

# DIGITAL TECHNOLOGIES IN AGRICULTURAL CREDITING

Elvira Satylganova<sup>1</sup>  
Umut Abdyldaeva  
Gulmira Baiterekova

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## ABSTRACT

*This article examines how the introduction of digital technologies creates new opportunities in agricultural lending, increasing the availability of financial resources and optimizing risk assessment. The use of mobile platforms, blockchain, big data analysis and artificial intelligence allows farmers to quickly apply for loans, and banks to make more informed decisions. An important role is played by government support programs aimed at the digitalization of agriculture and the provision of subsidies to ensure favorable financing conditions for small and medium-sized farms. The importance of Big Data and machine learning is separately noted, which make it possible to take into account numerous factors, from weather conditions to price dynamics in global commodity markets, in order to form accurate scoring models. In conclusion, it is concluded that the development of digital tools in agricultural lending contributes to the accelerated growth of the industry, increased financial literacy and a more even distribution of investment flows, forming the long-term potential for food security. At the same time, the digital revolution not only accelerates the process of issuing loans, but also promotes closer cooperation between the state, banks and farmers, aimed at improving the methods of actually ensuring food stability and sustainability at the global level.*



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## 1. INTRODUCTION

The modern economy is integrating digital tools everywhere, and the agricultural sector is no exception. The transformation of the agricultural sector over the past couple of decades has been impressive, from the use of drones to monitor fields to the introduction of mobile financial services that allow farmers to apply for loans through online platforms in a matter of minutes. According to the World Bank, the volume of digital finance in agribusiness worldwide has grown by an average of 25-30% over the past five years, largely due to the emergence of fintech startups and the rapid pace of internet penetration in remote regions (World Bank, 2023).

But what is this digital revolution in the agricultural sector entailing? Why is agricultural lending in particular becoming the focus, and how are new technologies

helping to overcome old barriers? As agriculture becomes more technologically advanced, the need for flexible financial instruments increases. Lenders demand transparency and predictability, and farmers want quick and affordable access to money. Here, digital innovation acts as a bridge, enabling effective interaction between banks, investors and those who grow the crop (Maksimov et al., 2020).

## 2. MATERIALS AND METHODS

The presented article is based on the methods of content analysis of scientific and practical publications on the topic of the study, includes methods of economic and statistical analysis regarding the object under consideration.

<sup>1</sup> Corresponding author: Elvira Satylganova  
Email: [elvirafk8@gmail.com](mailto:elvirafk8@gmail.com)

Before delving into the benefits of digital transformation, it is worth considering the challenges agriculture has faced with traditional credit mechanisms. Historically, farmers have had difficulty accessing credit: high interest rates, a cumbersome bureaucratic system, and long waits for decisions. As a result, rural entrepreneurs either missed the opportunity to purchase equipment and seeds on time, or were forced to cooperate with intermediaries at exorbitant interest rates.

For example, in India, according to a study by the National Bank for Rural Development (NABARD), about 30% of small farmers had to resort to the services of informal lenders (so-called private moneylenders) for a long time, since state-owned banks refused them due to lack of collateral or the inability to provide the required package of documents in the shortest possible time (Seibel, 2005). Similar difficulties were experienced in sub-Saharan Africa, where, before the advent of mobile payment systems, many farmers were unable to attract investment for years to expand their crop areas.

The problem of information asymmetry aggravated the situation: the bank did not always have a clear picture of the real state of the farm, and the farmer often did not understand why the rate was so high. As a result, uncompetitive lending conditions slowed down the development of agribusiness, making it less attractive to young professionals and potential investors.

In recent years, mobile applications have become a key driver of agricultural lending growth, providing instant access to financial services even in remote areas. According to the International Telecommunication Union (ITU), by 2025, more than 70% of the rural population will have access to the Internet via smartphones globally. This is largely due to the initiatives of governments and telecommunications companies offering low-cost tariffs and investing in the development of 4G and 5G networks outside of megacities (Forge & Vu, 2020). One of the most striking examples is the M-Pesa platform in Kenya, which was originally intended for money transfers, but has subsequently evolved into a full-fledged mobile banking ecosystem. Now it offers microloans, insurance products and savings tools, and also cooperates with agroholdings and small farmers. According to statistics from the Central Bank of Kenya, M-Pesa processes over 50% of all personal money transfers in the country each year, with a significant share of transactions related to the agricultural sector (Mbiti & Weil, 2015).

