
AI-driven precision agriculture in Eurasia- coordinated innovation for belt and road agricultural transformationin

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Abstract International collaboration in AI based technologies in agriculture is essential factor to increase output and agriculture productivity. AI horizons/ alliance program aimed to increase awareness and accessibility of new agro markets and optimize supply routes in Eurasia. Precision agriculture is commonly used term that enables AI based instruments into practical agriculture works. Precision agriculture in Eurasia is undergoing a transformative wave powered by artificial intelligence (AI) and cross-border innovation. This article examines how AI-driven technologies including agro-drones for aerial crop monitoring, satellite-based NDVI analysis, image recognition for pest and disease detection, advanced weather forecasting models, and decision support systems – are being deployed across Great Eurasia and Belt and Road Initiative (BRI) countries to boost agricultural productivity and sustainability. A particular focus is given to the Eurasian context countries like China, Kazakhstan, Uzbekistan, Russia and Thailand are leveraging AI to overcome climate and labor challenges, increase yields, and optimize resource use. The AI Horizons Alliance, a Sber-driven consortium, is highlighted as a coordinating body facilitating the exchange of AI technologies and expertise across borders. Real-world case studies demonstrate tangible benefits, such as up to 20% increases in crop yields, and 30% improvements in efficiency, and significant cost savings, achieved through AI-enabled precision farming. The article discusses the collaborative efforts under BRI frameworks, the integration of traditional knowledge with cutting-edge digital tools, and the role of international organizations in guiding this tech-driven agricultural transformation. Challenges from data sharing to capacity building are considered alongside prospects for broader adoption. The findings underscore that AI-driven precision agriculture, underpinned by coordinated Eurasian partnerships, holds to promise for enhancing food security and sustainable development across the region. It is a part of innovation organic agriculture.

Keywords: Precision agriculture, Artificial intelligence, Agro-drones, Image recognition, Smart farming

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Introduction

Agricultural drones are a key component of AI-driven precision farming, providing aerial data for crop monitoring. Today's agrifood systems face mounting pressure to feed growing populations amid climate change and resource constraints (FAO, 2024). In Eurasia, particularly among countries participating in China's Belt and Road Initiative, there is a strategic push to modernize agriculture through AI-driven precision farming. This approach is often dubbed Agriculture 4.0, represents a new wave of farming based on digital technologies – from cheap sensors and GPS-guided equipment to big data analytics, Internet of Things (IoT) networks, robotics, and AI (Ajena *et al.*, 2020). By integrating these innovations, farmers can tailor inputs with unprecedented precision, optimizing water, fertilizer, and pesticide use on a site-specific basis (Hennig-Possenti, 2025). Such digital transformation is increasingly seen as vital for boosting yields and achieving sustainable agriculture, aligning with global goals like the UN's Zero Hunger SDG by 2030 (Ahmad *et al.*, 2024).

The Eurasian context provides fertile ground for AI-enabled agricultural innovation. Many BRI countries possess vast farmlands and diverse climates – from the steppes of Kazakhstan to the arid plains of Uzbekistan and high-tech greenhouses of China – yet they share common challenges of climate volatility, labor shortages, and aging rural infrastructures. Recognizing AI's potential, governments and institutions in the region are investing in digital agriculture programs. For instance, China's recent 10-years agricultural plan places AI and emerging technologies at the forefront of modernization efforts (Donnellon-May, 2025). Similarly, Kazakhstan's national agenda for agrarian reform includes heavy emphasis on precision farming and farm digitalization (Menon, 2024). These initiatives are not isolated; they are increasingly linked by cross-border collaboration under frameworks like the Digital Silk Road and Great Eurasian economic cooperation.

