

United States AI in Agriculture Market By Technology (Machine Learning, Predictive Analytics and Computer Vision), By Offering (Hardware, Software and AI-As-A-Service), By Application (Precision Farming, Livestock Monitoring, Agriculture Robots, Drone and Others), By Region, Competition, Forecast & Opportunities, 2019-2029F

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Abstracts

United States AI in Agriculture Market was valued at USD 351.09 Million in 2023 and is anticipated to reach USD 705.74 Million in the forecast period with a CAGR of 12.30% through 2029. Artificial Intelligence (AI) in agriculture represents the deployment of advanced technologies to improve crop yield, efficiency, and profitability. AI-driven models and tools facilitate precise farming methods, predicting weather patterns, and making sense of real-time data for better decision-making. Machine learning algorithms can identify potential diseases or pests, and automation technologies can perform mundane tasks, hence, improving overall agricultural productivity.

The AI in Agriculture market in the United States is a rapidly expanding sector, fueled by the country's strong technological infrastructure and its vast agricultural industry. It encompasses a plethora of services, software, and hardware products designed to enhance productivity, efficiency, and sustainability in farming. Market players range from tech-startups innovating in niche areas like disease identification, to major companies providing comprehensive AI-based farm management systems. Market growth is driven by factors such as increasing food demand, the need for climate-smart agriculture, and the desire to streamline farming operations. This has led to a surge in the adoption of AI technologies such as machine learning, computer vision, and predictive analytics in various agricultural practices.

Key Market Drivers

Increasing Demand for Food Security

In the dynamic landscape of agriculture, ensuring food security stands as a paramount concern. The United States AI in Agriculture market is witnessing a significant surge, fueled in part by the escalating demand for food security. Precision agriculture, empowered by AI technologies, addresses this challenge by optimizing crop yields. Through data-driven insights and predictive analytics, farmers can precisely manage resources such as water, fertilizers, and pesticides, ultimately enhancing productivity and contributing to food security objectives. The USDA's Economic Research Service (ERS) is at the forefront of research on food security and the measurement of food security within U.S. households and communities. The ERS provides data access and technical support to social science researchers, enabling them to conduct in-depth studies on food security.

Climate change-induced uncertainties pose formidable challenges to agricultural productivity. However, AI-driven predictive analytics offer a proactive approach. By analyzing historical and real-time data, AI algorithms forecast weather patterns, pest outbreaks, and disease occurrences. This enables farmers to implement preemptive measures, safeguarding crops and ensuring consistent food production despite environmental fluctuations. The quest for food security necessitates efficient resource management. AI-powered smart farming solutions optimize resource allocation by precisely tailoring inputs to crop requirements. By integrating IoT sensors, drones, and satellite imagery, farmers gain granular insights into soil health, moisture levels, and plant conditions. This data-driven approach minimizes waste, conserves resources, and maximizes agricultural output, aligning with food security imperatives. Food security encompasses not only quantity but also accessibility. AI technologies democratize access to advanced agricultural practices, benefitting smallholder farmers. Cloud-based AI platforms and mobile applications provide affordable solutions for remote monitoring, crop management, and market access. By leveling the playing field, these technologies empower smallholder farmers to improve yields, increase incomes, and contribute to broader food security efforts.

Government initiatives play a pivotal role in fostering food security objectives and driving AI adoption in agriculture. Subsidies, grants, and incentives encourage farmers to invest in AI technologies, accelerating market growth. Additionally, regulatory frameworks that promote innovation and technology integration create an enabling environment for AI

adoption. Collaborative partnerships between governments, industry stakeholders, and research institutions further amplify the impact of these initiatives, advancing food security agendas. Consumer preferences increasingly favor sustainably produced food, elevating the importance of sustainable agriculture practices. AI technologies enable precision farming techniques that minimize environmental impact while optimizing productivity. By reducing chemical inputs, conserving water, and promoting biodiversity, AI-driven sustainable agriculture aligns with consumer expectations for ethically sourced and environmentally friendly food products, thus bolstering food security efforts. The convergence of food security concerns and technological innovation has catalyzed investment in agri-tech startups. Venture capital firms and investors recognize the potential of AI-driven solutions to address global food security challenges. Consequently, funding flows into startups developing AI-powered agricultural technologies, fostering innovation and market expansion. This influx of investment capital not only propels technological advancements but also stimulates job creation and economic growth in the agricultural sector.

