in Georgia and Ukraine. It combines literature-based insights, expert documentation, existing tertiary level professional/VET and lifelong learning programmes related to PA, and analysis of survey results. The findings highlight critical skill shortages in agronomic, technical, and digital domains, and underline the necessity of modern training frameworks to address climate, sustainability, and technological challenges in agriculture.

Glossary of terms and abbreviations used

List of Abbreviations and Description	
AI	Artificial Intelligence
BSc	Bachelor of Science
ECTS	European Credit Transfer and Accumulation System
ECVET	European Credit System for Vocational Education and Training
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
GIS	Geographic Information Systems
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
HEI	Higher Education Institution
IoT	Internet of Things
KPIs	Key Performance Indicators
MSc	Master of Science
PA	Precision Agriculture
ROI	Return on Investment
SDGs	Sustainable Development Goals
UAV	Unmanned Aerial Vehicle
VET	Vocational Education and Training

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1. Methodology

For the creation of the Report, desk and field research methods were applied, using both qualitative and quantitative indicators. The Report contains insights from the literature review conducted, while the most important and relevant input comes from the partner institutions in Georgia and in Ukraine.

To achieve impactful and important information, partners created a series of methods to gather this information. The activities implemented followed the structure described in the Project Proposal under Work Package 3, “Needs Assessment & Benchmarking of Curricula in Precision Agriculture,” and more specifically, Task 3.3, “Identification of Tertiary Level VET Curricula in Ukraine and Georgia.” In particular, the research began with a structured approach to catalogue the existing tertiary level VET/Professional and lifelong learning programmes related to Precision Agriculture in Georgia and Ukraine (Action 3.3.1). A reporting template was developed (see Annex) and sent to the Higher Education Institutions of the project, in which they reported their existing training courses, sharing useful insights on the delivery methods, alignment with industry standards, etc.

Industry professionals and educational experts were contacted to fill out a feedback survey (Action 3.3.2), to ascertain the specific skill gaps prevalent among farmers and agricultural workers, to identify the key competencies needed to support the findings of the literature review based on personal experiences. The questionnaire was divided into eight (8) sections:

1. Demographics
2. Current knowledge and use of Precision Agriculture technology
3. Training and Education
4. Important barriers to adoption
5. Important barriers to teaching
6. Collaboration and partnerships
7. Workforce readiness and skills
8. Impact and future of Precision Agriculture

All sections were subdivided into the two (2) main target groups of the survey, farmers/agricultural workers and educators.

This document is a concluding action (Action 3.3.3), serving as a synthesis of all collected data and presenting a detailed landscape of existing Professional/VET courses. It outlines areas for upskilling, since it provides a roadmap for developing short learning programme curricula for farmers and workers to meet the evolving demands of the emerging field of PA. Using the insights of the “Comparative Analysis and Recommendations for Precision Agriculture Curricula (D3.1)”, the report will contribute to the modernisation of agricultural practices, strengthening HEI and Industry collaboration in Georgia and Ukraine, as well as boosting innovation and employability of students with the alignment of the HEIs in Georgia and Ukraine with the labour market. These results will actively contribute to the development of the “ReGrow MSc Program Course Framework (D4.2)”.

2. Background and Importance of Precision Agriculture

Precision Agriculture, often referred to as smart farming or site-specific crop management, is a data-driven and technology-intensive agricultural approach that enables tailored decision-making for agricultural inputs and operations (McBratney, et. al. 2005). This strategic management relies on integrated systems that combine:

a. Geographic Information Systems (GIS);
b. Global Positioning System (GPS);
c. Internet of Things (IoT) sensors;
d. Remote sensing;
e. Advanced data analytics.

McBratney et al. (2005), describe PA as the use of technological tools and information to manage spatial and temporal variability in agricultural production for enhanced economic and environmental outcomes. These tools provide crucial data on soil conditions, crop health, weather variability, and input efficiency, facilitating decisions that minimize waste and maximize productivity.

The agronomic significance of PA lies in its ability to stabilize yields by adapting to in-field heterogeneity. It ensures optimal use of resources such as water, fertilizers, and pesticides (Zhang & Kovacs, 2012), thereby reducing environmental footprints and operational costs. From an ecological standpoint, PA contributes to sustainable agricultural practices by promoting efficient input use and minimizing runoff and greenhouse gas emissions (Bongiovanni & Lowenberg-Deboer, 2004; Pierce & Nowak, 1999). It redefines modern farming by enabling precise, informed, and environmentally responsible agricultural practices.

Key technologies that complement PA include GPS/GIS for precise mapping, sensor networks for real-time monitoring of field parameters, drones and satellite imagery for crop surveillance, and machine learning algorithms for data interpretation and predictive modeling. Tasks like planting, irrigation, and harvesting have further developed and enabled precision, mainly due to the integration of technological means, such as automation and robotics.

According to the Food and Agriculture Organisation of the United Nations – FAO (2009), with global food demand will increase by up to 70% by 2050 and cultivable land expansion is becoming increasingly limited, PA is seen as a pivotal strategy to intensify production sustainably. By enhancing input-use efficiency and reducing variability-induced losses, Precision Agriculture aligns with climate-smart agriculture goals, ensuring food security and ecological balance. It is also instrumental in meeting the SDGs, particularly those related to zero hunger, responsible consumption, and climate action (Gebbers & Adamchuk, 2010). Precision Agriculture illustrates the intersection of agronomy and digital innovation. As the sector evolves, PA continues to play a transformative role in global agri-food systems, making it an indispensable component of future-ready agriculture

3. Agronomic and Environmental Significance

Precision Agriculture delivers substantial agronomic and environmental benefits by optimizing resource allocation, enhancing system efficiency, and aligning agricultural practices with sustainability imperatives. In this chapter, different practices, trends, and challenges in PA will be addressed.

Collectively, benefits listed below position Precision Agriculture as a cornerstone of sustainable agricultural intensification. By integrating advanced technologies into traditional farming systems, PA supports a paradigm shift toward more resilient, efficient, and environmentally responsible food production.

3.1. Agricultural practises for environmental sustainability

Table 1 - Agricultural practices for environmental sustainability

Benefit	Explanation	Example
Yield Stability and Efficiency	One of the primary agronomic advantages of PA is its ability to enhance yield stability across variable field conditions. By using site-specific management strategies and real-time monitoring, PA ensures that inputs such as fertilizers, irrigation, and pesticides are applied precisely where and when needed. This level of control improves both mean yields and the consistency of production outcomes, particularly in heterogeneous landscapes (Pierce and Nowak, 1999).	In the United States, John Deere's GPS-guided auto-steering systems help farmers in Iowa apply fertilizers and seeds with sub-inch accuracy. This has led to more consistent corn yields across fields with varied topography, reducing over-application in low-yield zones and improving productivity on marginal land3.
Resource Conservation	PA plays a critical role in conserving natural resources. Precision application of inputs like water, fertilizers, and pesticides reduces excess usage and minimizes environmental externalities such as nutrient leaching, surface runoff, and groundwater contamination. By implementing variable-rate technology and sensor-guided operations, farmers can achieve more with fewer resources, significantly improving input-use efficiency (Gebbers and Adamchuk, 2010).	In Australia, farmers using the Trimble GreenSeeker system have reduced nitrogen fertilizer use by up to 30%. The system adjusts application rates based on real-time NDVI data, preventing over-fertilization and minimizing nitrate leaching into groundwater4.

[3] John Deere. (n.d.). *AutoTrac™ guidance system*. Farm Progress. Retrieved from https://www.farmprogress.com/planting/gps-autosteer-gives-sub-inch-accuracy

[4] Trimble Agriculture. (n.d.). *GreenSeeker handheld crop sensor*. Trimble Inc. Retrieved from https://ww2.agriculture.trimble.com/product/greenseeker-handheld-crop-sensor/

Sustainability Goals	PA aligns closely with the principles of climate-smart agriculture, which emphasize resilience, productivity, and emissions reduction. Technologies such as real-time environmental sensing and predictive analytics allow farmers to adjust practices dynamically in response to climatic variations. These adaptive capabilities are crucial for mitigating the effects of climate change and ensuring long-term agricultural viability (Bongiovanni and Lowenberg-Deboer, 2004).	In the Netherlands, Wageningen University's experimental farms integrate real-time soil sensors and weather forecasting tools to adjust irrigation schedules. This practice has reduced water use by 20% while maintaining yields, demonstrating how PA supports climate-smart agriculture5.
Food Security and Safety	By reducing the variability in crop performance and limiting yield losses due to stress, disease, or nutrient deficiencies, PA contributes directly to global food security. Furthermore, traceability and monitoring systems incorporated in PA frameworks enhance food safety by tracking the sanitary and chemical histories of agricultural products. This level of transparency and control is increasingly demanded in global food markets (Zhang and Kovacs, 2012).	In Brazil, the agri-tech startup Solinftec provides digital traceability for sugarcane production. Their platform monitors inputs and field conditions throughout the growing season, helping producers meet international food safety standards and ensuring compliance with export market requirements6.

3.2. Trends and Technologies in Precision Agriculture

PA is underpinned by a suite of advanced technologies that collectively transform raw data into actionable insights, enabling farmers to make informed, real-time decisions. These tools enhance productivity, optimize resource use, and support environmental sustainability. Together, these technologies create a synergistic ecosystem that empowers precise and sustainable agricultural practices, aligning economic goals with environmental stewardship. In the table below are the core technological pillars of PA:

Table 2 - Core technological pillars of PA

Technological Pillars	Explanation	Examples
GPS/GNSS and GIS	These technologies are foundational in PA. GPS (Global Positioning System) and GNSS (Global Navigation Satellite	Eos Arrow GNSS – A high-precision rover (cm-level) used in field mapping, land surveying, and yield mapping. https://eos-gnss.com/industries/agriculture

[5] Sensoterra. (n.d.). *How Dutch agriculture is feeding the world*. Retrieved from https://www.sensoterra.com/news/how-dutch-agriculture-is-feeding-the-world/

[6] Solinftec. (n.d.). *Solinftec solutions for sugarcane in Latin America*. Retrieved from https://www.solinftec.com/en-us/sugarcane-latam/