A critical enabler of this transnational synergy is the AI Horizons Alliance – a consortium driven by Sber (Russia's leading technology-focused bank) – which coordinates the deployment of AI solutions across borders. This alliance functions as a platform for sharing knowledge, datasets, and best practices in AI including industry and agriculture, uniting experts from across the BRICS and BRI nations. In 2025, for example, Sber's TechHub convened top AI researchers from 17 countries (including China, India, and Uzbekistan) to identify priority AI application tracks and form a BRICS+ AI expert community (Electronics Media, 2025). Such efforts lay the groundwork for joint projects and AI knowledge transfer in fields like agriculture. As a result, Chinese agritech

expertise is being shared with Central Asian partners, Russian AI platforms are being adapted for foreign farms, and regional institutions are co-developing new technologies. Agricultural cooperation between China and Central Asia is already “*spanning technology transfers, infrastructure development, and capacity building*” – boosting local economies, food security, and sustainable development as noted by experts (Global Times, 2025). Clearly, coordinated innovation that might be supported by regional expert associations like AATSEA is emerging as a hallmark of Eurasia’s agricultural transformation.

Methodology / Technology Overview

Modern precision agriculture leverages a suite of AI-powered technologies to gather data, derive insights, and support on-farm decisions. Key components of this digital toolkit include:

- **Agro-Drones and Aerial Imaging:** Unmanned aerial vehicles (UAVs) equipped with cameras and sensors are now commonplace on progressive farms. Agro-drones can rapidly survey large fields, capturing high-resolution images that reveal crop conditions not visible from the ground. They are particularly useful for generating vegetation index maps (like NDVI, the Normalized Difference Vegetation Index) that indicate plant health and vigor across a field. For example, a Kazakh research team developed a system combining satellite imagery and drones: first a satellite provides the big picture and uses NDVI to flag possible problem spots via AI analysis, then drones are dispatched for detailed inspection (Satbayev University News, 2025). This hybrid approach allows real-time monitoring and pinpointing of issues – whether disease, pest infestation, or water stress – at precise field locations. By focusing attention exactly where needed, drone surveillance helps farmers respond promptly and avoid blanket treatments. In practice, targeting inputs with drone scouting has been shown to both raise yields and cut costs; in Kazakhstan, integrated drone-and-satellite monitoring enabled up to 25–50% yield increases in pilot trials while saving a typical farmer as much as 30 million tenge (~\$65,000) annually in fertilizer costs (Satbayev University News, 2025).

- **Remote Sensing and NDVI Analysis:** The use of satellite data and multi-spectral imagery is another pillar of precision ag. Platforms like Europe’s Sentinel and private satellites, or high-flying drones, provide frequent, wide-area coverage of farm landscapes. NDVI analysis converts spectral data (often near infrared and visible light reflectance) into indicators of crop biomass and chlorophyll levels, essentially mapping where crops are thriving or struggling. AI algorithms enhance this process by cleaning and interpreting the data rapidly and even compensating for cloud cover gaps by predicting values (Satbayev

University News, 2025). Remote sensing driven by AI can accurately discern crop phenotypes, monitor land-use changes, estimate soil moisture, and model plant biomass over time (Ahmad *et al.*, 2024). This wealth of information feeds into early warning systems: for instance, if NDVI trends indicate a section of a wheat field is declining relative to its historical norm, the system flags it. The AI might correlate that with weather or irrigation data to suggest likely causes (e.g. drought stress or nutrient deficiency) and recommend targeted interventions. Such data-driven insights were unattainable at scale before – now they are increasingly accessible even to resource-limited countries as satellite coverage expands. Uzbekistan, for one, has conducted satellite monitoring on over 4 million hectares of farmland to identify discrepancies in crop plantings and to better manage land use (Government of Uzbekistan, 2025). By integrating these remote observations into digital platforms, governments can enforce more rational land management and detect issues like unreported fallow areas or water misallocation.