The increasing demand for food security serves as a powerful catalyst for the growth of the United States AI in Agriculture market. By harnessing AI technologies to optimize productivity, mitigate risks, and promote sustainable practices, stakeholders across the agricultural value chain can address food security challenges effectively. Through collaborative efforts, innovative solutions, and strategic investments, the agriculture industry can ensure a resilient and sustainable food supply for future generations.

Labor Shortages & the Desire for Automation

In the landscape of modern agriculture, labor shortages emerge as a pressing challenge, compelling stakeholders to seek innovative solutions. The United States AI in Agriculture market is witnessing notable growth, driven in part by the imperative to address labor scarcity.

Labor shortages in agriculture necessitate the optimization of operational efficiency. AI technologies offer solutions by automating labor-intensive tasks, thereby reducing dependency on manual labor. Through machine learning algorithms and robotics, farmers can streamline processes such as planting, harvesting, and monitoring crops. Agriculture presents an ideal niche for innovations in robotics, as farmers often face repetitive, labor-intensive tasks in the field. Today, agricultural robots, or 'agrobots,' are capable of performing a wide variety of tasks, including harvesting, watering, seeding, and more. This enhanced efficiency not only mitigates the impact of labor shortages but also improves productivity and profitability. Agricultural labor demand experiences

significant fluctuations, particularly during peak seasons such as planting and harvest. However, labor availability often fails to align with these seasonal demands, leading to inefficiencies and operational disruptions.

AI-driven automation provides a viable solution by offering continuous support throughout the agricultural cycle. By deploying autonomous machinery and smart systems, farmers can maintain consistent productivity levels despite fluctuations in labor supply, ensuring operational continuity and meeting market demands. Automated tractors can be operated remotely, requiring minimal involvement during initial setup and regular maintenance. Over time, these smart tractors will become increasingly autonomous, integrating technologies such as vision systems, light detection tools, GPS, and more. Bear Flag Robotics specializes in developing driverless tractors, with the goal of reducing labor costs for farmers. The company's technology allows operators to control multiple tractors remotely, plan their routes, and receive real-time reports and alerts, enabling field operations to proceed without direct human intervention.

Escalating labor costs and wage pressures exert financial strain on agricultural operations. As labor scarcity intensifies, competition for available workers drives wages higher, eroding profit margins. AI technologies offer a cost-effective alternative by reducing labor dependency and minimizing wage-related expenses. By investing in AI-powered solutions, farmers can achieve long-term cost savings while maintaining operational efficiency and competitiveness in the market. Labor shortages underscore the need for precision agriculture solutions that optimize resource utilization and maximize productivity. AI technologies enable data-driven decision-making, allowing farmers to achieve optimal outcomes with limited labor inputs. Through real-time monitoring, predictive analytics, and autonomous equipment, farmers can optimize planting densities, irrigation schedules, and crop treatments. This precision-driven approach not only mitigates the impact of labor shortages but also enhances overall farm productivity and profitability.

Eco Robotics manufactures fully autonomous robots powered by solar energy, representing the most sustainable approach in agricultural technology. These compact, four-wheeled machines navigate fields, applying herbicides with minimal impact on crops and the environment. Subsurface Drip Irrigation (SDI), a widely recognized method in agriculture, offers precise control over water usage and timing for plant irrigation. While SDI systems are a significant advancement over manual plant-by-plant watering, they are not entirely autonomous and still require some level of human involvement. Labor shortages represent a critical challenge facing the agricultural

industry, but they also present an opportunity for innovation and growth. By embracing AI technologies, stakeholders can overcome labor constraints, optimize efficiency, and ensure the sustainability of agricultural operations. Through strategic investments, technological advancements, and collaborative partnerships, the United States AI in Agriculture market can harness the transformative potential of AI to thrive in the face of labor scarcity and emerge as a global leader in agricultural innovation.