	Systems) enable precise geolocation, while GIS (Geographic Information Systems) allows spatial analysis and mapping of field variability. Together, they support operations such as variable-rate application, yield mapping, and automated steering of agricultural machinery (Pierce and Nowak, 1999).	Farmonaut Guidance App – Mobile application offering GNSS auto-steering and real-time field mapping, ideal for small-to-medium farms. https://farmonaut.com/precision-farming/
Smart Sensors and IoT	Internet of Things (IoT) devices and smart sensors continuously monitor field parameters like soil moisture, pH, nutrient levels, and microclimatic conditions. These sensors transmit data in real time to cloud-based platforms, where it is analyzed to inform irrigation, fertilization, and pest control decisions (Gebbers and Adamchuk, 2010).	Trackpac LoRaWAN Farm Sensors – Networked soil moisture, temperature, and weather sensors with cloud dashboards and remote alerts. https://trackpac.io/sensors/lorawan-smart-agriculture/ Milesight Smart Agriculture – LoRaWAN-based multi-sensor devices (soil, climate, asset tracking) with centralized visualization. https://www.milesight.com/solution/smart-agriculture
Drones and Satellite Imagery	Unmanned Aerial Vehicles (UAVs) equipped with multispectral or thermal cameras provide high-resolution imagery that can detect crop stress, disease outbreaks, and nutrient deficiencies. Satellite imagery offers broader, albeit less granular, spatial coverage. Both tools support timely interventions and yield forecasting (Zhang and Kovacs, 2012).	DJI Mavic 3 Multispectral – Compact drone with RGB + multispectral imaging for detecting crop stress and NDVI mapping. https://ag.dji.com/mavic-3-m FIXAR 007 NG Multispectral UAV – Industrial-grade drone built for high-resolution environmental and vegetation monitoring. https://fixar.pro/precision-agriculture-and-forestry/
Automation and Robotics	Autonomous tractors, robotic planters, and weeding machines enhance operational efficiency by performing repetitive tasks with high precision. Variable-rate technology (VRT) enables differential input application based on field data, reducing waste and improving crop	John Deere Autonomy Kit – A retrofit upgrade turning conventional tractors into autonomous, GPS-guided machines. https://www.deere.com/en/autonomous/ Monarch MK-V Electric Autonomous Tractor – Fully electric, driver-optional, autonomous tractor with remote operation via Wingspan AI platform. https://monarchtractor.com/

	uniformity (Bongiovanni and Lowenberg-Deboer, 2004).	
Data Analytics, AI, and Machine Learning	These technologies facilitate the interpretation of vast datasets generated by sensors, UAVs, and satellites. Machine learning models can predict crop yields, disease outbreaks, and input requirements. AI-driven decision support systems optimize farm management strategies (McBratney et al., 2005).	Farmonaut AI Yield Forecasting – Uses satellite imagery and machine learning to predict yields and offer actionable farm insights. https://farmonaut.com/precision-farming/ai-powered-farm-financial-planning-for-precision-agriculture Folio3 Agtech AI ERP – Integrates AI and ML to optimize farm operations, enhance sustainability, and boost profitability. https://agtech.folio3.com/blogs/ai-and-ml-in-agriculture-erp-systems/
Nanotechnology	Nanosensors are being developed to detect soil and plant health indicators at a molecular level. These devices promise ultra-sensitive, real-time monitoring capabilities, which could revolutionize disease diagnostics and nutrient management (Chhipa, 2017).	Nanosensors for Soil & Water Monitoring – Portable, ultra-sensitive sensors that detect moisture, pesticides, nutrients, and pathogens at nanoscale. https://www.sciencedirect.com/science/article/abs/pii/B9780323919081000122 USDA NIFA Nanosensor Research – Smartphone-compatible nanosensors for field-level detection of contaminants in soil and water. https://www.nifa.usda.gov/about-nifa/impacts/nanotechnology-agriculture-food-systems

3.3. Meeting 21st-century challenges through Precision Agriculture

As stated before, the need to increase food production is one of the most pressing challenges facing agriculture in the 21st century. In particular, global food production must increase by approximately 70% in by 20250 to meet the demands of a growing global population, which is expected to reach between 9 and 10 billion people (FAO, 2009). Land degradation, urban expansion, and environmental conservation pressures restrict the potential for horizontal agricultural growth, making the expansion of the arable land a nonviable solution.

Consequently, the focus must shift toward vertical intensification, by producing more from existing agricultural lands without degrading the natural resource base. PA offers the tools and systems necessary to decouple agricultural output from input intensity. By delivering targeted interventions based on real-time field data, PA enhances input-use efficiency and reduces waste. This allows for increased productivity without a proportional rise in inputs such as water, fertilizers, and agrochemicals, which are often associated with adverse environmental impacts (Bongiovanni and Lowenberg-Deboer, 2004).

Moreover, PA enables more sustainable and resilient farming systems. By integrating weather forecasting, predictive analytics, and adaptive management strategies, farmers can better navigate climatic variability and reduce vulnerability to extreme events. This adaptive capacity is essential for ensuring food security in an era of intensified climate change, resource scarcity, and socioeconomic uncertainty (McBratney et al., 2005).

In essence, Precision Agriculture is a transformative pathway that allows for the reconciliation of productivity goals with environmental stewardship. It embodies the principles of sustainable intensification, promoting a high-output, low-impact agricultural model suited for the complex demands of the 21st century.

4. Required Skills Framework

Based on the literature review, there are several sectors within Precision Agriculture framework, with skills required by farmers and agricultural workers. Four (4) core sectors will be analysed, with the main skills and an extensive analysis for each skill area.

Table 3 - Required Skills Framework

Skill Sector	Sector Analysis	Skills required	Skill analysis
Agronomic skills	Agronomic skills are central to the successful implementation of PA, ensuring that data-driven insights are translated into effective field management strategies. These skills require a deep understanding of plant-soil-environment interactions and the capacity to interpret real-time data streams in agronomic contexts.	Soil and crop monitoring	Modern agronomists must be skilled in assessing soil health and crop conditions using both traditional field methods and digital tools such as soil sensors, satellite imaging, and UAV-based remote sensing (Mulla, 2013; Zhang et al., 2022). This includes evaluating soil moisture regimes, nutrient dynamics (e.g., nitrogen and phosphorus availability), and indicators of biotic and abiotic stress in plants. Such evaluations are essential for implementing variable-rate applications of water, fertilizers, and pesticides, thereby improving efficiency and reducing environmental impact.
		Decision-making based on data	One of the cornerstones of PA is the ability to make agronomic decisions based on diverse data sources—ranging from weather forecasts and historical yield maps to real-time sensor outputs (Gebbers & Adamchuk, 2010). Professionals in this field must be proficient in interpreting data visualizations, trend analyses, and agronomic models to inform practices such as seeding density, fertilization timing, and irrigation scheduling. The ability to balance algorithmic recommendations with experiential knowledge is vital for adaptive management.
		Integrated crop/livestock management	The convergence of digital agriculture tools supports integrated crop-livestock systems, where data streams from animal health monitors, pasture growth sensors, and crop yield monitors are jointly interpreted (de Oliveira Silva et al., 2021). Agronomic expertise is required to coordinate crop rotations, fertilization plans, and irrigation schemes in response to sensor-based alerts and seasonal dynamics. Moreover, understanding the nutrient cycling between crops and livestock—such as manure application based on nutrient budgets—is increasingly essential for sustainable mixed-farming systems.
Technical skills	A spectrum of advanced technical competencies to manage spatial data, field-based sensors,	GPS/GIS operation & mapping	Competence in Global Navigation Satellite Systems (GNSS) and Geographic Information Systems (GIS) is a foundational requirement in PA. Practitioners must perform accurate georeferencing of field boundaries and generate situational maps that reveal spatial variability in soil properties, yield, and topography (Kushwaha et al., 2024; Mulla et al., 2015). These skills underpin site-specific management strategies and inform variable-rate input applications.

	unmanned systems, and autonomous machinery. These skills enable stakeholders to optimize inputs, improve yields, and enhance environmental sustainability.	Sensor installation & maintenance	The deployment of IoT-enabled sensors—monitoring parameters such as soil moisture, pH, nutrient status, and plant stress—requires technical know-how in both installation and maintenance (Frontiers in Plant Science, 2025; Krishnababu et al., 2024). Competence is required to select appropriate sensor types, configure radio-frequency communication modules (e.g., LoRaWAN), and maintain sensor calibration to ensure data accuracy and system longevity.
		Drone operation & image interpretation	Unmanned aerial vehicles (UAVs) are widely employed for high-resolution aerial imaging, crop scouting, and precision application (Nunes, 2023). Operators must navigate drones safely while adhering to aviation regulations, and select appropriate imaging payloads (multispectral, hyperspectral, thermal). Moreover, interpreting UAV-derived imagery—such as NDVI maps, plant emergence patterns, and early pest or water stress indicators—requires expertise in remote sensing methods and software for stitching, index calculation, and actionable map production.
		Automated machinery control	Autonomous tractors and implements equipped with Variable Rate Technology (VRT) rely on precise programming of application maps and GNSS-based guidance systems (Wired, 2010). Professionals working with such equipment must create and upload prescription maps into onboard computers, validate GNSS accuracy (e.g., RTK corrections), and troubleshoot hardware/software issues during operations. This includes configuring electronic control units (ECUs) governing flow rates, boom activation, and seed placement, as well as ensuring synergy between aerial, sensor, and ground-based systems.
Digital and IT skills	Digital and IT skills form the technological backbone of PA, enabling efficient data collection, analysis, and actionable decision-making. As farming systems become increasingly digitized, the	Data handling	The ability to manage large volumes of sensor and UAV data is critical in PA. This includes tasks such as capturing high-resolution imagery, collecting data from soil and environmental sensors, and uploading it to cloud-based farm management platforms (Zhang et al., 2022). Professionals must also ensure data integrity and proper labeling to support subsequent analytics.
		Data analytics	Analyzing agricultural data requires basic proficiency in statistics and familiarity with decision-support dashboards (Liakos et al., 2018). Users must interpret trends in yield, pest outbreaks, and soil moisture using tools that may include Excel, Python-based interfaces, or proprietary software. The transformation of raw data into agronomic insights is vital for real-time decision-making and operational efficiency.
		Software literacy	Farm workers and agronomists alike must be literate in the use of digital tools such as GIS platforms, precision agriculture software (e.g., Trimble Ag Software, John Deere Operations Center), and mobile applications (Wolfert et al., 2017). This includes managing spatial layers,

	workforce must be equipped with competencies spanning data management, software usage, and cyber-physical system integration.		editing prescription maps, and synchronizing cloud data across devices. Regular training is often needed due to frequent software updates and the adoption of new features.
		Cyber-physical setup	A deeper layer of IT skill is required to establish and maintain cyber-physical systems that integrate IoT devices with cloud or edge-computing infrastructures (Kamilaris et al., 2017). Workers must configure local gateways, connect sensors using protocols such as MQTT or LoRaWAN, and monitor data transmission via edge analytics. Ensuring secure, scalable network architectures is vital for robust PA deployment.
Soft Skills	A robust set of soft skills that are critical to innovation, collaboration, and long-term adoption of new technologies. These human-centric capabilities enable agricultural professionals to adapt to fast-changing technological environments, foster interdisciplinary teamwork, and effectively communicate insights to diverse stakeholders.	Problem-solving & adaptability	The dynamic nature of PA requires the ability to address unforeseen issues such as equipment malfunctions, erratic sensor data, or software errors. Workers must troubleshoot both digital and mechanical systems, often in real-time, while adapting to changing environmental and market conditions (Rose et al., 2021). Adaptability is also necessary to respond to the rapid evolution of tools and platforms, requiring mental flexibility and a proactive mindset.
		Collaboration	Effective implementation of PA technologies is inherently interdisciplinary, involving cooperation between agronomists, data scientists, engineers, and service providers. Professionals must be capable of navigating diverse working relationships, managing interdependencies, and contributing meaningfully to collective decision-making processes (Bronson, 2019). Collaborative soft skills also include openness to shared leadership and mutual learning.
		Continuous learning orientation	Given the pace of innovation in digital agriculture, workers need a strong orientation toward lifelong learning. This includes staying informed about new software, data standards, automation tools, and regulatory changes. Agricultural professionals must actively seek out training, certifications, and peer learning opportunities to maintain relevance in the field (EIP-AGRI, 2018).
		Communication	Clear communication is essential for conveying the practical benefits of PA to stakeholders such as farm managers, financial institutions, and public-sector funders. This involves translating complex technological outputs into accessible language, justifying return on investment (ROI), and building trust with end-users like farmers (Klerkx et al., 2019). Good communicators bridge the gap between abstract data and practical decision-making, enhancing adoption and sustainability.