- **Image Recognition and AI Vision Systems: Computer vision** – powered by machine learning models – is revolutionizing crop scouting and machinery operation. On the crop monitoring side, AI-driven image recognition can analyze photos of plant leaves to diagnose diseases, detect pest damage, or assess ripeness, far faster than manual scouting. Farmers can literally use a smartphone app to take a photo of a diseased leaf and receive an instant AI analysis of whether it's fungal blight or nutrient deficiency, often with recommended treatments. In one Central Asian project, an app was trained on standard operating procedures so growers can assess plant health via a simple photo, effectively “*democratizing access to agricultural knowledge*” by putting expert eyes in every farmer's hand (Coin World, 2025). On the equipment side, image recognition enables autonomous farm machinery. Cameras mounted on tractors or combine harvesters feed live video to AI models that can identify field rows, obstacles, and crop yield in real time. Russia's Cognitive Agro Pilot, an AI-based autopilot for combines co-developed by Sber, is one notable example. Using a single front-mounted video camera and a specialized convolutional neural network, the system “sees” the environment and can steer machinery through fields without human input (Global Ag Tech Initiative, 2021). Impressively, over 350 combines equipped with Cognitive Agro Pilot harvested more than 720,000 tons of crops on 160,000 hectares in one season during large-scale trials (Global Ag Tech Initiative, 2021). These AI vision systems not only reduce the need for drivers, but also optimize operations – the Russian autonomous combines cut harvest time by ~25% and reduced grain losses substantially by maintaining ideal trajectories and speeds (Global Ag Tech Initiative, 2021). In summary, from microscopes to megafarms, image-based AI

is acting as a tireless observer, enhancing both the microscopic detection of plant issues and the macroscopic control of heavy machinery.

- **AI-Guided Weather Forecasting:** Weather remains one of the biggest variables in farming outcomes. AI-driven weather forecasting tools are now helping farmers anticipate and adapt to weather-related risks at the local level. Traditional forecasts often operate on coarse regional grids, which overlook farm-level microclimates. Machine learning techniques can downscale these predictions by incorporating data from on-farm sensors and long-term climate patterns, yielding highly localized forecasts. For instance, specialized AI models can provide frost alerts for a specific valley or predict soil moisture for an individual field, rather than a broad regional average (Morrison, 2024). This precision matters: a recent industry survey found 90% of agribusinesses say climate change is affecting their yields, and ~80% believe improved forecasts would enhance crop quality and resilience (Morrison, 2024). AI weather platforms address this by training hundreds of models weekly for specific farm locations, updating predictions continuously as new data comes in (Morrison, 2024). The results have been striking in some cases – California specialty crop growers using an AI micro-forecasting system managed to save 10% of irrigation water and boost yields by 50–100% through timely adjustments (Morrison, 2024). In Eurasia, where extreme weather (droughts, heatwaves, late frosts) can be devastating, such tailored forecasts are invaluable. They enable farmers to, for example, deploy wind machines or water spray to protect an orchard on the very nights frost risk is highest, or to adjust planting schedules in anticipation of an unusually dry spring. By minimizing guesswork, AI-enhanced weather intelligence supports more climate-smart agriculture, helping mitigate the impact of weather volatility on food production.

- **Decision Support Systems (DSS):** All the above technologies generate a deluge of data – far more than a farmer or agronomist can manually process. This is where AI-driven decision support systems come in, serving as the analytical brain that synthesizes data and recommends actions. A robust agricultural DSS will integrate inputs from satellites (remote sensing data), drones (imagery), ground IoT sensors (soil moisture, nutrient levels), weather forecasts, and perhaps market price trends or crop growth models. AI algorithms (often combining machine learning with domain expert rules) then analyze these multilayered data to produce actionable insights, typically via a user-friendly interface. For example, an AI-based DSS might notify a wheat farmer: *“Section B of Field 4 shows early drought stress and low NDVI – irrigate 2 days sooner than usual”* or *“Pest pressure high in corn fields this week; consider targeted spraying in zones 3 and 5, and only during the 6–9am window as our weather model predicts low wind (optimal spraying conditions)”* (Morrison, 2024) In

Uzbekistan, authorities are rolling out a unified digital platform where farmers will input their crop plantings and receive forecasts of expected yields for primary and secondary crops (Government of Uzbekistan, 2025). This “Digital Agriculture” platform, supported by AI analytics, will help predict national production and improve food security planning. Crucially, it will also assist individual farmers in planning crop rotations and market strategies based on predictive insights. More broadly, decision support tools embody the knowledge integration role of AI – turning big data into smart guidance. They empower even smallholder farmers with expertise that was once accessible only to large, resource-rich farms or research institutions. By following tailored recommendations on everything from planting dates and variety selection to irrigation timing and input application, farmers can maximize productivity while using resources efficiently. Early studies indicate that AI-driven DSS implementation leads to more timely field operations, reduction in input waste, and higher net profits for farmers who adopt them (Ahmad *et al.*, 2024). In essence, the DSS is the cockpit of the modern digital farm – where data streams coalesce into decisions that enhance precision, productivity, and sustainability.

