The Council for Agricultural Science and Technology

September 2026

AI in Agriculture: Transforming the Food System from Data to Decisions to Action

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Agriculture presents one of the world's most challenging environments for artificial intelligence (AI) because weather, pests, and markets change continuously. These same characteristics make agriculture one of AI's most consequential application areas. As AI advances, it is rapidly becoming a foundational technology across agriculture and the food system. Like mechanization, improved genetics, and precision agriculture before it, AI is expanding the capabilities of producers, researchers, and other agricultural stakeholders by enabling faster, better informed, and increasingly automated decisions. It also discusses emerging AI developments, how AI is being applied across the agricultural value chain, the technological and institutional foundations needed to support its continued development, and the policy considerations that will shape its future in U.S. agriculture. The policy choices made during the next few years will influence how rapidly AI is adopted in agriculture as well as who benefits from its deployment and how effectively it strengthens the U.S. food system.

Five Key Messages

- AI is becoming a foundational capability across agriculture. It is no longer limited to research labs or isolated software applications. It is increasingly embedded in agricultural equipment, production systems, food processing, logistics, and natural resource management.
- AI is changing the role of computing in agriculture. It is moving beyond analyzing information to enabling intelligent systems that can perceive, reason, and increasingly act in the physical world.
- Data quality, human expertise, and trust remain essential. AI systems depend on accurate, representative data and effective human oversight. Successful adoption requires attention to validation, transparency, cybersecurity, interoperability, and responsible governance.
- AI is transforming the entire agricultural value chain. Applications extend beyond crop production to include livestock management, food processing, supply chains, natural resource stewardship, and scientific research.
- The future of AI in agriculture depends partially on policy. The benefits of AI in agriculture depend not only on advances in AI itself, but also on the computing infrastructure needed to develop and operate increasingly capable models and services. Policies affecting data centers, connectivity, interoperability, producer choice, workforce development, and responsible governance will therefore influence how rapidly agricultural AI develops and how broadly its benefits are realized.

Introduction

Artificial intelligence (AI) is already transforming agriculture, enabling new approaches to production, processing, natural resource management, and scientific discovery. Applications now support livestock monitoring, crop management, food quality assessment, supply-chain logistics, and many other functions across the food system. AI is also changing the role of computing in agriculture. Systems that once primarily collected and displayed information can now interpret complex conditions, support decisions, and, through robotics and autonomous equipment, perform physical tasks. These capabilities are making AI an increasingly important part of agricultural production and the broader food system.