5. Tertiary Level Professional/VET and Lifelong Learning Programmes in PA in Georgia and Ukraine

In this Chapter, the findings of the data provided by the Higher Education Institutions from Georgia and Ukraine on the existing professional/VET and lifelong learning training courses related to Precision Agriculture will be detailed and analysed.

KPI – Number of Professional/VET Programs in PA mapped (Quantitative indicator):

Baseline: 5

Target: 11 in Georgia and Ukraine, 14 in total

The institutions participating in the research are:

- Georgian Technical University (GTU) – Georgia
- Samtskhe-Javakheti State University (SJSU) – Georgia
- Shota Meskhia State Teaching University of Zugdidi (ZSS) – Georgia
- Sumy National Agrarian University (SNAU) – Ukraine
- Polissia National University – Ukraine
- Khmelnytskyl National University (KhNU) – Ukraine

The catalogue is divided into the following sections:

1. Programmatic depth and maturity
2. Technological integration
3. Pedagogical models and delivery
4. Target audiences
5. Strategic gaps and opportunities
6. Recommendations for Capacity Building actions
7. Skills Alignment Matrix

5.1. Programmatic depth and maturity

Table 4 - Programmatic depth and maturity in Georgia and Ukraine

Country	Results
Georgia	Only one (1) VET level programme is mentioned (Integrated Pest Management at SJSU)
	It lacks detailed structured and digital focus, being likely centred on traditional agronomic techniques
	Other institutions suggest PA education as emerging rather that institutionalised
Ukraine	There is a lack of formal PA curricula at the BSc or MSc levels, implying a need for foundational development
	Mature ecosystem of PA programmes at tertiary level (BSc and MSc)
	Strong academic infrastructure supports agronomic, technical, and digital integration
	Programmes are hosted by specialized agricultural universities with access to real-world testing environments and interdisciplinary faculties

5.2. Technological Integration

Based on the research findings, the programmes delivered in Ukraine are preparing graduates for both practical operation and decision-support roles, while Georgian programmes still rely on more conventional and narrow-scope skills.

Table 5 - Technological Integration in Georgia and Ukraine

Technology Area	Country	Implementation
GIS & Mapping	Georgia	Not mentioned
	Ukraine	Core part of both BSc and MSc curricula
Remote sensing	Georgia	Possibly minimal or absent
	Ukraine	Included in theory and practice
Drones / UAVs	Georgia	Not mentioned
	Ukraine	Explicitly taught
GPS-controlled machinery	Georgia	Not evident
	Ukraine	Covered with term papers and labs
Data Management	Georgia	Not covered
	Ukraine	Focused on agri-data analysis
AI & Robotics	Georgia	Not included
	Ukraine	Found in MSc modules, such as the MSc on Digital Farming

5.3. Pedagogical Models and Delivery

Table 6 - Pedagogical Models and Delivery in Georgia and Ukraine

Country	Results
Georgia	Only one (1) identified programme 10 weeks long, likely seminar-based
	There is no clear integration of digital tools or practical components
	Suggests a more theoretical or advisory orientation, rather than hands-on VET delivery
Ukraine	Uses modular, ECTS-structired programmes compatible with EU standards
	Blends lectures, labs, project-based learning, and practical placements
	Includes problem-based learning and exposure to real-world technology (GNSS, UAVs)
	Practical training ensuring field experience for the students

5.4. Target Audiences

Table 7 - Target Audiences of programs in Georgia and Ukraine

Group	Country

	Georgia	Ukraine
Undergraduate students	Not identified	Structured BSc programmes
Graduate students	Not identified	MSc programmes in PA sectors
Agricultural technicians	Possibly vocational	With hands-on training
Lifelong learners/Farmers	10-week vocational option	In need of short courses

5.5. Strategic Gaps and Opportunities

Table 8 - Strategic Gaps and Opportunities in Georgia and Ukraine

Country	Gaps and Opportunities
Georgia	Urgent need to develop formal BSc/MSc programmes in PA
	Potential to start with modular short courses on digital skills, sensors, GIS, etc.
	Institutions like GTU or SJSU could be supported to scale from vocational to academic offerings
Ukraine	Excellent academic base, but in need of expansion in lifelong learning and modular VET for working professionals
	Could lead regional collaboration or pilot online and blended trainings

5.6. Recommendations for Capacity Building Actions

Table 9 - Recommendations for Capacity Building Actions in Georgia and Ukraine

Country	Recommendation	Priority
Georgia	Fund demo farms and digital labs for VET hands-on learning	High
	Translate and localise EU-aligned content	Medium
Ukraine	Create lifelong learning PA certificate programmes	High
Both	Develop common PA curriculum framework (modular, ECVET-based)	High
	Offer train-the-trainer programmes on PA tools and software	Medium

5.7. Skills Alignment Matrix

Below is a Skills Alignment Matrix comparing the most relevant PA skills with the existing Professional/VET courses identified in Georgia and Ukraine. The goal is to identify how well current tertiary/VET programs address the most critical PA skill areas.

Table 10 - Skills Alignment Matrix comparing the most relevant PA skills with the existing Professional/VET courses

Skill Sector	Skill area	Country		Notes
		Georgia	Ukraine	

Agronomic skills	Precision fertilisation/irrigation	Not covered	Agrochemical MSc	NUBiP targets site-specifc nutrient management
	Integration of PA in agronomic planning	Possibly covered in concept	Implicit in MSc design	Core strength in Ukraine
	Environmental sustainability using PA	Possible focus in pest control	Implicit in crop monitoring	Needs deeper integration
	Practical field-based experience	Not confirme d	Strong component in MSc and BSc	Ukraine included internships, demo fields
Technical skills	Operation of PA equipment	Not covered	Strong practical focus	Covered in Lviv Polytechnic BSc (GPS machinery, UAVs)
	Maintenance/calibration of PA tools	Not covered	Operational focus in Lviv Polytechnic	Some technical content, but lacking dedicated modules
	Remote sensing (satellite/UAV imagery)	Not covered	Integrated in BSc and MSc	Lviv Polytechnic includes remote methods, digital photography
	GIS and geographical mapping	Not covered	Core subject in BSc and MSc	GIS featured in Ukrainian programmes
Digital and IT skills	Data collection and analysis	Not covered	Included in BSc and MSc	Ukraine offers programming, data literacy, analytics
	Digital literacy for agri-tools and software	Not covered	Covered in programming, databases	Ukraine provides foundational digital skills
	ROI and cost-benefit analysis in digital age	Not covered	MSc design	Room for improvement on economic aspects
Soft skills	Policy and regulatory compliance	Not covered	Minor exposure	Legislative frameworks not emphasized
	Change management/innovation mindset	Not covered	Not explicit	Could be added as transversal module
	Communication of PA knowledge to stakeholders	Not covered	Possible through seminars	Important for vocational instructors
Summary	**Ukraine**		**Georgia**	
	Strong alignment in technical and agronomic areas, especially GIS, sensors, and crop management		Minimal alignment	

	In need of legislative, business/ROI training, and soft skills (change communication, innovation)	Current programme of SJSU lacks digital and technical depth, though pest management is tangentially relevant

6. Survey-based skills gap analysis

This comprehensive report presents a skills mismatch analysis in the context of PA in Georgia and Ukraine. Based on the questionnaire data, the report evaluates the current capabilities, training needs, barriers, and perceptions of key stakeholders, including farmers and educators. It highlights gaps in technical, managerial, and legislative knowledge, as well as opportunities for curriculum and policy development to better align workforce competeneces with the demands of modern sustainable agriculture.

KPI – Number of participants in Skills Gap Assessment Survey for Farmers and Workers (Quantitative indicator):

Baseline: 30 (15 participants from each country)

Target: 37 (20 participants from Georgia, 17 participants from Ukraine)

6.1. In-depth analysis of responses

6.1.1. Demographics

Respondents represented a balanced mix of roles – educators and farmers/agricultural workers – across Georgia and Ukraine – 22 participants identified as Farmer/Agricultural Worker, 15 participants as Educator. Age groups ranged from under 18 to over 65, with the majority falling within the 25-50 age range. Educational backgrounds included a significant proportion with BSc and MSc degrees, suggesting a moderately educated audience.

6.1.2. Current knowledge and use of Precision Agriculture technology

About half of the respondents are currently using or teaching PA practices. However, the self-assessed skill levels revealed that most participants rate themselves as having only 'small' to 'medium' expertise in key areas such as:

- Technological expertise
- Legislative expertise
- Local community leadership
- Combine traditional and precision agriculture
- Genetics expertise
- Expertise in circular agriculture
- Knowledge of local ecosystems

Less than 10% consider themselves highly proficient in these domains, highlighting a significant skills gap.

6.1.3. Training and Education

While some respondents reported participation in online courses, workshops, or company-led training (e.g. through FRENDT or LANCLAAS), a majority lacked structured training in PA. Most expressed a strong desire to engage in further professional development.

Needs for further training

The top areas identified for future training include:

- Working with automation technology
- Working with processed data (data science)

- How to choose the right technologies or solutions
- Diverse high-tech production skills
- “Diplomacy” and “people skills” in working with institutions
- Expertise in circular agriculture
- Insight into local needs

Training Method Preferences
Respondents ranked the following as most effective training approaches:

- Educational excursions/visits
- Field demonstrations
- Practical courses/exercise
- Education at the individual level/individual contact
- Agriculturalist’s visit in farms

Online methods like webinars and e-learning were seen as moderately effective, while passive formats like radio broadcasts were considered least effective.

6.1.4. Barriers to Adoption and Teaching

Some of the biggest challenges in adopting precision agriculture are:

- Lack of knowledge
- Cost
- Equipment availability

In particular, farmers cited the following main barriers to adopting PA:

- High cost of equipment
- Lack of technical knowledge and support
- Limited access to internet or modern tools

Educators, meanwhile, faced challenges including:

- Lack of resources and teaching infrastructure
- Inadequate funding and limited access to up-to-date tech
- Low student awareness or interest in PA topics

6.1.5. Collaboration and Industry Partnerships

While over 80% of respondents showed interest in collaboration with agribusinesses or fellow farmers, fewer had actually engaged in such partnerships. There is a clear potential to build cooperative ecosystems involving HEI, local farms, and tech companies to bridge the knowledge and practice gap.

6.1.6. Perceptions on impact and future of Precision Agriculture

The sentiment towards PA was largely positive. Respondents agreed that PA:

- Increases productivity

- Reduces production costs
- Improves sustainability and land use

Concerns were also recorded, particularly about:

- The cost and risk associated with adopting new technologies
- Uncertainty about returns on investment
- The complexity of tools for older or less tech-savvy users

Influential factors in adoption included peer success stories, business consultants, and government incentives.