But mobile apps are just the tip of the iceberg. Deeper changes are associated with Big Data analysis. High-precision satellite images, weather data, and price dynamics on international commodity markets allow lenders to objectively assess financial risks. For example, in the US, more than 40% of farms already use special services to analyze the actual condition of the soil and forecast crop yields for several seasons ahead. Thanks to such data, banks can more accurately calculate the probability of default, setting lending rates at a fairer level.

### **3. RESULTS**

One of the promising areas at the intersection of finance and information technology is big data analysis. Large arrays of information on weather conditions, soil types, agricultural practices, and global market dynamics can provide an accurate picture of the profitability of future harvests. As a result of such a scrupulous assessment, the risks of loan defaults are reduced, which is beneficial to all participants in the process. Bankers can fully rely on statistics when creating lending conditions, and farmers receive more flexible interest rates and do not overpay for the inevitable risks inherent in “standard” products (Swinnen & Gow, 1999).

In addition, the possibilities of blockchain technologies are becoming increasingly clear on the horizon, which can increase the transparency of transactions, simplify document flow, and minimize corruption schemes. Electronic smart contracts allow for the automation of the process of issuing and repaying a loan: the terms are written into the blockchain algorithms themselves, and when certain events occur (for example, receipt of revenue into the account after selling the harvest), the loan payment is made instantly. This approach not only reduces debt management costs, but also strengthens trust between the bank and the borrower. Let's imagine that a farmer in Argentina enters into an agreement with a bank to finance the purchase of a new tractor, and the smart contract specifies the parameters under which the loan payment is debited from his account automatically - for example, after selling a certain portion of the harvest from a warehouse, the data on which is recorded in the inventory accounting system in real time. Such a mechanism significantly reduces the risks of delays and fraud, because the information recorded in the blockchain is essentially not subject to retroactive adjustment. In the European Union (for example, in Estonia and Germany), there are already pilot projects where small farming cooperatives combine their resources into a digital pool and then distribute them to the needs of participants in accordance with automatic rules. Banks acting as external lenders also gain access to such a pool. As a result, an ecosystem is formed in which the transparency of financial flows is guaranteed by technology, and the terms for reviewing applications are reduced several times compared to traditional models (Lee & Shin, 2018).

Another emerging area is the use of artificial intelligence (AI) and machine learning in lending. Banks and fintechs are increasingly creating algorithms that can analyze complex data sets about a farmer's activities, including field monitoring, repayment history on previous loans, weather data, and even trends on social media related to the agricultural market.

Machine learning algorithms can identify hidden patterns. For example, if a region experiences a series of droughts, but one farmer manages to maintain stable yields through smart farming practices and drip irrigation systems, the farm's credit score may be higher than the average for the area. As a result, the bank will offer it a

lower interest rate, given its proven resilience to weather risks.

According to a McKinsey report, by 2030, the potential savings from AI implementation in the financial sector will exceed \$1 trillion globally, with the agricultural sector potentially benefiting from this by 20-25%. This is due to both the optimization of interest rates and the reduction of operational costs for document verification, since many processes of identity verification and creditworthiness assessment will be automatically handled by software (Nwachukwu, 2024).

To illustrate the significant role that digital technologies play in agricultural lending, let's look at a few illustrative examples from around the world:

**USA:** According to the US Department of Agriculture (USDA), the volume of digital loans in the American agricultural sector increased by 35% from 2018 to 2023. Startups offering online services for leasing agricultural equipment, where documents are signed electronically, and approval of applications takes from a few hours to a couple of days, have been particularly developed (Birner et al., 2021; Gomber et al., 2018; Paul Jr et al. 2024, Suprem et al., 2013).

**Brazil:** In Latin America's largest economy, agriculture accounts for about 20% of GDP and actively uses mobile applications for microfinancing farmers. According to the Brazilian Confederation of Agriculture (CNA), the share of digital transactions in the agricultural lending segment exceeded 45% in 2022, which was a record figure compared to previous periods (Arias et al., 2017).

**India:** Digital agricultural lending projects are growing at a rate of 40-50% per year, and government programs to subsidize internet access in rural areas are allowing more farmers to use online platforms. In 2023, about 60% of the country's agricultural enterprises had at least one episode of receiving credit resources through mobile apps or web portals, according to the Indian Council of Agricultural Research (ICAR) (Singh et al., 2025).