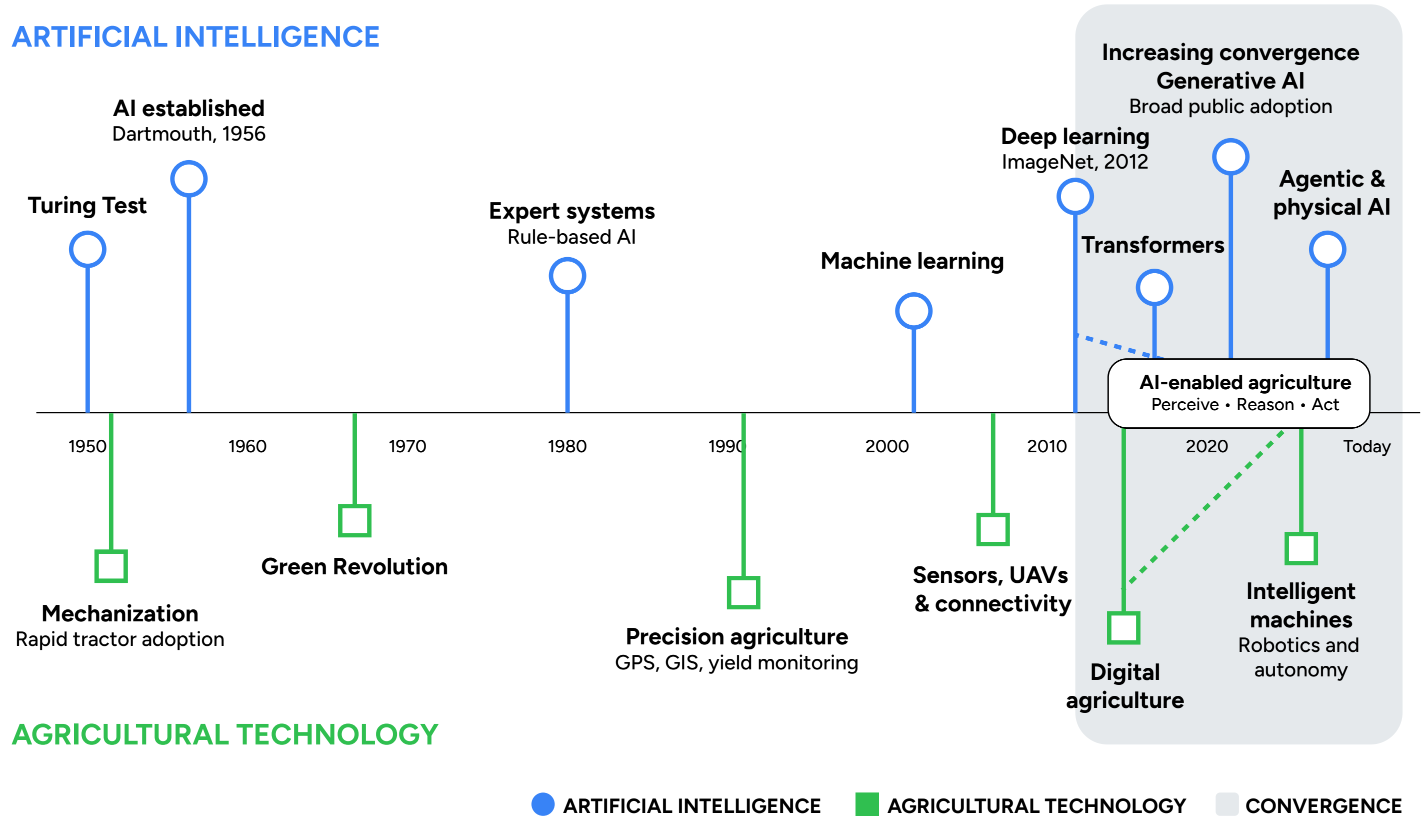
Section 1. Agriculture Enters the AI Era

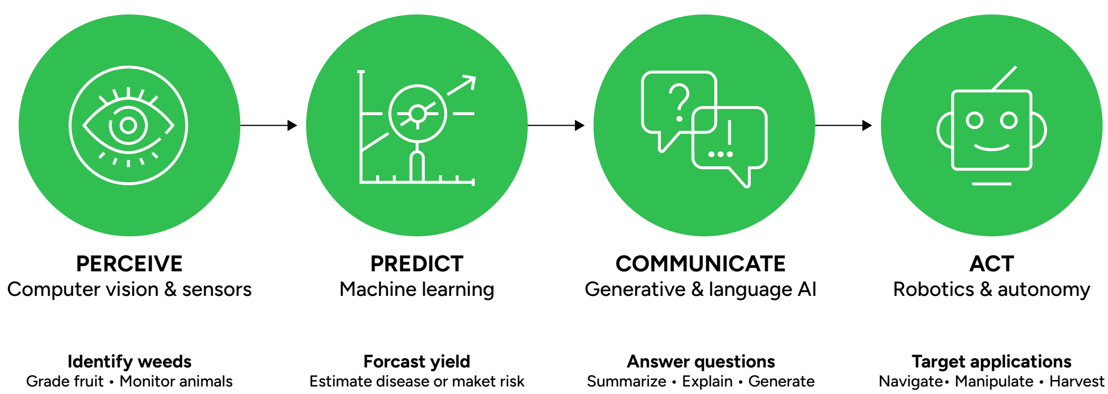
Agriculture is becoming one of the world's most consequential applications of AI. Few industries combine biological variability, environmental uncertainty, and the need for real-time decision making at the scale required for modern food production. Unlike previous digital technologies, AI can learn from data, recognize complex patterns, and improve its performance over time. Public attention has focused largely on generative AI systems capable of producing text, images, and software code, but agriculture is being transformed by a much broader set of AI technologies. AI-based technologies are beginning to enable equipment and software to recognize biological and environmental conditions, support increasingly sophisticated decisions, and perform tasks that previously required continuous human observation or intervention.