7. Identified Skill Gaps

From the quantitative and open-ended responses, several priority skill areas emerged. The skills were divided into five (5) main categories, as listed in the Proposed Skills Matrix below.

KPI – Number of Skills and Competencies identified as missing in Skills Gap Analysis for Farmers and Workers (Quantitative indicator):

Baseline: 10-15 skills

Target: 12 skills

7.1. Quantitative results

Table 11 – Skills area and needs emerged through quantitative responses

Skill Area		Needs
Operation of PA equipment	→	Lack of hands-on experience
Data analysis and management	→	Difficulty interpreting data from PA tools
Legislative/policy knowledge	→	Unfamiliarity with standards, regulations
Economic assessment (ROI)	→	Unclear cost-benefit ratio
Localised technology adaptation	→	Tools not well-tuned to local conditions
Infrastructure use (e.g. GPS, IoT)	→	Limited access in rural settings
Change management and mindset	→	Cultural resistance to new practices
Agronomic integration with tech	→	Need for combined tech and agronomy expertise

7.2. Open-ended responses

The survey revealed several recurring challenges face by farmers and educators in adopting of teaching PA. Key obstacles include high initial investment costs, limited technical skills, and difficulties in managing large volumes of data. Respondents also cited limited funding, low awareness of PA technologies, and resistance to change – especially among older or traditionally minded professionals. Infrastructure limitations in rural areas, particularly unreliable internet access and poor digital connectivity, were also seen as significant barriers, alongside uncertainty about the return on investment. Sample responses include: *"High initial investment, lack of technical skills, data management issues", "Insufficient infrastructure in rural areas, uncertainty of ROI".*

To overcome these barriers, respondents emphasized the need for practical and institutional support. This includes access to demonstration fields, updated equipment, and hands-on training *opportunities ("Access to demo fields, equipment, and specialist training").* Some highlighted the importance of embedding PA modules into university curricula *("PA components in university curriculum"),* while others called for broader, continuous learning initiatives and targeted government support.

In terms of motivating factors, many respondents noted that peer influence, particularly the success stories of other farmers, as well as public incentives, significantly encouraged adoption. Innovation was widely regarded as essential in making PA work effectively on the ground. Most respondents agreed that PA is not only increasingly necessary for modern agriculture but also holds the potential to enhance their social and professional standing. As one noted, *"PA is now necessary," while another remarked, "PA would improve my social position".*

7.3. SWOT Analysis – Common Strategic Assessment of Skills and Training Needs in PA

A joint SWOT Analysis is provided to reflect the findings from both Georgia and Ukraine. The analysis highlights shared challenges and opportunities, bridging qualitative and quantitative findings (Sections 7.1 – 7.2) with the proposed skills matrix below, underpinning the design of a unified MSc program.

Table 12 – SWOT Analysis – Common Strategic Assessment of Skills and Training Needs in PA

Strengths	Weaknesses
Increasing recognition of PA as essential for modern agriculture	Lack of hands-on training and demonstration facilities
Emerging pool of digitally literate young professionals and students	Limited experience with data analysis and PA digital tools
Inclusion of PA modules in some academic curricula	Unfamiliarity with relevant legislation and policy frameworks
Shared understanding of the importance of sustainability and innovation	Weak digital infrastructure in rural areas (e.g. poor internet, IoT access)
	Cultural resistance and low motivation, especially among older stakeholders
	Absence of combined tech-agronomy training approaches
Opportunities	**Threats**
Design of a unified MSc curriculum tailored to identified skill gaps	Risk of diverging national approaches without coordinated action
Peer-to-peer learning and success stories to promote PA adoption	Continued uncertainty around ROI and financial viability for small-scale farmers
Public incentives and institutional support for upskilling	Ongoing underinvestment in rural infrastructure and training capacity
Integration of PA into sustainability and climate-smart farming agendas	Brain drain of lack of retention of digitally skilled youth in rural/agricultural sectors

7.4. Proposed Skills Matrix

Below is a proposed Skills Matrix with 12 key areas of competence for future training curricula:

Table 13 – Proposed Skills Matrix with 12 key areas of competence for future training curricula

Skill Sector	Skill Area
Agronomic skills	Precision fertilization/irrigation methods
	Environmental sustainability with PA
	Localisation of PA to soil/crop types
Technical skills	Operation of PA tools (drones, GPS systems)
	Data collection and analysis
	Integration of IoT in fieldwork
	Maintenance of digital agri-tools
Digital and IT skills	GIS and mapping tools
	Interpretation of sensor data
Soft skills	Change management and innovation leadership

Other skills	Policy and compliance in agriculture (legislative sector)
	Cost-benefit and ROI evaluation (economic sector)

8. Conclusions and Recommendations

The findings of this report underscore the urgent need for a comprehensive and coordinated approach to skills development in Precision Agriculture. While some academic institutions, mainly in Ukraine, have already developed formal curricula integrating agronomic and technical components, a broader and more inclusive training framework is needed to meet the evolving demands of the agricultural sector in both Georgia and Ukraine.

A blended training model that combines agronomic, technical, digital, and soft skills is essential. Curricula should move beyond theory to incorporate real-world applications, including the use of demo fields, practical equipment, and modular e-learning environments. This approach will better prepare learners for the challenges of modern farming and ensure immediate relevance in real agricultural contexts.

To address the current **skills mismatch between academic offerings and market needs**, the report strongly recommends the **development of modular training programs** focused on emerging PA technologies such as sensors, UAVs, GPS-guided systems, and data-driven decision tools. These programs should be **localized into national languages** and **adapted to the specific agro-climatic and infrastructural conditions** of each region.

Public-private partnerships are vital for facilitating **internships**, access to **pilot farms**, and **hands-on equipment**. **Government and EU support** is also critical, particularly in **funding digital tools and offering soft loans or subsidies** that make advanced technology accessible to both large and small-scale farmers.

Moreover, the success of PA adoption depends not only on technical know-how but also on **strong industry-academic collaboration** and the **active involvement of peer learning and mentorship networks**. Programmes should be designed to engage **young professionals**, as well as **older or transitioning farmers**, through **lifelong learning platforms** that are flexible, modular, and inclusive.

Finally, the report recommends improving access to **clear, updated legislation and compliance training**, as well as providing **interactive, multilingual digital tools** that make PA both understandable and actionable at the practitioner level.

Together, these strategies form a roadmap for closing the skills gap in Precision Agriculture and lay the foundation for **scalable, inclusive, and future-oriented VET and lifelong learning programs** across the region.

Annexes

Annex I: References

Bongiovanni, R., & Lowenberg-Deboer, J. (2004). Precision agriculture and sustainability. *Precision Agriculture, 5*(4), 359–387.

Bronson, K. (2019). Looking through a responsible innovation lens at uneven engagements with digital farming. *NJAS - Wageningen Journal of Life Sciences, 90–91*, 100294.

Chhipa, H. (2017). Nanofertilizers and nanopesticides for agriculture. *Environmental Chemistry Letters, 15*(1), 15–22.

de Oliveira Silva, R., van der Weide, R. Y., van Middelaar, C. E., & de Boer, I. J. M. (2021). A systems approach to support precision agriculture strategies for integrated crop-livestock systems. *Agricultural Systems, 191*, 103171.

EIP-AGRI. (2018). *Skills development for digital farming*. European Innovation Partnership for Agricultural Productivity and Sustainability.

Food and Agriculture Organization of the United Nations (FAO). (2009). *How to feed the world in 2050*. Rome: FAO.

Gebbers, R., & Adamchuk, V. I. (2010). Precision agriculture and food security. *Science, 327*(5967), 828–831.

Kamilaris, A., Kartakoullis, A., & Prenafeta-Boldú, F. X. (2017). A review on the practice of big data analysis in agriculture. *Computers and Electronics in Agriculture, 143*, 23–37.

Klerkx, L., Jakku, E., & Labarthe, P. (2019). A review of social science on digital agriculture, smart farming and agriculture 4.0: New contributions and a future research agenda. *NJAS - Wageningen Journal of Life Sciences, 90–91*, 100315.

Krishnababu, M. E., Devi, B. R., & Soni, A. S. (2024). A review on precision agriculture: Navigating the future of farming with AI and IoT. *Asian Journal of Soil Science and Plant Nutrition, 10*(2), 336–349.

Kushwaha, M., Singh, S., Singh, V., & Dwivedi, S. (2024). Precision farming: A review of methods, technologies, and future prospects. *International Journal of Environmental, Agriculture and Biotechnology, 92*, 1–12.

Liakos, K. G., Busato, P., Moshou, D., Pearson, S., & Bochtis, D. (2018). Machine learning in agriculture: A review. *Sensors, 18*(8), 2674.

McBratney, A., Whelan, B., Ancev, T., & Bouma, J. (2005). Future directions of precision agriculture. *Precision Agriculture, 6*(1), 7–23.

Mulla, D. J. (2013). Twenty five years of remote sensing in precision agriculture: Key advances and remaining knowledge gaps. *Biosystems Engineering, 114*(4), 358–371.

Mulla, D. J., et al. (2015). Applications of remote sensing in precision agriculture: A review. *Remote Sensing, 12*(19), 3136.

Nunes, E. C. (2023). Employing drones in agriculture: An exploration of various drone types and key advantages. *arXiv*.

Pierce, F. J., & Nowak, P. (1999). Aspects of precision agriculture. *Advances in Agronomy, 67*, 1–85.

Rose, D. C., Wheeler, R., Winter, M., Lobley, M., & Chivers, C. A. (2021). Farming and the future of data-driven decision-making: Understanding barriers to the uptake of agricultural decision support systems. *Computers and Electronics in Agriculture, 178*, 105784.

Wolfert, S., Ge, L., Verdouw, C., & Bogaardt, M. J. (2017). Big data in smart farming – A review. *Agricultural Systems, 153*, 69–80.

Zhang, C., & Kovacs, J. M. (2012). The application of small unmanned aerial systems for precision agriculture: A review. *Precision Agriculture, 13*(6), 693–712.

Zhang, C., Kovacs, J. M., & Kondylis, C. (2022). Remote sensing for site-specific management in precision agriculture: Current status and future perspectives. *Computers and Electronics in Agriculture, 196*, 106879.

Frontiers in Plant Science. (2025). Integration of smart sensors and IoT in precision agriculture. *Frontiers in Plant Science*.

