Careers and Skills in Precision Agriculture

Introduction / Need for Research

Precision Agriculture (PA) has been rapidly integrated into a multitude of agricultural practices and technologies. Over 50% midsize farms and 70% of large-scale crop farms have adopted at least one PA technology (Lim et al., 2024). The quick integration of PA technologies has opened new career opportunities in the PA world. With the rapid changes in services available, universities struggle to adequately prepare new employees for these jobs (Bournaris et al., 2022). PA adoption has shifted the demand for technician labor and has led to increased jobs and wages (Kalva & Janzen, 2026). A 2015 survey identified PA careers including equipment operators, sales specialists, technical support, and agronomist (Erickson et al., 2018). This participatory research project seeks to update the research regarding current PA careers available and the skills needed by individuals applying for these jobs.

This study was guided by a pragmatic research paradigm, emphasizing practical knowledge generation to address real-world workforce needs. The Developing a Curriculum (DACUM) framework (Norton & Moser, 2008), a well-established occupational analysis process used to identify industry-validated careers and competencies through structured engagement with practitioners, served as a conceptual framework. The framework aligns with workforce development and career and technical education research by centering practitioner expertise as the primary source of competency identification.

Methodology

The purpose of this participatory research was to describe current jobs available in PA and the skills associated with those jobs as perceived by young PA professionals. Young PA professionals are digital natives and work in entry-level positions similar to those of students entering the profession. Since participatory research is informed by real-world context, it can be more easily translated into a non-academic setting (Vaughn & Jacquez, 2020). Through purposive and snowball sampling, we recruited 13 individuals heavily engaged in precision agriculture to participate in this study. Participants included managers of agricultural cooperatives, agronomists, PA equipment specialists, seed dealers, PA regional sales managers, custom applicators, farmers, and faculty from three postsecondary institutions. Due to limited time and resources, some participants joined via zoom while others met face-to-face. First, we conducted a 60-minute focus group interview to understand full-time PA careers within each participant's professional context. At the conclusion of the interviews, participants and researchers worked together to refine career titles and build consensus. Next, the group followed an adapted DACUM (Developing a Curriculum) process, where we identified job priorities, analyzed and verified duties and tasks, and identified knowledge and skills required to perform the tasks successfully (Norton & Moser, 2008). Member checking was conducted at the conclusion of the workshop to ensure accuracy and credibility of findings. An audit trail helped enhance trustworthiness of findings (Lincoln & Guba, 1985).

Findings

Researchers and participants identified 18 distinct full-time PA careers within four focus areas:

Equipment and hardware focus: Applicator/equipment operator (learning the monitor, operating vehicle), drone pilot/technician (data processing, imaging, operating the drone), equipment-based service specialists (answering internal questions for service technicians), and service technician/specialist (hardware installation, in-field troubleshooting, updating software).

Field and input focus: Agronomist (input recommendations, IPM, making a claim, mapping to resolve issues), Scout/crop consultant (collecting data by drone/foot, application, identify and solve issues), technical agronomist (local research, solve issues for local producers to improve efficiency), soil sampler (operate side by side/soil probe, RTK and mapping), precision agronomic specialist (make fertilizer and seed recommendations), consultant (contractors and sub-contractors work independently to support farmer).

Digital and human focus: Data manager (pull/load data for farmers, troubleshoot applied maps and information), Call center operator (customer troubleshooting, terminal management), Trainer/program developer (internal tech training, external field days, postsecondary).

Innovation and development focus: Program development specialist (writing code, software, API for online data sharing), Product management (conduct market research, identify new product opportunities), Researcher (in-field, on technology, planning setup, execution, conclusions on data), Engineer (technology application/development, develop solutions for technical problems).

Across careers, several skill domains emerged. Technical competencies included equipment operation, calibration, prescription file management, data processing, GIS and mapping, software and display operation, troubleshooting, and systems integration. Agronomic knowledge, including soils, crop management, pest management, and nutrient application, was emphasized across many roles. Data-related skills such as cleaning, interpreting, and communicating spatial and operational data were identified as critical. Additionally, participants highlighted communication skills, regulatory compliance, safety, customer support, training, and problem-solving as essential regardless of role.

Conclusions/Implications/Recommendations

PA careers encompass a diverse and expanding set of roles which extend well beyond traditional agronomy and equipment operation positions. The findings demonstrate that PA professionals are expected to integrate technical, agronomic, and interpersonal competencies, often spanning multiple domains, within a single role. Compared to earlier literature, the number and specialization of careers identified in this study reflect the rapid evolution of PA technologies and services. Results from this study have implications for agricultural education, workforce development, and industry recruitment. Postsecondary institutions can use these findings to align curricula, certificates, and experiential learning opportunities with current industry needs. Emphasis should be placed on interdisciplinary skill development, including data management, communication, and applied problem-solving. Industry partners may use career and skill descriptions to improve job postings, onboarding, and professional development programs. Future research should expand this work nationally and examine alignment between educational outcomes and employer expectations over time.

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