Agriculture presents one of the most demanding operating environments for AI. Weather, pests, and markets change continuously and cannot be easily predicted or controlled. Unlike most industrial applications, agricultural AI must function reliably under highly variable conditions while maintaining productivity, safety, and economic performance. These characteristics make agriculture both an exceptionally challenging and an exceptionally important application area for AI.

AI has implications not only for agricultural productivity, but also for food security, natural resource stewardship, rural economic development, workforce preparation, scientific research, and U.S. competitiveness. As AI capabilities continue to advance, public policy will play an important role in determining how rapidly these technologies are adopted in agriculture, how broadly their benefits are shared, and how effectively potential risks are managed.

This brief examines how AI is being applied across the agricultural value chain, explores the technological and institutional foundations needed to support its continued development, and discusses policy considerations that will influence the future of AI in U.S. agriculture.





Agricultureal AI often combines several capabilities
A smart sprayer can perceive weeds, predict what they are, and act by treating only the plants that require control.

Section 2. AI Across the Agricultural Value Chain

AI is becoming embedded throughout the agricultural value chain, from crop and livestock production to food processing, transportation, distribution, and natural resource management. Although applications differ among agricultural sectors, they share a common objective: enabling people and machines to perceive conditions, interpret information, make better decisions, and increasingly to take physical action. AI is therefore helping address some of agriculture's most persistent challenges, including labor shortages, biological variability, resource constraints, food safety, and environmental stewardship. Understanding where AI creates value, as well as where barriers remain, helps identify where public policy can facilitate innovation, reduce risk, and ensure that the benefits are broadly shared.

Crop Production. Crop production has emerged as an early application of AI because crop management depends on interpreting enormous quantities of visual, spatial, and environmental information. Decisions involving weeds, diseases, irrigation, fertility, and harvest timing must account for conditions that vary continuously between fields, across fields, and often from one plant to the next. Computer vision and machine learning now enable equipment to distinguish crops from weeds, identify disease symptoms before they are readily apparent, estimate crop maturity and yield, and guide autonomous equipment in real time.

Let's look at an increasingly common example based on John Deere's See & Spray™, which uses AI to selectively apply herbicides only where weeds are detected. A cotton producer may begin spraying a 100-acre field where, historically, every acre would receive the same herbicide treatment. Today, the AI-enabled sprayer can identify individual weeds while traveling at field speed and apply herbicide only where individual weeds, even very small ones, are detected. The producer is no longer managing a 100-acre field; the AI system is making millions of plant-level decisions as it crosses that field. This use of AI has implications beyond productivity, affecting pesticide use, conservation programs, and regulatory frameworks that were developed for field-scale management. Another brief example is the Carbon Robotics™ laser-weeding system, which identifies and destroys individual weeds without chemical applications. Finally, robotic systems are beginning to be developed to thin blossoms, prune branches, and harvest high-value specialty crops based on fruit maturity and quality.

These technologies represent more than another step in precision agriculture. They change the fundamental unit of management from the field or zones to the square meter or even individual plant. Historically, agronomic recommendations, pesticide labels, conservation programs, and many economic decisions have assumed relatively uniform field management. AI increasingly makes plant-level management – a high-level version of precision agriculture – both technically feasible and economically practical. This shift raises important policy questions. Precision application technologies have the potential to reduce pesticide use, improve input-use efficiency, and lessen environmental impacts while maintaining productivity, but realizing these benefits will require continued investment in agricultural research, interoperable equipment among manufacturers, high-quality benchmark datasets, and regulatory frameworks that accommodate AI-enabled systems capable of making management decisions in real time.