Annex II: Tertiary Level Professional/VET and Lifelong Learning Programmes in Precision Agriculture Template

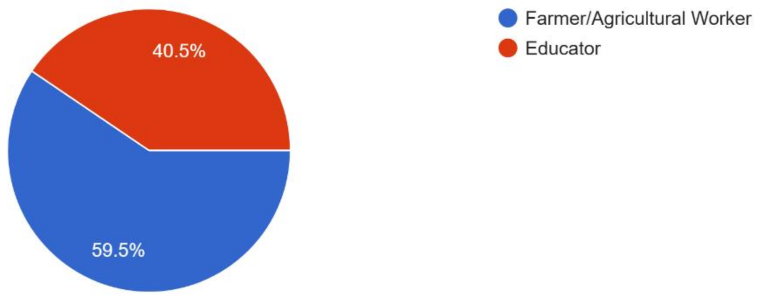
Please fill in all the requested information	
Academic Institution	
Faculty	
City	
Country	
Name of VET or Lifelong Learning Programme	
Type of Programme	
Duration	
Professional/VET training course **(Add a short description about the programme-course)**	
Programme structure *(Describe the programme structure such as lessons, delivery methods etc.)*	
Programme goals	
Course Topics (modules per semester, ECVET credits)	
Admissions requirements	
Career outcomes *(alignments with industry standards)*	
URL	
Keywords	
Field	

Annex III: Assessment of Skills Gaps for Farmers and Workers Results

PART I. Sample information

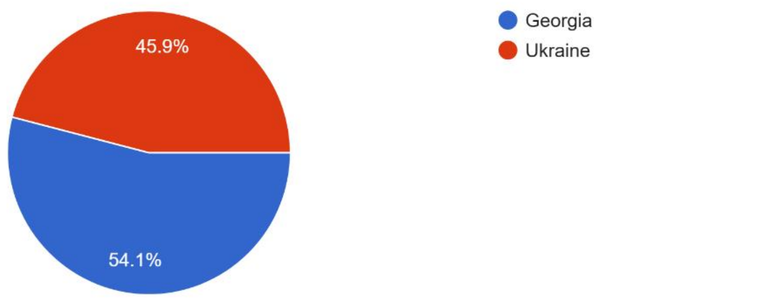
1. Please specify your role:

37 responses



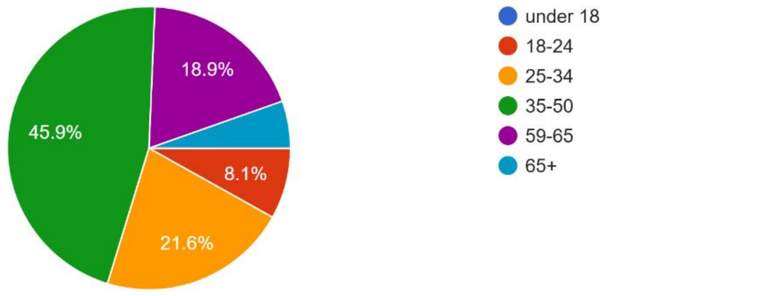
2. Country:

37 responses

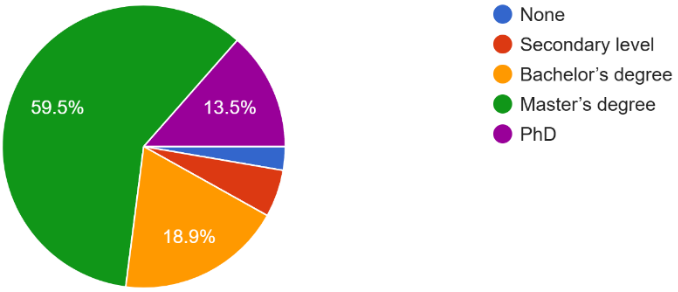


3. Age:

37 responses

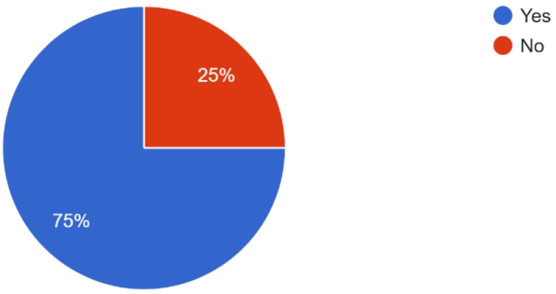


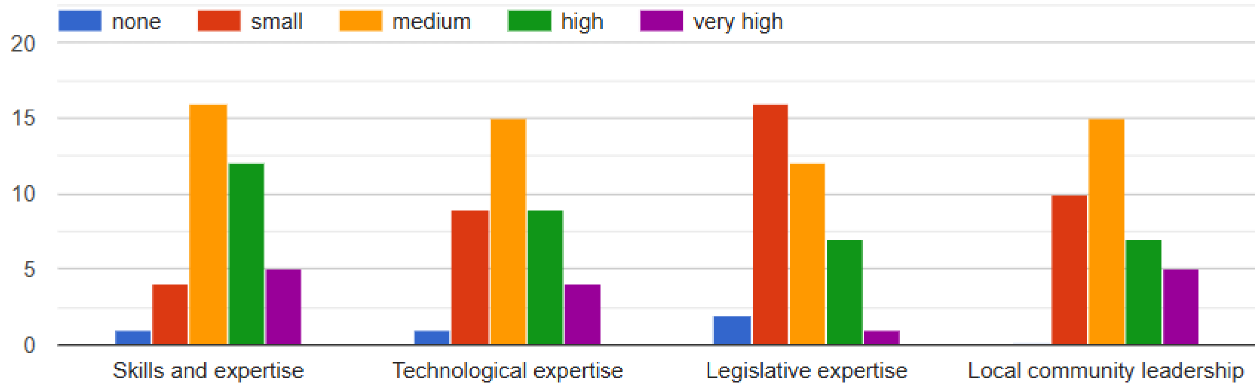
4. Educational level:
37 responses

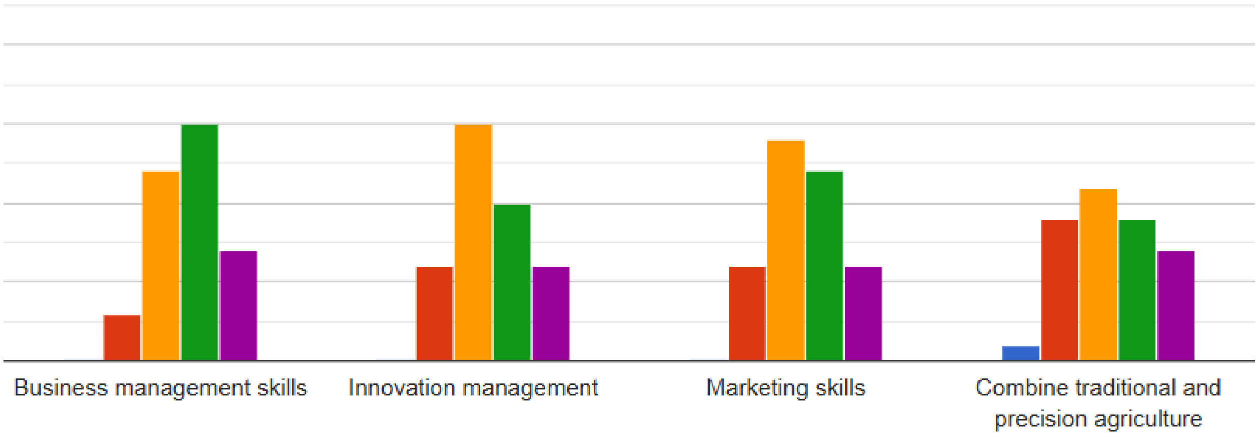


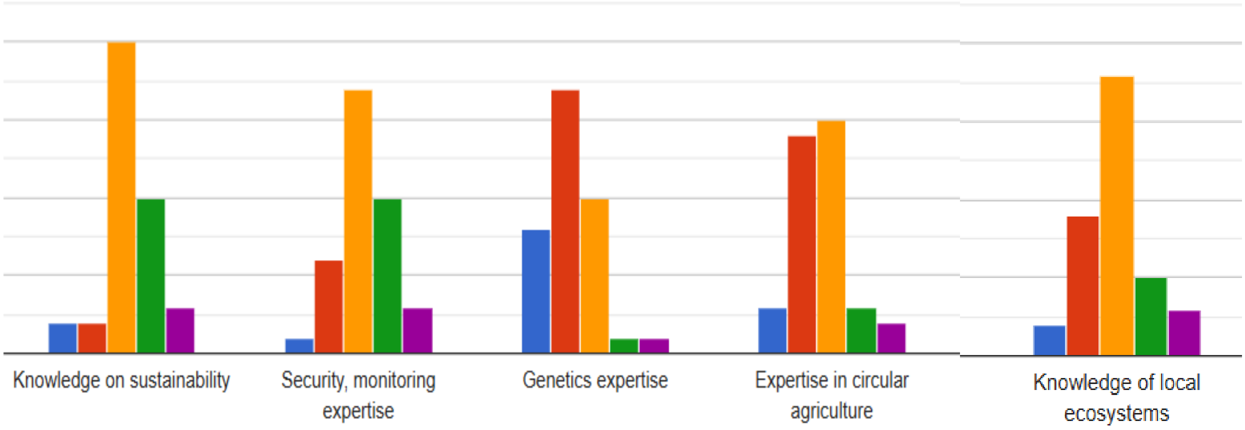
PART II. Current Knowledge and Use of Precision Agriculture Technology

5. Do you currently use or teach about any form of precision agriculture in your work environment?
36 responses





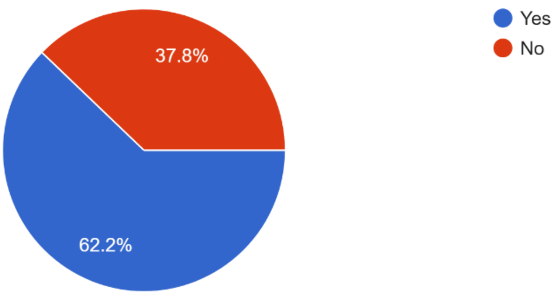




PART III. Training and Education

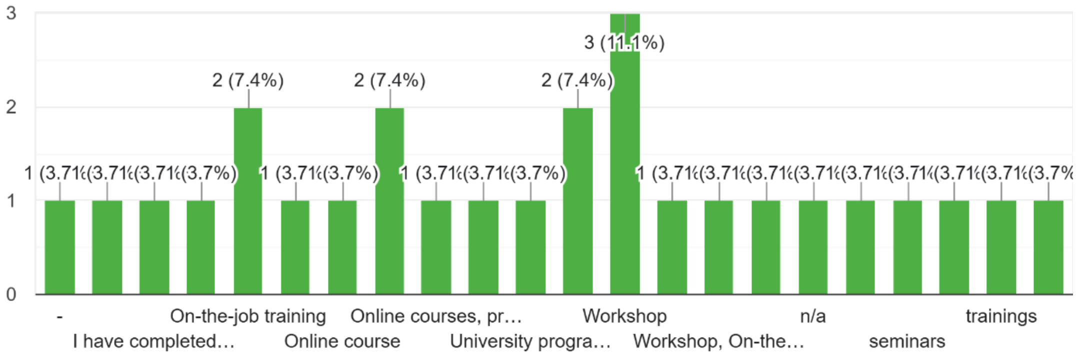
7. Have you received formal or informal training in precision agriculture techniques?

