

The Digital Transformation of Agriculture: Advancing Productivity Towards a Circular Bioeconomy

Abstract

Over the past 150 years, agriculture has witnessed a significant shift with the mechanization of machine systems aimed at enhancing productivity and convenience. The advent of precision agriculture technologies since the 1990s has acted as a pivotal point, gradually evolving into a catalyst for smart agriculture and further improving production practices. The integration of machine electronics, automation, precision guidance, communication, and cloud computing has not only increased machine productivity but also brought about notable enhancements in worksite productivity. Presently, autonomous machine systems are emerging as the next frontier, offering diverse pathways for future productivity and convenience while addressing the pressing need for sustainability and decarbonization. This presentation will review the fundamental aspects of digital technologies that currently deliver value in agriculture and explore the research opportunities lying ahead in the journey from automation to autonomy of large-scale production systems. The focus will be on how these advancements contribute to the creation of a circular bioeconomy. By leveraging digital transformation, the agriculture sector can foster sustainable practices, optimize resource utilization, and enhance overall productivity, paving the way for a more circular and environmentally conscious future.



Professor John F. Reid

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RESEARCH AREAS AND EXPERTISE

- Translation of research into practice, outcome-driven innovation processes, business model innovation, and innovation management.
- Circular bioeconomy in agriculture, precision agriculture technologies, agricultural robotics and automation, automation of agricultural and biological systems.
- Deployment of embodied AI in agriculture, construction, and marine application verticals.

SELECTED AWARDS AND RECOGNITION

- Fellow, International Academy of Agricultural and Biosystems Engineering (2024)
- National Academy of Engineering (2019)
- John Deere Fellow (2017)
- ASABE Fellow (2004)

Dr. Reid has more than 35 years of highly accomplished technology leadership experience in industry and academia. From 1986-2000, he served on the faculty and achieved the rank of Professor at the University of Illinois where his research focused on sensing, automation, and control of food and agricultural systems.

Dr. Reid then spent 19 years with Deere and Company where initiated the development of enterprise field robotics capabilities. He has experience in innovation management having served as John Deere's Director, Enterprise Product Innovation and Technology for 14 years. In 2017 he was recognized as John Deere Technical Fellow for his contributions in Technology Innovation.

From 2020-2022, he was Vice President of Enterprise Technologies for Brunswick Corporation and responsible for building organizational capabilities that enabled initial products in vessel electrification and autonomy. In 2019, he was elected to the National Academy of Engineering for contributions to automation in agriculture.

In 2022, Dr. Reid returned to academia at the University of Illinois in Urbana-Champaign where he is a research faculty member with joint appointments in CS, Ag and Bio Engineering, and Electrical and Computer Engineering. He also is the Executive Director of the NCSA Center for Digital Agriculture.