Animal Production. Unlike crops, livestock are mobile biological systems, and their health and welfare depend on timely observation at different locations. AI enables continuous monitoring through computer vision, wearable sensors, automated feeding systems, and acoustic monitoring. Rather than relying solely on periodic human observation, AI systems can detect subtle behavioral or physiological changes associated with respiratory disease, lameness, heat stress, estrus, or parturition before they become readily apparent. For example, AI may analyze thousands of coughs by hogs each day in a commercial swine facility. Rather than waiting for workers to recognize obvious clinical symptoms, acoustic sensors coupled with AI models can detect subtle changes associated with respiratory disease days earlier, allowing more targeted intervention and potentially reducing unnecessary antimicrobial treatments. Similar approaches are being developed for dairy cattle, poultry, and other livestock systems.

As livestock operations become increasingly data-driven, policy questions extend well beyond the technology itself. Continuous monitoring generates large volumes of operational data whose ownership, accessibility, privacy, and cybersecurity require careful consideration. Equally important is ensuring that AI systems are scientifically validated under commercial production conditions and that producers have options among proprietary ecosystems to maximize interoperability and producer choice.

Food and Postharvest Systems. Public discussions of agricultural AI often focus on production agriculture, yet some of the greatest economic value is created after products leave the farm, through grading and inspection to certify high-value products, by minimizing physical loss, by extending shelf life, and by converting raw produce into higher-value marketable goods. AI is increasingly integrated into these activities as well as logistics and inventory management. Modern optical imaging systems can inspect every fruit, vegetable, nut, or meat product moving through a processing facility, evaluating size, color, and even contamination by foreign materials. Imagine a packing facility processing hundreds of thousands of apples each day. Instead of inspecting a statistical sample, AI evaluates every individual apple in milliseconds for size, color, bruising, defects, and, in some systems, internal quality. Products are directed to the highest-value market while defective fruit are removed before reaching consumers. AI changes quality control from sampling to comprehensive inspection.

These AI-based capabilities are not limited to improving efficiency. AI also supports predictive maintenance of processing equipment, cold-chain monitoring, inventory optimization, and end-to-end product traceability. Earlier detection of quality and food-safety problems can reduce recalls, strengthen consumer confidence, and improve export competitiveness. As these systems become more widespread, policymakers should consider how AI intersects with grading and certification, food-safety regulations, traceability requirements, cybersecurity, and data sharing throughout increasingly connected food supply chains.

Natural Resource Management. Agriculture depends on the long-term stewardship of soil, water, forests, and other natural resources. AI is increasingly shifting resource management from reactive to predictive by integrating information from satellites, weather networks, soil sensors, stream gauges, and other environmental monitoring systems. Applications include harmful algal bloom prediction, wildfire risk assessment, drought assessment, irrigation scheduling, watershed management, invasive species detection, and conservation planning. Rather than responding after problems occur, AI allows managers to identify emerging risks earlier and evaluate alternative management strategies using far more information than traditional analytical methods permit.

Many of these capabilities depend heavily on publicly supported environmental observations, including weather networks, satellite imagery, soil surveys, and hydrologic monitoring. Consequently, policy questions extend beyond AI algorithms to the long-term investment required to sustain the environmental data infrastructure on which these systems depend. Decisions regarding monitoring networks, public datasets, and data-sharing policies will strongly influence the future effectiveness of AI for agricultural and natural resource stewardship.

A Common Pattern. Across each sector, AI is changing agriculture in remarkably similar ways. First, it enables far more information to be collected and interpreted than is possible through human observation alone. Second, it converts that information into predictions, recommendations, or management decisions. Third, it increasingly enables machines to perform physical tasks with greater precision, consistency, and efficiency. Public policy will influence how AI develops, how broadly it is adopted, and who benefits from its deployment. Achieving improvements in productivity, food-system resilience, natural resource stewardship, and producer choice will require investments in research, data infrastructure, education, interoperability, and governance, in addition to advances in AI itself.