37 responses



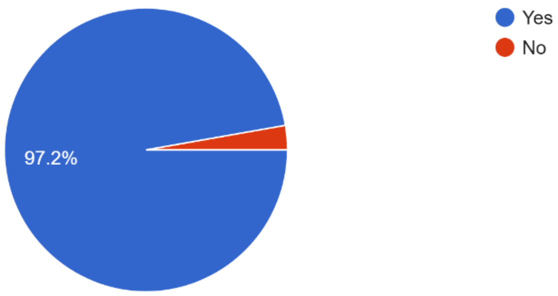
7a. If yes, what kind of training did you receive? (e.g., Online course, Workshop, University program, On-the-job training)

27 responses

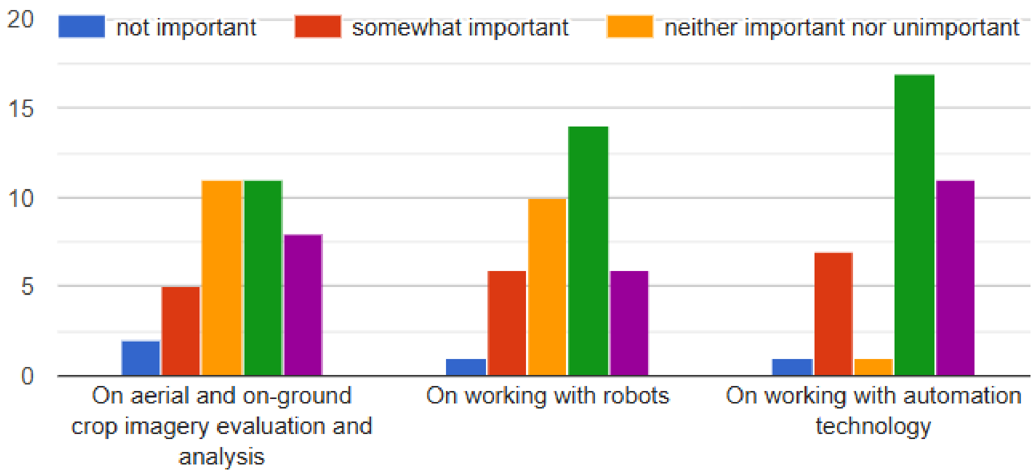


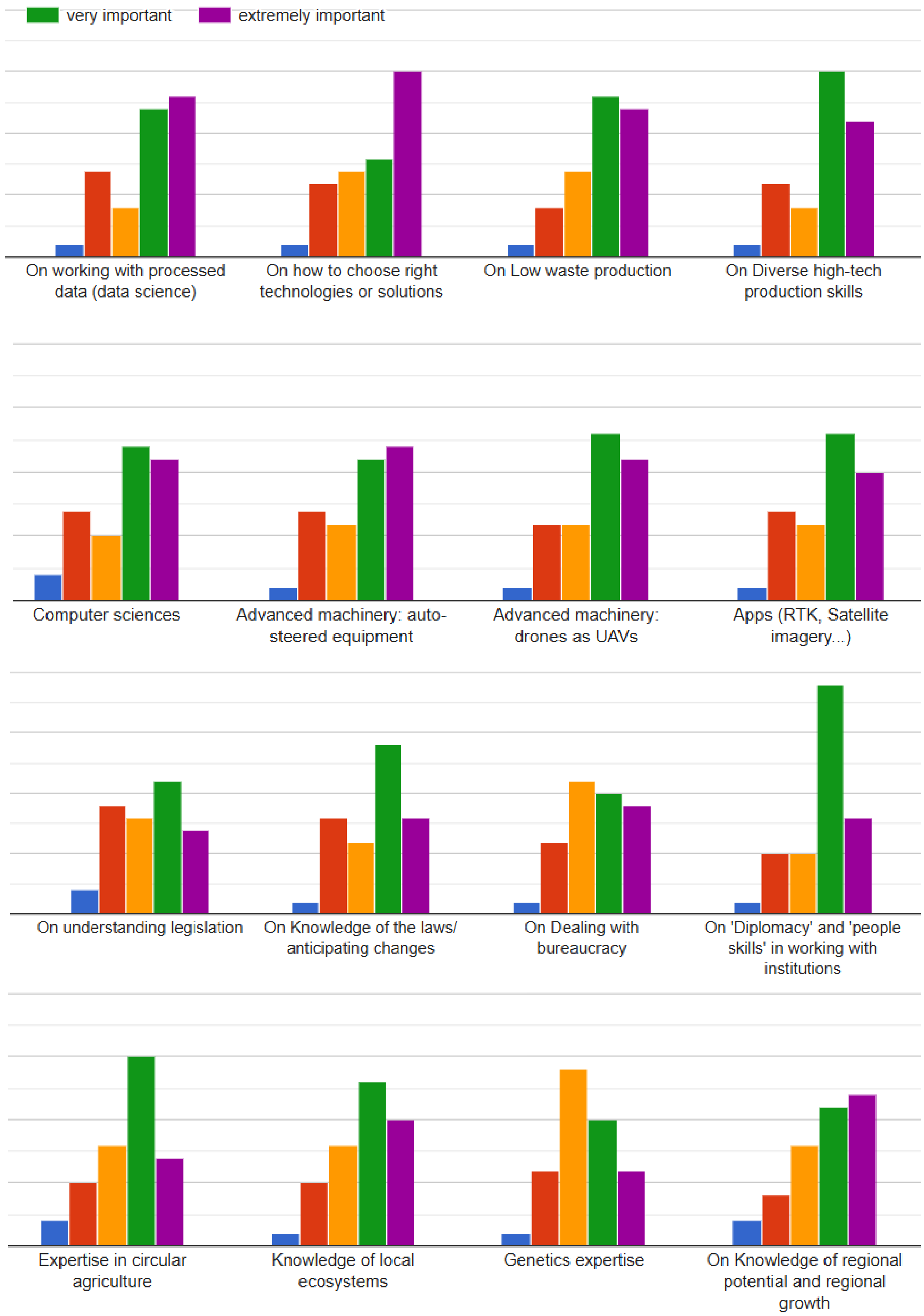
8. Would you be interested in further professional development or certification in precision agriculture?

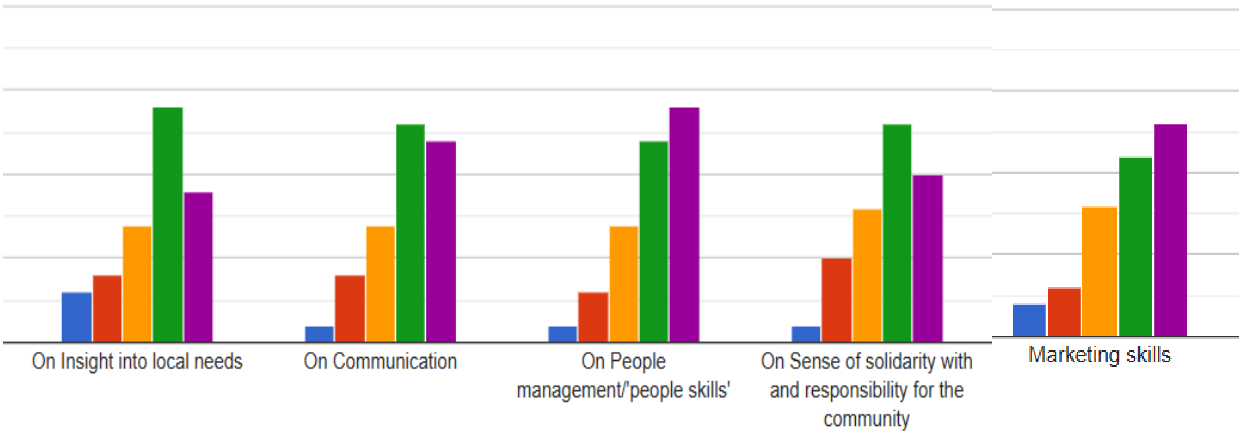
36 responses



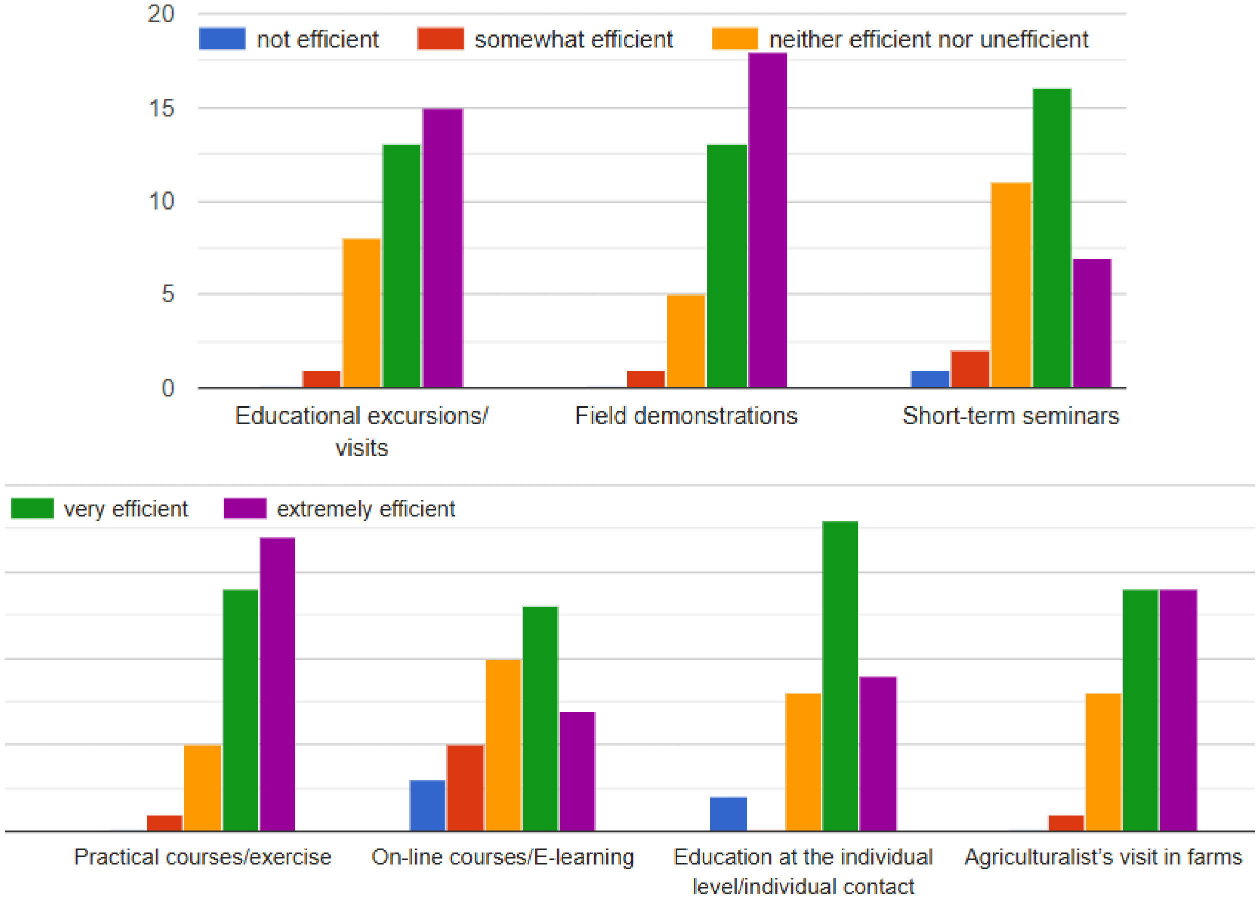
9. **Rate your need for training to the following** (1:not important at all & 5:extremely important)