Case examples of AI in Eurasian agriculture

To illustrate how these AI-based technologies are being applied in practice, we examine several case examples across Eurasian Belt and Road countries. These examples underscore the tangible impacts of AI in agriculture – from yield improvements and cost reductions to new modes of cross-border cooperation.

China: Unmanned farms and smart agriculture for food security

China has emerged as a leader in applying AI to agriculture, driven by the imperative to feed a large population with limited arable land. Under national strategies like the *Smart Agriculture Action Plan (2024–2028)*, AI and robotics are being deployed to boost efficiency and self-sufficiency (Donnellon-May, 2025). A striking example is China’s first fully unmanned farm in Henan province, which showcases the power of integrating multiple AI technologies. At this 233-hectare experimental farm, intelligent drones patrol overhead while driverless tractors and harvesters tend the fields – all coordinated via AI and the Beidou satellite navigation system (AgroPages News, 2025). The results have been remarkable: the farm achieved a “*stunning 20% increase in wheat yields*” compared to traditional farms (AgroPages News, 2025). Additionally, harvesting time was cut from 7 days to 4, labor requirements for irrigation and fertilization

dropped by 80%, and overall human labor costs fell 40% thanks to automation (AgroPages News, 2025). These gains stem from hyper-precision management – drones gather real-time field data (soil moisture, pest alerts, crop growth status) every 30 minutes, feeding predictive models that fine-tune water and fertilizer delivery to the exact needs of each crop zone (AgroPages News, 2025). As a result, irrigation is now so targeted that one person with a smartphone can manage what used to require ten workers, and fertilizer use has decreased 20% while absorption efficiency improved (AgroPages News, 2025). The Henan unmanned farm, developed under the “sci-tech backyard” program of a local agricultural university, is seen as a “*scalable blueprint for China’s agricultural future*” (AgroPages News, 2025). Plans are underway to replicate this model, refine the AI tech further, and reduce costs for broader adoption across China’s vast agricultural landscape (AgroPages News, 2025).

Beyond such pilot projects, AI is diffusing into everyday farming in China. Predictive analytics for crop yields, automated greenhouses using computer vision to monitor vegetables, and AI-guided pork farm systems are being implemented by agritech companies. The Syngenta Group (owned by a Chinese conglomerate) has established Modern Agriculture Platform (MAP) centers across countries that integrate drones, AI-driven decision support, and robotic assistance to help local farmers optimize crop management (Coin World, 2025). These centers provide farmers with data-driven insights – even small improvements, when scaled to millions of farmers, can have a huge cumulative impact (Coin World, 2025). The Chinese government is also actively sharing its agri-AI expertise with other countries. Under the Digital Silk Road initiative, China has partnered with Central Asian nations to transfer smart farming technologies, set up demonstration zones, and train personnel. For instance, a China-Kazakhstan Smart Agriculture research center was recently established, focusing on agricultural digitalization and low-carbon tech (Menon, 2024). Likewise, a China-Uzbekistan agriculture demonstration park is showcasing advanced farming techniques like AI-enhanced cotton cultivation (Global Times, 2025). These collaborations indicate that China not only uses AI at home but also sees it as a diplomatic tool to foster agricultural development along the Belt and Road. As sufficiency improves for China and its partners through an “*agriculture+AI*” strategy, regional food trade patterns may also shift, with less reliance on imports and more stable local production (Donnellon-May, 2025). In summary, China’s embrace of AI in agriculture – from unmanned farms to international tech transfer – demonstrates how a data-driven approach can address longstanding challenges in food security and rural productivity.