Section 3. From Data to Decisions to Action

AI is changing the role of computing within agriculture. Earlier generations of digital technologies primarily collected, stored, displayed, and communicated information. AI analyzes that information, identifies patterns, predicts outcomes, recommends management strategies, and increasingly directs physical operations. As AI becomes integrated with robotics, sensors, and autonomous equipment, agriculture is moving beyond decision support toward intelligent physical systems – “physical AI” – capable of perceiving, reasoning, and acting in complex environments.

Using a physical AI system to pick a marketable peach requires it to do more than simply recognize where the fruit is. The system must estimate ripeness, determine whether the fruit can be reached without damaging nearby branches, plan a collision-free path, adjust its grip as the fruit moves, and respond if wind or branch motion changes unexpectedly. Agriculture is one of the world's most demanding proving grounds for applying physical AI, because success depends on integrating perception, reasoning, and action in dynamic biological environments.

From Data to Decisions. Agriculture has become one of the world's most data-intensive industries, generating information continuously from machinery, weather stations, satellites, soil sensors, water availability or scarcity, livestock monitoring systems, laboratory analyses, and supply chains. Individually, these data streams provide only a partial view of agricultural systems. AI integrates diverse sources of information to identify relationships, detect anomalies, estimate future conditions, and recommend management actions that would be difficult, if not impossible, for humans to produce consistently.

Generative AI has further expanded access to these capabilities. Producers and other agricultural professionals increasingly interact with sophisticated analytical tools through natural language rather than specialized software, lowering technical barriers to advanced data analysis. As AI is increasingly embedded in agricultural software, decision support is becoming a routine feature of farm management rather than a specialized capability available only to large operations or technical experts.

The continued expansion of AI will depend not only on better models but also on better agricultural data. Many of the current datasets are fragmented, difficult to access, or were collected using incompatible standards. Investments in benchmark datasets, long-term environmental observations, and interoperable data standards can accelerate innovation while allowing researchers, technology developers, and producers to evaluate AI systems using common, scientifically credible references.

From Decisions to Action. Earlier generations of agricultural software supported human decision-making by organizing information and recommending management actions. AI increasingly closes the loop between perception and execution by enabling intelligent systems to act on those recommendations. This transition represents an important change in the role of computing within agriculture. Information systems become operational systems. Decisions that once required continuous human interpretation can increasingly be translated into physical actions performed by intelligent machines under human supervision. As this transition continues, AI will influence not only how agricultural decisions are made, but also how agricultural work is performed.

This transition has implications extending beyond computation in agriculture. When AI controls physical equipment, policy considerations expand to include equipment certification, operational safety, liability, cybersecurity, and system reliability. Existing regulatory frameworks were largely developed for machines operated directly by humans. Increasing levels of machine autonomy will require a corresponding evolution in standards, testing methodologies, and public confidence.

Toward Physical AI. Recent advances in multiple AI technologies (see the sidebar below) are accelerating the development of physical AI, a concept describing AI that can perceive its surroundings, anticipate the consequences of alternative actions, and coordinate complex sequences of physical tasks. The underlying technologies have attracted considerable attention in manufacturing and logistics, but agriculture presents a far more demanding operating environment. Agricultural systems tend to be dynamic and unrestrained rather than controlled like a factory environment. Crops grow continuously. Insects and diseases come unexpectedly. Weeds compete with crops. Animals behave unpredictably. Weather changes hourly. Soil conditions vary across landscapes. These biological and environmental complexities require AI systems to operate under uncertainty while maintaining safety, reliability, and economic performance. Progress therefore depends not only on advances in AI, but also on continued improvements in sensing technologies, robotics, communications, and systems engineering – the integration of all the pieces into a reliable working system for a particular application, which is where the value is derived. As these capabilities mature, AI will increasingly support proactive rather than reactive management across agricultural systems.

