

Preparing the Future Agricultural Technology Workforce

Ty Casey

Ty.t.casey@ndsu.edu

701-318-7673

Department of Agricultural and Family Education

North Dakota State University

FLC 216A Hall, Fargo, ND 58108

Brooke Thiel

brooke.thiel@ndsu.edu

701-231-5839

Department of Agricultural and Family Education

North Dakota State University

FLC 216B Hall, Fargo, ND 58108

Introduction

Agriculture is experiencing rapid technological change as precision agriculture, automation, artificial intelligence (AI), geographic information systems (GIS), and data-driven decision making become increasingly embedded in agricultural production. These changes are reshaping the agricultural workforce by increasing the need for employees who can combine technical knowledge, digital literacy, problem solving, and communication skills (National Association of Colleges and Employers, 2024). National workforce discussions in food, agriculture, and natural resources continue to emphasize the need for stronger education-to-workforce pathways and preparation for both technical and high-skill careers (National Academies of Sciences, Engineering, and Medicine, 2021).

School-based agricultural education (SBAE) has historically served as an important pathway for preparing students for agricultural careers through classroom instruction, supervised agricultural experiences, and leadership development (Roberts & Ball, 2009). However, as agricultural technology advances, programs must continually examine whether students are being prepared for the types of skills employers now expect. Recent agricultural education research continues to call attention to the importance of technical skill development in teacher preparation and agricultural pathways (Wells & Hainline, 2021). At the same time, employers broadly emphasize career readiness competencies such as communication, critical thinking, professionalism, teamwork, and technology (National Association of Colleges and Employers, 2024). Therefore, the purpose of this study was to explore agricultural technology employers' perceptions of workforce readiness and identify educational priorities necessary for preparing the future agricultural technology workforce.

Conceptual Framework

This study was framed through Human Capital Theory, which suggests that investments in education and training increase individual productivity and strengthen workforce capacity (Becker, 1964). In the context of agricultural technology, human capital is not limited to one technical skill or content area. Instead, it includes the ability to apply technical knowledge, adapt to new tools, communicate with others, and solve real problems in changing agricultural systems. This framework was useful because the study focused on how employers understand the skills, knowledge, and educational experiences needed to prepare a stronger agricultural workforce.

Methodology

A qualitative research design using semi-structured telephone interviews was used to understand agricultural technology industry representatives' perceptions of workforce preparation (Creswell & Poth, 2018; Merriam & Tisdell, 2016). Participants represented 19 different companies (n= 20; one company had two) across North Dakota's agricultural industry (Patton, 2015). Individuals self-selected themselves as they volunteered to be a part of this study during an agricultural technology workforce event. Interview questions focused on current workforce challenges, desired technical competencies, transferable skills, educational preparation, and recommendations for strengthening workforce development. Because interviews were not audio recorded, detailed field notes were documented during each interview and subsequently analyzed using descriptive coding procedures (Saldaña, 2021). Researchers reviewed the data, compared codes pulled from the field notes, and organized recurring ideas into categories and themes (Lincoln & Guba, 1985). This process allowed the research team to identify common patterns across companies.

Findings

Three major themes emerged from the data. First, employers described a multi-skilled workforce gap. Participants consistently noted that agricultural technology employees need basic mechanical ability, equipment operation skills, digital literacy, troubleshooting ability, communication skills, and an understanding of agronomic principles. However, representatives also noted that applicants rarely possess all of these competencies together. In many cases, individuals may be strong mechanically but weaker with software and data systems, or they may understand technology but lack practical equipment or agronomic knowledge. Second, participants described the increasing importance of interdisciplinary agriculture. These representatives explained that agricultural technology work no longer fits neatly into one program area or discipline. A real problem in the field may require an employee to understand equipment, software, mapping systems, electrical components, agronomy, and customer communication at the same time. This finding suggests that agricultural education programs may need to decrease silos between program areas and create more learning experiences where students solve real-world problems that crosscut fields. Third, the participants emphasized the need to continue and grow workforce collaboration. Participants identified advisory boards, internships, classroom connections, and direct engagement with students as important ways to connect with future employees and strengthen the workforce pipeline. These partnerships allow employers to communicate current skill needs while also helping educational programs remain connected to real industry expectations.

Conclusions

The findings suggest that agricultural technology representatives are not only looking for more workers; they are looking for workers who are prepared more holistically. Modern agricultural technology careers require individuals who can combine technical, digital, agronomic, and interpersonal skills in practical settings (National Institute of Food and Agriculture, 2026). This creates a challenge for educational systems that may still organize learning in separate departments. Preparing the future agricultural technology workforce will require learning experiences that mirror the integrated nature of the workplace. These findings also connect directly to Human Capital Theory (Becker, 1964). If education and training are investments in workforce capacity, then agricultural education must invest in the specific competencies that employers identify as valuable. In this study, the most valuable preparation was not one isolated skill, but the ability to transfer knowledge across settings, solve problems, and continue learning as technology changes (National Academies of Sciences, Engineering, and Medicine, 2021).

Several recommendations emerged from this study. First, additional research should examine how agricultural education can intentionally develop transferable or durable skills such as communication, adaptability, teamwork, professionalism, and critical thinking. These skills were important to employers, but they are often more difficult to teach and assess than technical content. Second, future research should more clearly examine the gap between the skills individuals enter the workforce with and the skills employers need, especially related to transferable skills. Better understanding this gap can help educators and workforce organizations design more targeted learning experiences. Third, organizations should continue serving as connectors between education and industry by strengthening pathways, expanding workforce learning opportunities, and supporting partnerships with employers.

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