



Family Farming Digitalisation: Strengthening Sovereign and Independent Development through China–Brazil Cooperation

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The Convergence of Digital and Family Agriculture

As humanity steps into a new era of comprehensive digitalisation, technologies such as artificial intelligence (AI), big data, and the Internet of Things are reshaping industries with unprecedented depth and breadth—including agriculture. For an agricultural powerhouse like Brazil, which has agriculture as an important foundation of its society and economy, this moment presents not only vast opportunities but also profound challenges concerning the future. Digital technology is no longer a distant notion—it has become a critical instrument for transforming agricultural ecosystems, safeguarding food sovereignty, and achieving sustainable development.



Family farming plays a vital economic and social role in Brazil. According to the final results of the [2017 Agricultural Census](#) conducted by the Brazilian Institute of Geography and Statistics (IBGE), the country has approximately 5.073 million agricultural establishments, of which around 3.9 million (roughly 77%) are classified as family farms. These smallholder farmers are the backbone of national food security and the custodians of Brazil's rich cultural diversity. Yet over time they have faced structural barriers in accessing advanced technology, market information, and production inputs.

Digital agriculture provides a transformative new pathway to overcome these obstacles. Through remote sensing, drones, and IoT sensors, farmers can monitor soil conditions, weather, and crop status with precision. Combined with big data analytics and AI, an ecosystem can be established in which smallholders can access, interpret, and apply data—leading to better plantation decisions, precision farming, reduced resource wastage, increased productivity, and ultimately a sustainable agricultural transition.

The Brazilian government has keenly recognised this trend and demonstrated a firm commitment to embracing AI. In 2024, the Ministry of Science, Technology and Innovation (MCTI) launched the national plan [Artificial Intelligence for the Benefit of All \(2024–2028\)](#), pledging over R\$23 billion over the coming years. Its aim is to develop sovereign and controllable AI technologies that enhance public services, drive industrial innovation, and benefit the entire population. Agriculture is designated as one of its priority application areas, with emphasis on using AI to tackle significant social, economic, and environmental challenges.

President Lula made this point sharply at [the BRICS Leaders' Summit](#) in February: “Today, no attempt at economic development is possible without artificial intelligence. We must not allow inequality in access to this technology to leave the Global South behind.” Against that broad backdrop, Sino-Brazilian agricultural cooperation is entering a new stage of opportunity. As two major agricultural nations and emerging-market powers, Brazil and China bring highly complementary strengths in this sector. From traditional trade in agricultural commodities to deeper collaboration in biotechnology, digital agriculture, and sustainable development, the partnership is advancing towards greater quality and sustainability.

The Role of Universities and Grassroots Organisations in Building Digital Agriculture

The inclusive application of technology depends on the dissemination of knowledge and innovation in practice. In the complex process of digitalising family farming, the research capacity of universities, the social networks of NGOs, and the technical expertise of enterprises form a vital collaborative innovation system. Its core objective is to ensure that technological progress genuinely serves food sovereignty and the public good—not just capital accumulation. Universities are the source of knowledge innovation, while grassroots organisations act as bridges between technology and local communities, ensuring that technological solutions are both scientifically advanced and rooted in local needs.



The *Science and Technology Residence* model is an outstanding exemplification of bridging theory and practice to resolve real agricultural challenges. Originating in the innovative practices at China Agricultural University's (CAU) Quzhou Experimental Station, the model was established at the University of Brasília (UnB) in 2024 and the Residence will welcome its first Chinese students in 2025. The two universities, together with the International Association for Popular Cooperation (IAPC), Sinomach Digital Technology Co., Ltd., Jiangsu World Agriculture Machinery Co., Ltd., Hunan Nongfu Technology Co., Ltd., Hebei Nonghaha Machine Group Co., Ltd., Beijing Debang Dawei Technology Co., Ltd., Shanghai Dahui Machinery Co., Ltd., Qingdao Hongzhu Agricultural Machinery Co., Ltd., Shandong Beiyuan Machinery Co., Ltd., Suzhou Jiufu Machinery Co., Ltd., Hebei Yihang Technology Co., Ltd., and Zhejiang SiFang Co., Ltd.—among other renowned Chinese agricultural machinery companies—jointly established the Brazil–China Science and Technology Residence for Family Farming Mechanisation at UnB's Água Limpa Farm. Since then, CAU has begun dispatching postgraduates and doctoral students in batches to reside at the farm, assisting local farmers with practical production challenges and preparing for future exchanges and training at Sino–Brazilian agricultural mechanisation demonstration farms and resettlement communities.