Kazakhstan: Integrating drones and satellites for precision farming

Kazakhstan, with its vast steppe lands and legacy as a major grain producer, stands to benefit enormously from precision agriculture. The Kazakh government has prioritized digital agriculture in its national strategy, aiming to become a regional leader in smart farming (Menon, 2024). One cutting-edge project in Kazakhstan is the development of an integrated drone-satellite farming system by scientists at Satbayev University. As described earlier, this system called “Agroscope” uses satellite imagery to get a broad view of crop conditions and AI (using NDVI analysis) to pinpoint potential problem areas, then dispatches drones for fine-grained inspection and intervention (Satbayev University News, 2025). By combining the strengths of both platforms – satellites cover entire farms quickly, drones provide close-up detail – Kazakh farmers can monitor crop health continuously and respond to issues in near real-time. This is especially valuable in Kazakhstan’s expansive fields where traditionally a problem could go unnoticed until it grew severe. In preliminary trials, the Agroscope system not only detected issues like localized pest outbreaks early, but also enabled variable rate application of inputs: fertilizers and herbicides were applied “strictly in the right places and right dosages,” leading to significant input savings (Satbayev University News, 2025). Farmers saw fertilizer costs drop dramatically (with savings up to 30 million tenge per year as mentioned) and in some cases yields increased by 25–50% due to timely interventions and more precise input use (Satbayev University News, 2025). This synergy of data sources exemplifies how AI helps adapt broad technologies to local needs – satellites give the macro insight, AI narrows it down, drones execute the micro action. The pilot launch for this system was scheduled for the 2025 growing season across several regions of Kazakhstan (Satbayev University News, 2025), with both large agri-holdings and smaller farms expressing interest. Notably, the platform is to be offered in a “rental format”, meaning farmers can access the service without heavy investment in equipment (Satbayev University News, 2025) – a clever approach to make high-tech farming inclusive for those who cannot buy fleets of drones themselves.

Kazakhstan is also actively fostering international partnerships to bolster its precision agriculture capabilities. The China-Kazakhstan Smart Agriculture Center (a joint initiative between Lanzhou University in China and Kazakh National Agrarian Research University) is focusing on digital farming research, germplasm innovation, and carbon-smart technologies (Menon, 2024). This center symbolizes how Kazakhstan is tapping into global expertise to modernize its agriculture. Furthermore, Kazakhstan’s participation in forums like the Eurasian Economic Union and collaboration with Russia’s Skolkovo Institute are

facilitating knowledge exchange on AI and robotics in farming. Domestically, Kazakhstan has over 200 “digital farms” as early adopters – these farms use drones, GPS mapping, and sensors to implement precision ag practices (Menon, 2024). They serve as showcases to encourage wider adoption across the country. Government support has been strong: the Digital Kazakhstan program (since 2018) and the Agro-Industrial Complex Development Plan (2021–2030) both emphasize precision ag and allocate funding for technology and farmer training (Menon, 2024). Investments in rural broadband are also underway, given that connectivity is critical for real-time data transmission in precision farming (Menon, 2024). With its strategic position as a bridge between Asia and Europe, and as one of the world’s top grain exporters, Kazakhstan’s successful integration of AI in agriculture could have global ripple effects on food supply. The country’s recent record harvests (e.g. 26.7 million tonnes of grain in 2024) (Menon, 2024) hint at the potential unlocked when traditional agricultural strengths meet modern technology. By embracing AI and partnering with neighbors, Kazakhstan is working to ensure that its vast lands are utilized efficiently and sustainably, cementing its role as a linchpin of Eurasian and global food security.

Uzbekistan: Digitalization drive and ai for cotton and irrigation

Uzbekistan, a key Central Asian agriculture producer (especially famous for cotton), is undergoing a bold digital transformation of its agricultural sector. Recognizing challenges like water scarcity and outdated farming methods, the Uzbek government has launched initiatives to infuse technology and data-driven management into agriculture. In August 2025, President Shavkat Mirziyoyev convened a high-level meeting focused on expanding the use of space data and digital systems in farming (Government of Uzbekistan, 2025). One major outcome is the creation of a unified “Digital Agriculture” platform that will integrate information on land use, crops, inputs, and yields at the national level (Government of Uzbekistan, 2025). Farmers are to input data on what they cultivate, which will then allow the government’s platform (augmented by satellite monitoring and AI analytics) to forecast crop volumes in advance – critically important for ensuring food security, stabilizing prices, and planning storage or import needs (Government of Uzbekistan, 2025). This marks a shift from fragmented record-keeping to a centralized, data-driven approach in Uzbekistan’s agriculture management.