AI as a Force Multiplier. The long-term benefit of AI lies in expanding human analytical capability so we can interpret more information, recognize emerging problems sooner, evaluate more management alternatives, and automate dull, dirty, dangerous, and drudgerous (4D) tasks. Some farm jobs will be upskilled from manual labor to high-tech supervision, repair, and maintenance of physical AI systems. Producers, crop advisers, veterinarians, food processors, engineers, and natural resource managers will continue making the decisions that define successful agricultural enterprises. The resulting workforce will require different skills rather than fewer skills. Future agricultural professionals will need to understand how AI systems are developed, validated, supervised, and integrated into routine operations. Research, education, Extension, and workforce development therefore remain central components of agricultural AI policy. Investments in people will determine how effectively intelligent systems are deployed and how broadly their benefits extend throughout U.S. agriculture.

Section 4. Enabling Responsible AI Adoption

AI systems do not succeed at a large scale simply because algorithms become more sophisticated. They succeed because the surrounding ecosystem enables reliable deployment in real-world applications. For agriculture, that ecosystem includes high-quality data, robust digital infrastructure, interoperable technologies, a skilled workforce, and institutions capable of evaluating and supporting AI applications. Investments in these foundational capabilities will largely determine the speed at which AI becomes a widely adopted component of agricultural production and food systems.

Data Infrastructure. Agricultural AI depends on data that are accurate, representative, and scientifically credible. Unlike internet applications, where billions of users continuously generate training data, agricultural data are often expensive to collect, geographically dispersed, and highly variable across crops, production systems, climates, and management practices. Images of crop diseases, machinery operations, animal behavior, soil conditions, and food quality frequently require expert annotation before they become useful for training AI systems. Long-term environmental observations, benchmark datasets, standardized metadata, and open evaluation protocols function as research infrastructure that can accelerate innovation across universities, government agencies, and industry. USDA has long supported shared scientific resources such as germplasm collections, weather observations, soil surveys, and genomic databases. Comparable investments in agricultural AI datasets and evaluation frameworks could reduce duplication of effort,

KEY AI TERMS

A quick guide to terms shaping AI in agriculture

AI is evolving rapidly, and new terminology is emerging alongside new capabilities. These definitions highlight key terms used throughout this brief.

MACHINE LEARNING	AI systems that learn patterns from data rather than following explicitly programmed rules. These systems improve with experience and are the foundation of most modern AI applications.
GENERATIVE AI	AI that creates new content—such as text, images, software code, or designs—based on patterns learned from existing data. Generative AI is primarily used to produce information.
AGENTIC AI	AI systems capable of planning, making decisions, and carrying out sequences of actions with limited human intervention to accomplish defined objectives.
PHYSICAL AI	AI systems that interact directly with the physical world through robots, vehicles, machinery, and other intelligent equipment. Unlike generative AI, physical AI perceives, reasons, and acts.
FOUNDATION MODELS	Large AI models trained on broad and diverse datasets that capture general patterns. They can be adapted (or fine-tuned) for many specialized tasks, reducing the need to build models from scratch.
DIGITAL TWIN	A dynamic virtual representation of a physical system that is continuously updated using real-world data. Digital twins allow users to simulate, monitor, and evaluate performance under different conditions.
WORLD MODEL	An AI model that learns how an environment behaves so it can predict future states and outcomes. World models enable systems to anticipate the consequences of different actions before taking them

WHY IT MATTERS Understanding these terms helps ensure informed decisions about research, policy, and responsible innovation in AI-driven agriculture.

improve scientific reproducibility, and lower barriers to innovation for both established companies and emerging technology developers.

Digital Infrastructure. AI also depends on infrastructure that extends well beyond data. Training large AI models and providing cloud-based AI services require immense computing capacity, much of which is housed in data centers. In addition to cloud computing, reliable broadband communications, edge computing, and positioning systems enable AI to operate in real agricultural environments. Unlike office-based activities, agricultural operations frequently occur where connectivity is intermittent or non-existent, environmental conditions are harsh, and computational decisions must often be made locally with minimal communication delays. Infrastructure decisions made today will influence the pace and geographic distribution of AI adoption for many years. Continued investment in rural broadband, advanced computing resources, and positioning technologies will help ensure that AI benefits are available across various agricultural regions, not only areas with the greatest existing digital capacity.