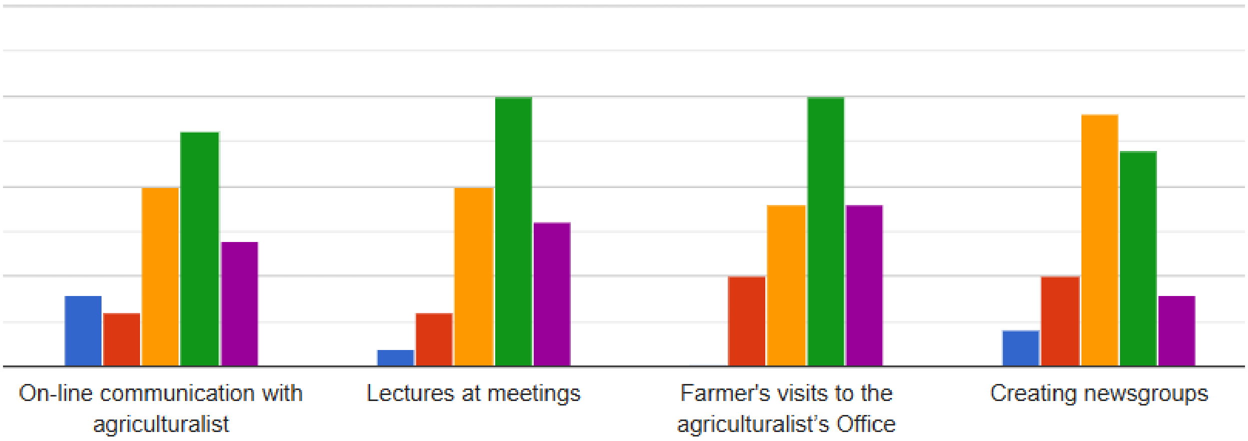


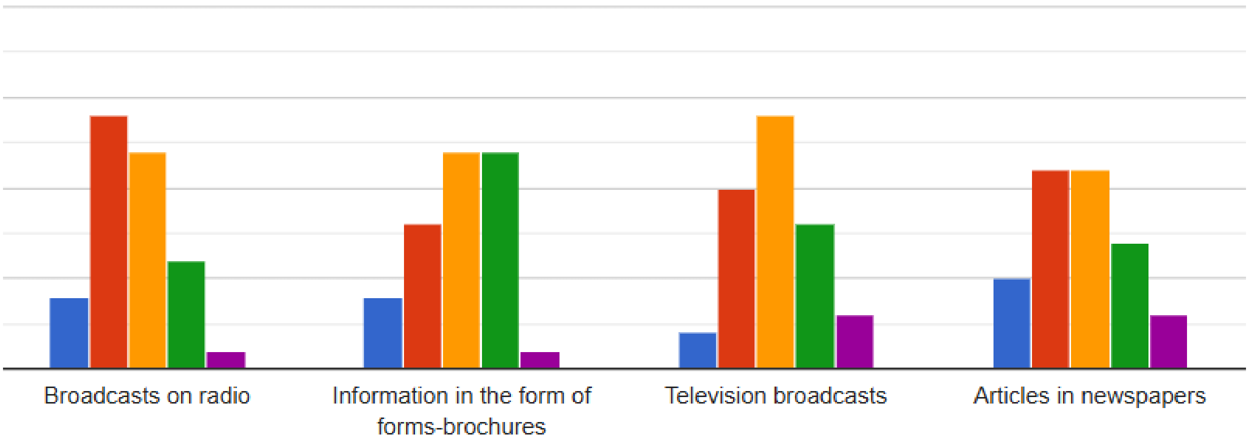

very important
extremely important
On working with processed data (data science)
On how to choose right technologies or solutions
On Low waste production
On Diverse high-tech production skills
Computer sciences
Advanced machinery: auto-steered equipment
Advanced machinery: drones as UAVs
Apps (RTK, Satellite imagery...)
On understanding legislation
On Knowledge of the laws/ anticipating changes
On Dealing with bureaucracy
On 'Diplomacy' and 'people skills' in working with institutions
Expertise in circular agriculture
Knowledge of local ecosystems
Genetics expertise
On Knowledge of regional potential and regional growth

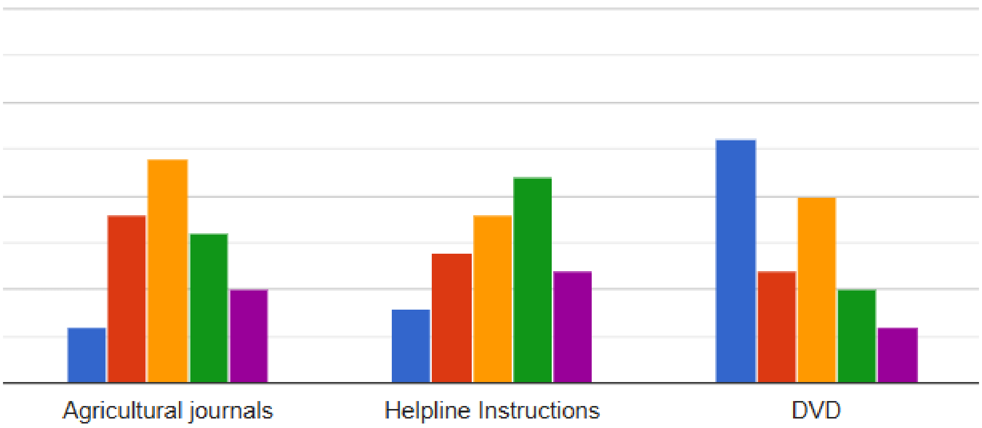


10. **Training methods efficiency** (1:not efficient & 5:extremely efficient)



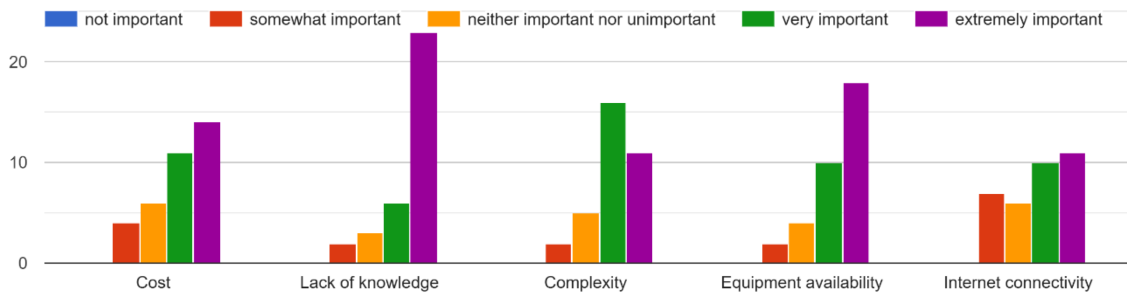






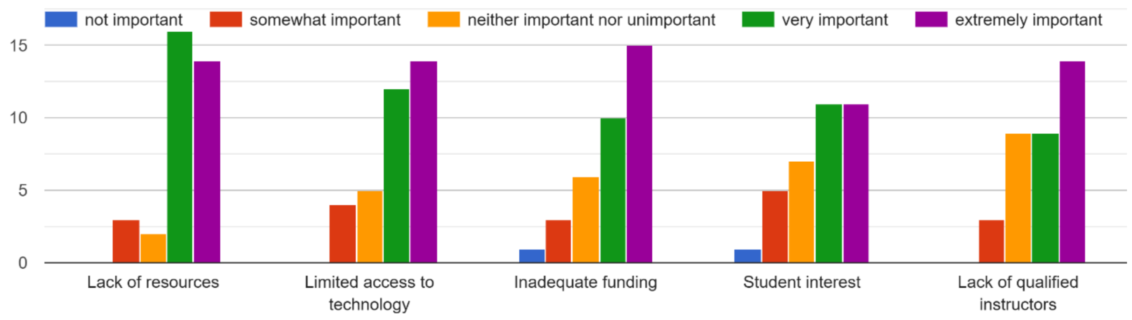
PART IV. Important barriers to Adoption

11. What do you see as the biggest challenges in adopting precision agriculture? (1:not important at all-5 extremely important)



PART V. Important barriers to Teaching

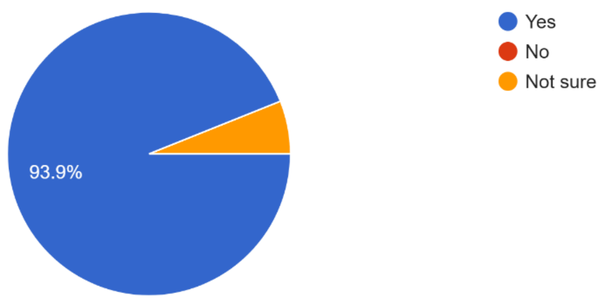
12. What do you see as the biggest challenges in teaching precision agriculture? (1:not important at all-5 extremely important) :



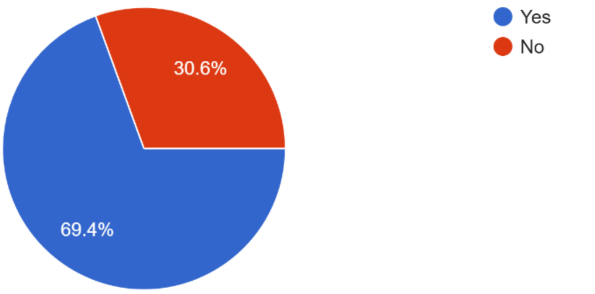
PART VI. Collaboration and Partnerships

13. Would you be interested in collaborating with other farmers or agribusinesses to share knowledge and resources related to precision agriculture?