Key Market Challenges

Data Integration & Interoperability Issues

One of the key challenges facing the United States AI in Agriculture Market is the complex nature of data integration and interoperability. Agricultural operations generate vast amounts of data from various sources, including sensors, drones, machinery, and weather stations. The challenge lies in integrating these diverse datasets into a cohesive and standardized format that AI systems can effectively analyze. Lack of interoperability between different data sources and proprietary systems hampers seamless integration, making it difficult for farmers to derive maximum value from AI applications. Overcoming this challenge requires the development of standardized data formats and protocols to ensure compatibility across different agricultural technologies.

Limited Access to High-Quality Data

While data is undeniably crucial for training AI models in agriculture, it is important to acknowledge the challenges surrounding the availability and accessibility of high-quality agricultural data. These challenges stem from various factors, such as the limited nature of agricultural datasets, their potential incompleteness, and the presence of biases that can impact the accuracy and reliability of AI algorithms. Moreover, concerns regarding data ownership, privacy, and security further complicate the landscape. Farmers may be hesitant to share their data due to apprehensions about how it will be used or safeguarded. These concerns can hinder the willingness of farmers to participate in data-sharing initiatives, which are crucial for improving the overall quality and representativeness of agricultural datasets.

In light of these challenges, collaborative efforts between stakeholders become paramount. This includes not only farmers but also technology developers and policymakers. By working together, these stakeholders can address data quality issues, establish robust data-sharing frameworks, and ensure that AI models are trained on diverse and representative datasets. By delving deeper into these considerations, we

can better understand the complex interplay between data, AI, and agriculture, and pave the way for more effective and responsible use of AI technologies in the field.

Key Market Trends

Precision Agriculture Adoption is on the Rise

A significant trend in the United States AI in Agriculture Market is the increasing adoption of precision agriculture practices. Precision agriculture involves the use of AI, sensors, and other cutting-edge technologies to optimize farming processes at the field level. By leveraging AI applications, data from various sources, including satellite imagery, sensors, weather forecasts, and historical data, is meticulously analyzed to provide farmers with detailed insights into crop health, soil conditions, and resource utilization. This in-depth analysis empowers farmers to make informed decisions in resource management, allowing them to implement precise irrigation techniques, targeted fertilization strategies, and optimal pest control measures. These advancements not only enhance productivity and reduce environmental impact but also contribute to the overall sustainability of farming practices. The integration of AI in agriculture is revolutionizing the way farmers approach challenges and equips them with advanced tools to achieve long-term sustainable farming practices.

Adoption of Data-Driven Decision-Making in Farming Operations

The trend of data-driven decision-making is rapidly gaining momentum in the United States AI in Agriculture Market. Farmers are increasingly embracing AI technologies to collect, analyze, and interpret vast amounts of data, enabling them to make well-informed decisions that optimize their agricultural practices. With the help of AI, farmers can now accurately predict optimal planting times, efficiently detect and combat disease outbreaks, and ensure precise resource management. The integration of AI-driven analytics platforms empowers farmers to receive actionable insights in real-time, leading to improved operational efficiency and enhanced sustainability. This transformative trend signifies a paradigm shift from traditional, experience-based decision-making to more data-centric and evidence-based practices in the field of agriculture.