Another concrete step is the broad introduction of unmanned aerial vehicles (UAVs) for farming. The government announced plans to bring in over 100 modern agro-drones in the immediate term (by autumn 2025) (Government

of Uzbekistan, 2025). These drones will be used for various purposes: monitoring crop conditions, spraying fields with precision, and even mapping farm plots for better land cadasters. Private sector companies are being encouraged to offer drone services to farmers, and a regulatory framework is being set up to integrate UAV operations safely into agriculture (Government of Uzbekistan, 2025). Drones can be especially game-changing in Uzbekistan's context where efficient water use is paramount – for instance, drones equipped with thermal cameras can quickly identify over-irrigated spots or leaks in irrigation canals, allowing timely fixes in a country where every drop counts. Indeed, Uzbekistan has been grappling with water allocation (due to upstream usage and climate change), so the government is also digitizing water management: installing smart meters on reservoirs, doing satellite-based reservoir volume surveys (finding significant siltation losses), and revising irrigation norms with scientific input (Government of Uzbekistan, 2025). AI will likely play a role in optimizing irrigation scheduling once digital control systems are in place.

On the crop side, cotton farming – historically Uzbekistan's most important sector – is getting a tech upgrade through international cooperation. Uzbekistan and China have jointly established an experimental agriculture base, introduced Chinese machinery and cotton plant varieties, and using AI to improve practices like pest control and breeding (Global Times, 2025). This has allowed Uzbek researchers and farmers to access advanced AI tools (for example, image-based pest diagnostic systems or ML models for yield prediction) and excellent germplasm resources from China (Global Times, 2025). Early results in those demo plots show improved cotton yields and quality, which is significant for a crop that is both a cash export and a water-intensive cultivation. The country is also exploring AI for diversifying crops – e.g., optimizing horticulture (fruit/vegetable) production to boost food self-sufficiency. With support from organizations like the World Bank and FAO, pilot programs are introducing machine learning for crop mapping and smart greenhouse control in Uzbekistan.

Perhaps most importantly, Uzbekistan's push in agri-tech is strongly backed by governance reforms. By exposing discrepancies (like satellite imagery revealing fields that were reported as cotton but not actually planted (Government of Uzbekistan, 2025), AI and satellite monitoring are helping increase transparency and accountability in land use. The government's establishment of a food security commission and emphasis on data in decision-making reflect a top-down commitment to leveraging digital tools for agriculture (Government of Uzbekistan, 2025). In a sense, Uzbekistan is using AI not just for immediate agronomic gains but to transform how agriculture is administered – moving from manual, paper-based systems to evidence-based digital

governance. The challenges are non-trivial (training personnel, upgrading rural internet, financing all these drones and systems), but progress is underway. By actively collaborating with neighbors (through platforms like the Shanghai Cooperation Organisation) and tapping into international expertise, Uzbekistan is making sure it is not left behind in the AI revolution in agriculture. If successful, its model of state-led yet collaborative digital ag transformation could be a blueprint for other developing countries seeking to leapfrog into tech-enabled farming.

Russia: AI alliances and autonomous farming at scale

Russia, with its large landmass and diverse climatic zones, has been steadily adopting AI in agriculture, often through initiatives spearheaded by major institutions like Sber and the Skolkovo innovation hub. A distinctive feature of Russia's approach is the formation of partnerships and alliances to accelerate AI deployment. The AI Alliance Russia (founded in 2019 by leading companies including Sber) underscores AI as a national priority and specifically highlights agribusiness as a sector where AI has “*gained impressive momentum*”, with active use in crop farming and livestock management (AI Alliance Russia, 2023). This alliance has facilitated sharing of AI solutions across companies and regions within Russia, from dairy farms using computer vision to monitor cow health to grain exporters using AI to optimize logistics.