Interoperability, Standards, and Trust. Agricultural producers routinely operate equipment, software, and services supplied by multiple manufacturers. AI will provide the greatest long-term value if these systems exchange information reliably and operate together safely. Open standards, interoperable data formats, and transparent evaluation methods promote competition, reduce technology lock-in, and allow producers greater flexibility when adopting new technologies.

Trust in AI is also important. Producers, processors, regulators, and consumers must have confidence that AI systems perform reliably under commercial operating conditions. Independent validation, rigorous field testing, cybersecurity, and clear performance standards will be increasingly important as AI assumes greater responsibility for operational decisions and autonomous equipment.

Workforce and Institutions. AI is changing the skills required throughout agriculture rather than reducing the importance of human expertise. Future agricultural professionals will increasingly supervise intelligent equipment, interpret AI-generated recommendations, evaluate system performance, and integrate digital technologies into routine operations. These responsibilities require knowledge that combines agricultural science with data science, engineering, and computer science.

Land-grant universities, Extension, community colleges, and workforce-development programs will play central roles in preparing this workforce. Extension systems, in particular, are well positioned to help producers evaluate emerging technologies, interpret AI recommendations, and identify applications that provide practical economic value under local production conditions. Investments in education and workforce development will therefore influence not only the availability of skilled workers but also the rate at which trustworthy AI is adopted throughout agriculture.

Section 5. Looking Ahead

AI is developing more rapidly than the policies, institutions, and infrastructure needed to support its deployment. Many decisions shaping agricultural AI over the next decade will not concern AI algorithms themselves. Instead, they will involve investments in infrastructure, research priorities, workforce development, data governance, energy systems, and regulatory frameworks that will deal with how AI is adopted, who benefits, and how risks are managed. Several considerations deserve particular attention.

Agricultural Data as National Research Infrastructure. High-quality agricultural datasets are becoming as important to AI innovation as experimental farms, weather observations, and genomic databases have been to previous generations of agricultural research. Yet many of the datasets needed to develop and evaluate AI systems remain fragmented, proprietary, or unavailable for scientific benchmarking. USDA and other agencies have an opportunity to expand the research infrastructure supporting agricultural AI by investing in benchmark datasets, standardized evaluation protocols, long-term environmental observations, and data stewardship. Such investments would improve scientific reproducibility, lower barriers to innovation, and enable more objective evaluation of competing AI technologies. At the same time, policymakers must balance the benefits of open scientific resources with the legitimate interests of producers and private companies in protecting proprietary information and commercially valuable data.

AI Infrastructure Is Agricultural Infrastructure. The rapid expansion of AI-based computing is creating new demands for electricity, water, land, and transmission capacity. Increasingly, data centers are being proposed in rural communities where land is available and access to electrical infrastructure, or the ability to produce it, may be favorable. These developments create new opportunities for rural economic development, but they also introduce important tradeoffs. Large AI facilities may compete with agricultural producers for electricity, water resources, and transmission capacity. Consider a rural electric cooperative that must accommodate growing electrical demand from expanded agricultural irrigation while also receiving a request to serve a large AI data center. Both projects promise economic benefits, but both require transmission capacity that is already constrained. One must also consider how those projects interact with the surrounding rural environment in terms of water resources and effects on fish and wildlife and their habitats. Decisions regarding utility investments, permitting, tax incentives, and water allocation have direct implications for agricultural competitiveness and natural resource conservation. Policymakers should evaluate AI infrastructure not only as an economic development strategy, but also as a component of long-term agricultural infrastructure and environmental planning, including water demands within regional watersheds and potential effects on land, wildlife, and other natural resources. Potential impacts can be minimized through appropriate site selection and facility design. Data-center demand for freshwater may be reduced through (for example) closed-loop cooling systems, use of reclaimed or other non-potable water, and cooling technologies that reduce evaporative water losses. It is also worth considering the possibility that agriculture may become an energy partner by hosting renewable generation, battery storage, small modular reactors, or behind-the-meter energy systems that improve resilience for both agricultural operations and AI infrastructure.