Segmental Insights

Technology Insights

Based on the Technology, in the United States, the AI in Agriculture market is

experiencing a significant growth in the application of Predictive Analytics. This cutting-edge technology is primarily being used to analyze complex patterns and trends from vast datasets, empowering farmers to make highly accurate forecasting decisions regarding crop yield and potential pest infestations. By leveraging the power of Machine Learning and Computer Vision, farmers can optimize various facets of agricultural operations, including irrigation management, soil health assessment, and equipment maintenance. However, the current dominance of Predictive Analytics in the agricultural landscape can be attributed to its direct and tangible impact on improving productivity, reducing farm-related risks, and ensuring sustainable farming practices. By harnessing the potential of AI, farmers are embracing a data-driven approach that not only enhances efficiency but also promotes environmental stewardship and food security for a rapidly growing population.

Offering Insights

Based on the Offering, in the United States, the AI in Agriculture market is currently undergoing a remarkable transformation. The emergence of AI-As-A-Service as the dominant solution is surpassing traditional Hardware and Software options. This shift is primarily driven by the remarkable benefits offered by AI-As-A-Service models, which include unparalleled scalability, flexibility, and cost-effectiveness. One of the most significant advantages of AI-As-A-Service is its ability to enable even small-scale farmers to leverage the power of AI. Previously, high upfront costs posed a significant barrier for these farmers to adopt AI technologies. However, with AI-As-A-Service, they can now gain access to advanced capabilities without the burden of hefty initial investments.

This democratization of AI in agriculture is fueling an unprecedented acceleration in the adoption of AI technologies within the sector. As a result, the industry's landscape is being revolutionized, paving the way for a more prosperous and technologically driven future. Also, the integration of AI technologies in agriculture is expected to bring about significant advancements in efficiency, productivity, and sustainability. From precision farming techniques to automated data analysis, AI has the potential to optimize various aspects of agricultural practices. This, in turn, can contribute to increased crop yields, reduced resource wastage, and enhanced environmental stewardship.

Regional Insights

The Midwestern region of the United States, often referred to as the 'breadbasket' of America, is currently leading the charge in the AI in Agriculture Market. This region,

known for its vast network of farms and agricultural enterprises, is wholeheartedly embracing AI technologies to transform the industry. By leveraging innovative solutions, these forward-thinking farmers are optimizing crop yield, streamlining operations, and even harnessing AI's predictive capabilities to accurately forecast weather patterns. The integration of AI in agriculture is revolutionizing the sector, enhancing productivity, and ensuring long-term sustainability. With AI-powered insights, farmers can make data-driven decisions, optimize resource allocation, and minimize waste. This not only leads to higher crop yields but also reduces the environmental impact of farming practices.

Likewise, the Midwestern region's commitment to AI in agriculture is paving the way for a more efficient and resilient future. By embracing cutting-edge technologies, farmers can adapt to changing market demands, mitigate risks, and enhance overall profitability. From automated irrigation systems to precision agriculture techniques, AI is driving innovation and transforming traditional farming practices. The Midwestern region's adoption of AI in agriculture is not only revolutionizing the industry but also setting a precedent for other regions to follow. By harnessing the power of AI, farmers are creating a more sustainable, efficient, and resilient agricultural landscape that will benefit both present and future generations.

Key Market Players

International Business Machines Corporation (IBM)

Granular, Inc.

Microsoft

Deere & Company

Awhere Inc.

Climate LLC.

Agribotix, LLC

Descartes Labs Inc.

Valmont Industries, Inc.

Report Scope:

In this report, the United States AI in Agriculture Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

United States AI in Agriculture Market, By Technology:

Machine Learning

Predictive Analytics

Computer Vision

United States AI in Agriculture Market, By Offering:

Hardware

Software

AI-As-A-Service

United States AI in Agriculture Market, By Application:

Precision Farming

Livestock Monitoring

Agriculture Robots

Drone

Others

United States AI in Agriculture Market, By Region:

North-east

Mid-west

West

South

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the United States AI in Agriculture Market.

Available Customizations:

United States AI in Agriculture Market report with the given market data, TechSci Research offers customizations according to a company's specific needs. The following customization options are available for the report:

Company Information

Detailed analysis and profiling of additional market players (up to five).

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