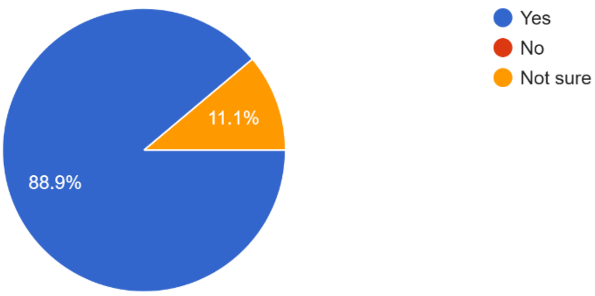
33 responses



14. Are you currently collaborating with agricultural industry partners or farms to provide practical experience in precision agriculture for your students?
36 responses

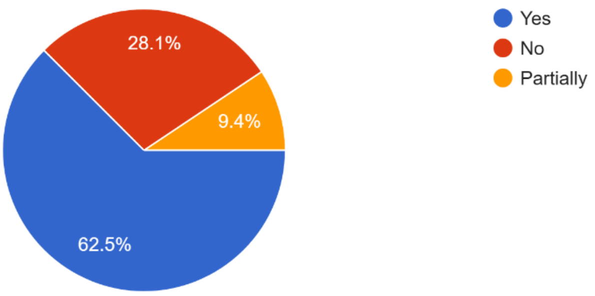


15. Would you be interested in partnerships with local farms or agribusinesses to enhance your students' hands-on learning?
36 responses

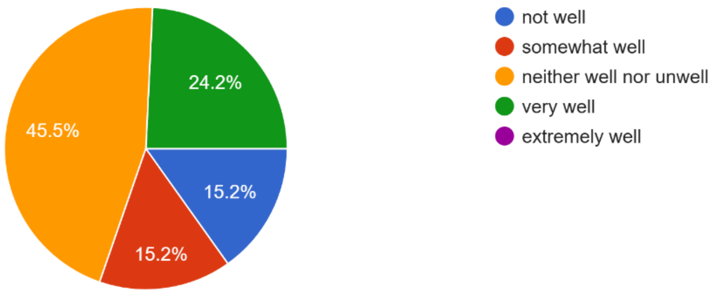


PART VII. Workforce Readiness and Skills

16. Do you have skilled workers or staff who are trained in precision agriculture techniques?
32 responses

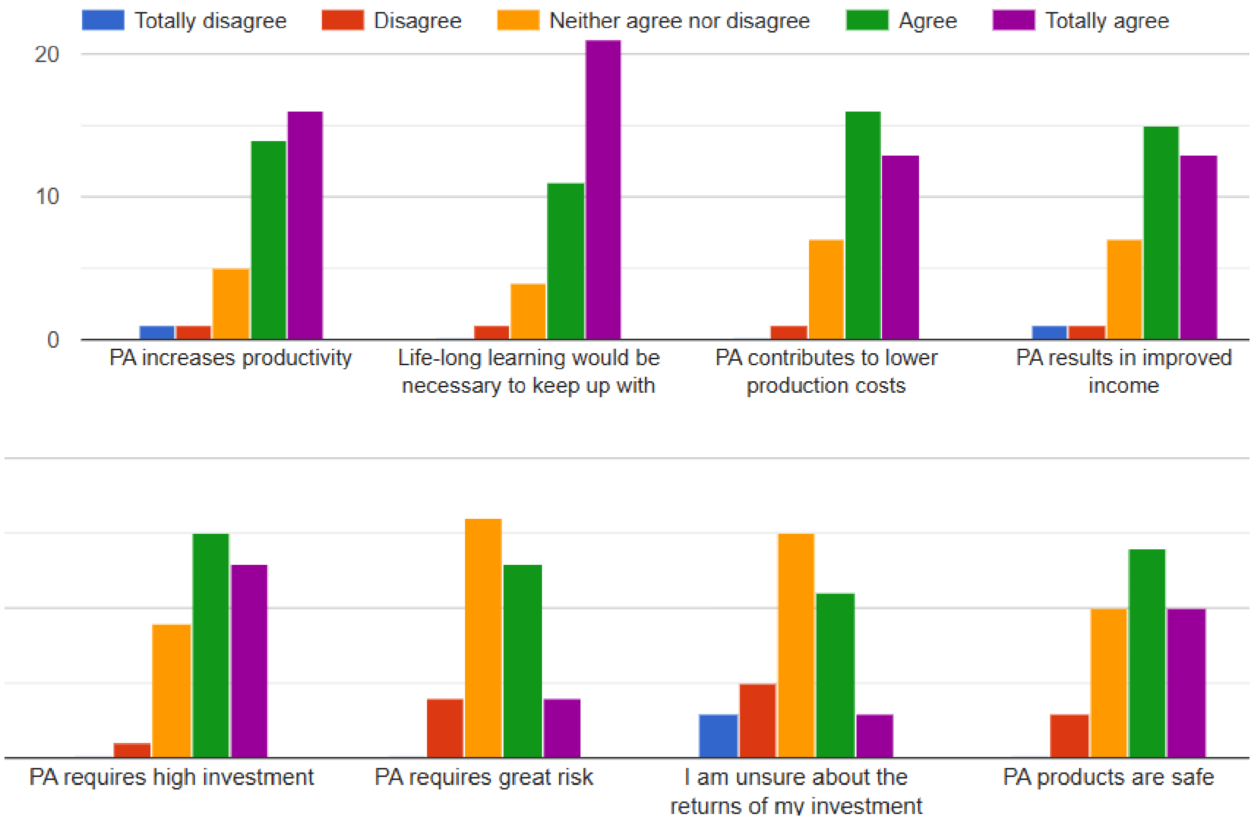


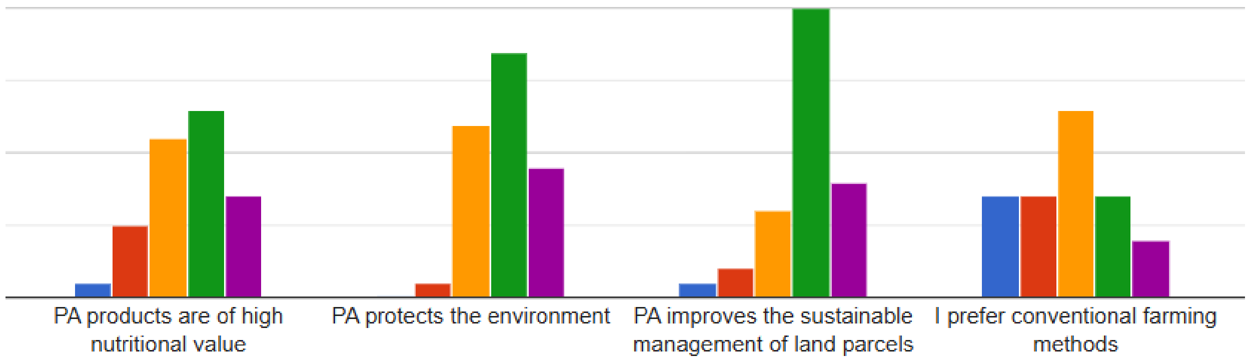
17. How well do you think your students are prepared to work with precision agriculture technologies after completing your program?
33 responses

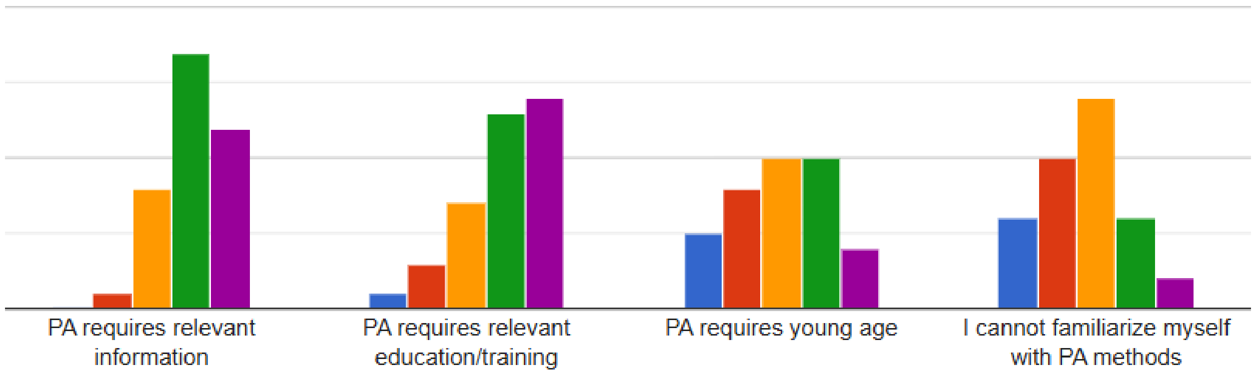


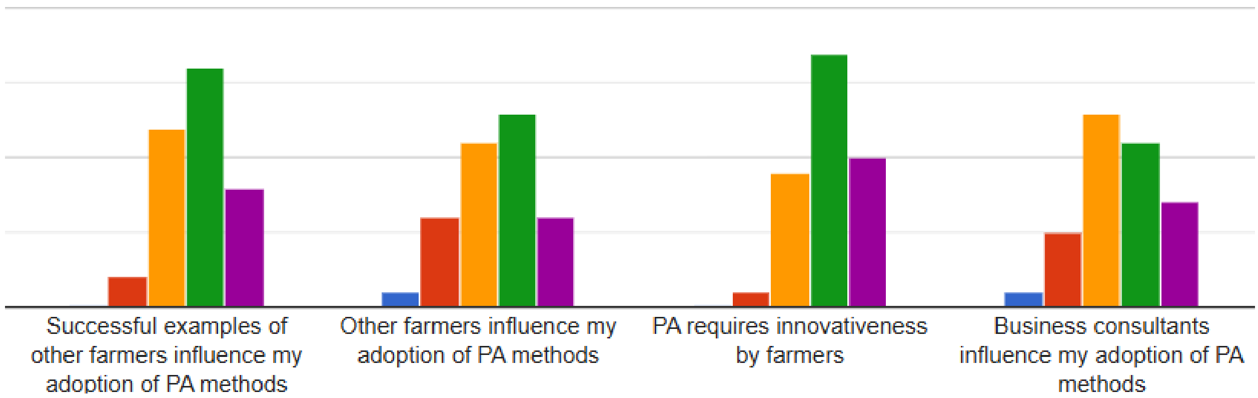
PART VIII. Impact and Future of Precision Agriculture

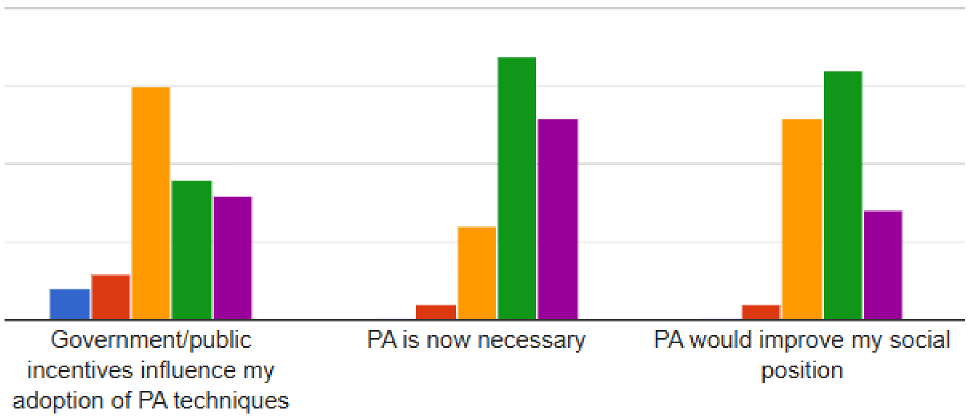
18. What is your agreement to the following sentences




PA products are of high nutritional value
PA protects the environment
PA improves the sustainable management of land parcels
I prefer conventional farming methods


PA requires relevant information
PA requires relevant education/training
PA requires young age
I cannot familiarize myself with PA methods


Successful examples of other farmers influence my adoption of PA methods
Other farmers influence my adoption of PA methods
PA requires innovativeness by farmers
Business consultants influence my adoption of PA methods


Government/public incentives influence my adoption of PA techniques
PA is now necessary
PA would improve my social position

Annex III: Key Performance Indicators (KPIs) reached

Indicator	Type	Baseline	Target
Number of Professional/VET Programs in Precision Agriculture mapped	Quantitative	**5**	Georgia and Ukraine: 11 Total: **14**
Number of Participants in Skills Gap Assessment Survey for Farmers and Workers	Quantitative	**30** (15 from each country)	Georgia: 20 Ukraine: 17 Total: **37**
Number of Skills and Competencies Identified as Missing in Skills Gap Analysis for Farmers and Workers	Quantitative	**10-15**	**12**