Competition, Interoperability, and Producer Choice. AI is increasingly delivered to producers through integrated digital platforms that combine machinery, software, cloud computing, agronomic services, and operational data. These integrated ecosystems can accelerate innovation and improve user experience, but they also raise questions about interoperability, data portability, market concentration, and producer choice. Public policies that encourage open standards, transparent interfaces, and interoperable data systems can help preserve competition while allowing producers to adopt technologies from multiple providers. Maintaining producer confidence will also require clear expectations regarding data ownership, cybersecurity, privacy, and the responsible use of operational information generated on farms.

Consider a producer who owns tractors from one manufacturer, sprayers from another, irrigation systems from a third, and agronomic software from yet another provider. If these systems cannot exchange information or if operational data cannot be transferred between platforms, adopting AI becomes more difficult and more expensive. Interoperability therefore influences not only convenience but also competition, innovation, and producer choice.

Preparing the Agricultural Workforce. AI will influence nearly every agricultural profession, including producers, laborers, consultants, veterinarians, engineers, food scientists, Extension specialists, equipment technicians, and natural resource managers. The greatest workforce challenge is unlikely to be widespread displacement of agricultural professionals. Instead, it will be preparing the workforce to supervise, maintain, and repair increasingly capable intelligent systems, interpret AI-generated recommendations, and integrate digital technologies into routine operations.

Land-grant universities, community colleges, Extension, and industry partnerships will play central roles in developing this workforce. Future graduates will require greater fluency in data science, AI, robotics, cybersecurity, and systems integration while maintaining strong foundations in agricultural sciences. Continuing education will be equally important as experienced professionals adapt to rapidly evolving technologies throughout their careers.

Looking Forward. AI represents the next step in the evolution of agricultural innovation. Like mechanization, improved genetics, electrification, and precision agriculture, AI will expand the capabilities of producers, processors, researchers, and resource managers rather than eliminate the need for human expertise. The speed of current advances, however, means that policy decisions made during the coming few years will have lasting consequences for agricultural productivity, food security, natural resource stewardship, rural economies, and U.S. competitiveness.

The opportunity extends beyond developing more capable AI systems. It lies in building the research infrastructure, data resources, educational programs, governance frameworks, and public-private partnerships needed to ensure that AI strengthens American agriculture while preserving producer choice, encouraging innovation, and promoting responsible stewardship of natural resources. Thoughtful policy can help ensure that AI becomes not simply another agricultural technology, but a durable foundation for a more productive, resilient, and globally competitive food system..

Section 6. Conclusions

AI has moved beyond a promising research topic to a foundational technology that is reshaping agriculture and the broader food system. It is expanding the ability of producers, processors, researchers, and natural resource managers to interpret information, improve decisions, and increasingly automate complex physical tasks. Its influence extends well beyond production agriculture to food processing, supply chains, environmental stewardship, and scientific discovery.

Like previous technological revolutions, the long-term impact of AI will depend not only on technological innovation but also on the institutions, infrastructure, and people that support its adoption. Investments in research, data resources, education, computing, connectivity, and standards have historically accelerated agricultural innovation while ensuring that its benefits extend broadly across society. Similar investments can enable AI to strengthen U.S. agricultural productivity, competitiveness, food security, and natural resource stewardship.

The policy choices made during the next few years will help determine whether AI develops as a collection of isolated technologies or as an integrated capability that benefits producers, consumers, rural communities, and the environment. No single organization possesses the data, expertise, infrastructure, and operational experience needed to develop and deploy agricultural AI at scale. Continued progress will depend upon partnerships among producers, technology developers, academic institutions, government agencies, conservation partners and commodity organizations. The nation's land-grant institutions can play important roles in developing new technologies, evaluating their performance under agricultural conditions, and preparing the workforce needed to support their adoption. AI will become an increasingly important part of U.S. agriculture. Thoughtful policy can help ensure that its benefits are broadly shared while strengthening agricultural productivity, resilience, competitiveness, and responsible stewardship of natural resources.

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