One headline success has been the Cognitive Agro Pilot system for autonomous farm machinery, developed by Sber's joint venture Cognitive Pilot. This AI system retrofits tractors, combines, and sprayers with an autonomous driving kit that includes video cameras and onboard AI computing (Global Ag Tech Initiative, 2021). After several years of testing, Cognitive Agro Pilot moved to commercial rollout: in 2021, Russia's Bryanskselelmash factory became the world's first to install AI autopilots as a standard option on its combines (Global Ag Tech Initiative, 2021). Large-scale field operations have validated its effectiveness – during a single harvest season in 2020, over 350 AI-driven combines (including international brands retrofitted with the system) covered more than 160,000 hectares and gathered upwards of 720,000 tons of crops with minimal human intervention (Global Ag Tech Initiative, 2021). Autonomous operation shaved off significant time (harvests were about 25% faster) and cut crop losses by 8–13% thanks to optimized routes and machine settings (Global Ag Tech Initiative, 2021). These improvements can make a big economic difference across millions of hectares. To make the tech accessible, Russia's state leasing firm, Rosagroleasing, has started subsidizing leases for AI-equipped machinery, which helps even medium and small farms to acquire them (Global

Ag Tech Initiative, 2021). This democratization of high-tech equipment echoes a broader theme: integrating AI into the traditional agricultural value chain.

Russia is also leveraging AI in crop monitoring and farm management platforms. For example, the integrated system by Sberbank-Telecom and Cognitive Pilot called Cognitive Sber Agro Analyst offers a Software-as-a-Service platform where farmers can monitor yields, crop conditions, and equipment performance in one dashboard (James, 2020). It aggregates data from autonomous machinery, drones, and IoT sensors into field maps and analytics, using AI to detect anomalies (like a harvester's grain losses or a section of field underperforming) in real time (James, 2020). The goal is to save costs (they estimate up to 30% savings by eliminating inefficiencies) and increase transparency of farm operations (James, 2020). These kinds of decision support platforms are increasingly common in Russia's large agribusiness companies and are beginning to spread to more regions – as of 2024, Sber reported that 85% of Russia's regions were using some form of Sber's AI solutions in sectors including agriculture (UDF-Space, 2024).

Cross-border, Russia is positioning itself as a hub of AI expertise that it can share with Eurasian neighbors using network of regional expert associations. The AI Horizons initiative mentioned earlier is one example, bringing foreign scientists to Russian forums and fostering collaborations (e.g., Russian and Belarusian engineers jointly testing autonomous combines (Global Ag Tech Initiative, 2021). Additionally, under political directives (e.g. Russia-China agreements on AI cooperation (Finextra, 2025). Russian entities are working with Chinese counterparts on AI for agriculture among other fields. The vision is to create a unified AI ecosystem across Eurasia, where Russian-developed frameworks (such as AI models for image recognition or yield prediction) could be adapted and used in Kazakhstan or Belarus, and vice versa. The AI Horizons Alliance thus can be seen as a broader extension of Russia's domestic AI Alliance, aiming to coordinate AI-driven agricultural transformation on a multinational scale. Given Russia's strength in fundamental AI research and the agricultural importance of the Eurasian region, such coordination could accelerate innovation. For instance, Russian and Central Asian researchers might co-develop drought-resistant crop models powered by AI or share data to improve pest outbreak predictions across similar climate zones.

In summary, Russia's contribution to AI in Eurasian agriculture lies not only in specific technologies (like autonomous equipment and farm management AI platforms) but also in institutional leadership.

Discussion

The above cases demonstrate that AI-driven precision agriculture is not a futuristic concept but a present reality in many parts of Eurasia. From the fully

automated farms of China to the drone-monitoring systems of Kazakhstan, AI technologies are delivering measurable benefits: higher crop yields, reduced input waste, labor savings, and greater resilience against climate shocks. Perhaps equally important, these technologies are fostering a new culture of data-informed decision-making in agriculture. Farmers and officials are beginning to trust digital insights – and incorporate them into their management practices, which marks a significant shift from traditional methods based largely on experience and intuition.