A key highlight of the Residence is the Brazil–China Family Farming Big Data System—the *Agri-Cloud* Smart Agriculture Platform—supported by Sinomach Digital.

With the central system installed in the Agroecological Digital Agriculture living laboratory, located in the UnB Technology Park, and with a monitored area at the university's own Água Limpa Farm, it is based on Internet of Things technology and allows real-time monitoring of the geographical location, operational routes and operating status of agricultural machinery, as well as integrating comprehensive data on four essential conditions in the field: soil moisture, crop development, occurrence of pests and diseases, and meteorological risks. This provides powerful data-supported precision management for the farm. With *Agri-Cloud*, university staff and students and local farmers jointly conduct family farming surveys, design experimental plans, and collaborate closely in fieldwork, data collection, and report drafting.

The international *Science and Technology Residence* model is not a simple transfer of technology but a deeply integrated co-construction platform combining talent development, scientific research, and social service. In this framework, CAU's research team brings its extensive experience in serving smallholder farmers and adaptable machinery technologies; UnB's scholars contribute profound insights into local ecological and social realities, in addition to recognised methodologies for working with farmers; technology companies such as Sinomach Digital and the other partner enterprises provide essential technical and equipment support; and IAPC, a long-standing international advocate for family farming and rural communities, plays a critical coordinating role—aligning resources precisely with the genuine needs of family farmers.

Thus, the Residence becomes a solid bridge—translating academic knowledge into real-world agricultural productivity, combined with social and ecological justice. It establishes a virtuous cycle: students conduct high-quality academic research while solving farmers' practical challenges; farmers improve their income and sustainability through new technologies; and



universities and enterprises fulfil their institutional development and social responsibility through service to the public. This represents a shift from one-way assistance to equal co-construction, offering a vivid example of how technology can truly serve public welfare.

Looking Ahead

The cooperation between China and Brazil in digital agriculture carries deep significance. It offers invaluable lessons for other countries of the Global South seeking to collaboratively pursue sovereign and sustainable technological pathways. The model's core lies in establishing a long-term, self-evolving mechanism that tightly integrates talent development, social service, and frontier research—thus ensuring the enduring vitality of the partnership. For countries across the Global South, it represents a path to technological autonomy and sustainable development distinct from capital-driven models. It demonstrates that developing nations can indeed learn from each other and collaboratively face the challenges of our time.

Looking forward, the model holds enormous potential for replication. Brazil's experience in family farming could offer useful guidance to rural communities with similar challenges in Latin America, Africa, and Asia. Regional knowledge-sharing networks and cooperation platforms can further amplify the impact of the *Science and Technology Residence* concept, generating broader synergies.

At bottom, the value of technology is determined by whom it serves. The China–Brazil experience in digital agriculture clearly shows that advanced technologies can not only bring economic benefit but also significantly enhance public welfare and social equity. The sustainable development of family farming is a complex systemic endeavour—requiring appropriate technology, innovative institutional frameworks, and respect for cultural diversity. We call on more universities, research institutions, civil society organisations, and communities across the Global South to engage in such collaborations. Together, we can advance a fairer, healthier, and more sustainable global food system and contribute meaningfully to food justice and the building of an ecological civilisation.