Another discussion point is sustainability and environmental impact. Precision agriculture inherently aims to increase efficiency – using fewer inputs for the same or greater output – which has environmental benefits such as lower chemical runoff and reduced water consumption. The cases showed examples like 20% less fertilizer use in China’s unmanned farm (AgroPages News, 2025), or water savings of 10% in AI-optimized Californian farms (Morrison, 2024). Scaling these improvements across Eurasia would support more sustainable land and water management in a region facing serious ecological strains (desertification in Central Asia, water shortages, soil degradation in over-farmed areas, etc.). Additionally, data-driven practices can promote climate-smart agriculture: farmers can adapt cropping patterns based on AI climate models, plant drought-tolerant varieties informed by big data analysis or sequester carbon in soils more effectively with precision techniques. There is also potential synergy between AI and agroecology – organizations like IFOAM (International Federation of Organic Agriculture Movements) suggest that digital tools should augment agroecological practices, not replace them, ensuring that technology is used to work with nature (for example, precisely targeting only the pests and not harming beneficial insects) rather than blanket intensification. As long as ethical guidelines are followed, AI can indeed be a friend to organic and sustainable farming by providing better observation and control without heavy chemical use (Ahmad *et al.*, 2024).

Another consideration is the human factor and job impacts. As AI automates certain tasks, from driving tractors to diagnosing plant diseases, there could be concern about rural employment. The examples generally suggest a strategy where AI augments rather than outright replaces labor – e.g., drones take over tedious scouting, freeing farmers to focus on management; robots handle repetitive tasks, while humans supervise multiple operations with higher productivity. In Asia, where rural labor shortages are actually a problem (young people leaving farms for cities), automation is filling a gap rather than displacing people. Still, careful change management is needed to re-skill workers for new roles (like drone operator, data analyst) so that the transition is smooth.

Finally, governance and policy will play a big role in how AI in agriculture unfolds. Issues such as data privacy (who owns farm data?), algorithmic transparency, and equitable access need attention. International institutions and forums could help here: for instance, FAO has been actively exploring AI's role in inclusive agricultural growth and promoting ethics (like the Rome Call for AI Ethics) (FAO, 2024). Eurasian countries might benefit from a shared framework or guidelines for AI in agriculture, possibly an agenda item in future BRI or SCO meetings, to ensure that standards are aligned and the technology is used responsibly and safely. The AI Horizons Alliance could evolve to also address these soft aspects – not just deploying technology but also shaping the rules of engagement (for example, agreeing that AI should be open-source or affordable, or that success stories are published openly for others to learn).

Conclusion

AI-driven precision agriculture is heralding a new era for Eurasian agrifood systems. As detailed in this article, countries along the Belt and Road in Europe and Asia are increasingly adopting technologies such as drones, satellite remote sensing, machine learning, and robotics to transform traditional farming practices. These technologies, underpinned by advanced data analytics, are enabling farmers to make smarter decisions – applying inputs at the right place and time, predicting problems before they escalate, and efficiently marshaling resources. Real-world deployments have led to impressive outcomes: higher yields (e.g. China's 20% wheat boost on unmanned farms (AgroPages News, 2025)), significant cost savings (Kazakh farmers cutting fertilizer bills by thousands of dollars (Satbayev University News, 2025)), and time and labor efficiencies (harvests completed in a fraction of the time with autonomous combines (AgroPages News, 2025)).

However, the journey is just beginning. Continued investments in infrastructure (connectivity, hardware), capacity building (training agronomists and farmers in digital skills), and research and development (to tailor AI tools to local crop varieties and conditions) will be necessary to sustain momentum. Policymakers should craft supportive policies – for example, incentives for tech adoption, frameworks for data sharing, and safeguards for privacy and security. International organizations and local institutions should work in tandem to ensure that smallholder farmers are not left behind; inclusivity will determine the ultimate success of AI in agriculture.

AI-driven precision agriculture in Eurasia offers a compelling narrative of coordinated innovation leading to tangible development gains. It demonstrates

how cutting-edge technologies can be harnessed in very practical ways to address age-old problems in farming. The “digital Silk Road” in agriculture is well underway, and its continued expansion will be critical for achieving food security and prosperity in the 21st century.

Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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