**China:** Chinese companies such as Alibaba and JD.com have launched their own agri-finance units. MyBank (owned by Ant Group) serves tens of millions of entrepreneurs, many of whom are small farmers in remote provinces. According to statistics from the Central Bank of China, more than 65% of farms registered on the MyBank platform were able to obtain a line of credit without traditional collateral, using digital analysis of their business activities instead (Huang, 2024).

The role of the state in the development of digital lending should not be underestimated. In many countries, governments realize that strengthening the agricultural sector directly affects food security and employment, which means that stimulating digital financial services is becoming a strategic priority.

The European Union has programs aimed at developing "smart agriculture" (Smart Farming), where a significant part of investments are made up of loans received by farmers through digital channels. By 2030, the EU plans to achieve full "digital maturity" of the agricultural sector: pilot zones are being created where new formats

of blockchain tools and automated lending platforms are being tested (Francksen et al., 2025).

African countries such as Nigeria, Ghana, and Ethiopia, with the support of international organizations (for example, FAO and the World Bank), are launching large-scale projects to spread high-speed Internet in rural areas and improve the financial literacy of farmers (Mollel et al., 2025; Mihret et al., 2025). This enables millions of people to join the digital economy by receiving loans and insurance products through mobile applications.

#### **4. DISCUSSION**

The digital evolution of lending is beneficial to all stakeholders. For farmers, the key advantage is faster access to money, often without the need for a massive package of paperwork and a long queue at the bank. In the case of small farms, this means timely purchase of seeds, fertilizers, as well as repair of equipment right in the season when prices for products are the highest.

Bankers, in turn, receive more reliable risk assessment tools. Technological platforms provide detailed information about the borrower's past experience, including their yield profile, consistency of product supply, and even social reputation in the professional community. Such transparency allows lenders to create more accurate scoring models, reducing the overall level of loan defaults.

In addition, the development of digital platforms makes it easier to organize collective financing (crowdfunding), when a group of private investors or business angels invests in a promising project with subsequent distribution of profits. Such schemes are already successfully operating in a number of European countries, contributing to the emergence of new forms of cooperation in agribusiness.

The issue of environmental sustainability is coming to the forefront, and digital technologies can make a significant contribution to solving this problem. When a bank evaluates a farmer's project using Big Data and AI, it can take into account not only financial but also environmental indicators: the use of organic fertilizers, careful use of water resources, the introduction of spot irrigation systems.

There is a concept of "green loans", where the interest rate can be lower for farms that comply with environmental safety standards. Such schemes are actively promoted in the countries of the European Union and partially in Canada. According to the European Investment Commission, in 2022, about 12% of all loan products related to the agricultural sector were categorized as "green", and this figure continues to grow. In addition, the digital reporting format simplifies monitoring compliance with environmental standards. If previously inspection bodies spent months auditing the activities of agricultural enterprises, now a significant part of the documentation is carried out automatically, and access to digital platforms will make it possible to ensure that the farmer complies with the regulations.

The expansion of digital lending methods has a positive impact on the socio-economic climate in rural areas. Firstly, farmers are encouraged to improve their financial and technological literacy, because without basic skills in handling applications and electronic platforms, it is more difficult to become a competitive player in the market. Secondly, new jobs are created in the field of agri-finance consulting, IT support and software maintenance, which is especially important for regions with high unemployment. According to a report by the Organization for Economic Cooperation and Development (OECD), by 2030, up to 10 million jobs may appear in developing countries directly or indirectly related to digital agri-lending and services that accompany the activities of farms. This trend helps to curb the outflow of young people from rural areas, since innovative technologies create an environment for them close to the urban level of opportunities (Cohen, 2006). Despite all the benefits, the transition to digital lending is not without its challenges. Complexity of technology and lack of infrastructure may hinder the process in some regions. For example, some countries in Africa and Asia still have problems with access to reliable electricity or internet, which directly affects the ability to use mobile and online platforms.

Data security and cyber threats are another challenge. Hacking, phishing, and fraudulent schemes can undermine trust in digital solutions. National regulators are gradually introducing cybersecurity standards, but farmers' awareness of such risks remains low.

Cultural barriers should not be forgotten either. Many communities still prefer to make payments "the old-fashioned way", verbally, since reliable digital identification can be difficult due to the lack of official documents or distrust of electronic systems. To overcome such barriers, governments and non-governmental organizations will need to do more to train rural populations in digital skills and take measures to combat financial fraud (Djatkiko et al., 2025; Grover et al., 2025).

## **5. CONCLUSION**

The introduction of digital solutions in agricultural lending is creating a new reality, where successful farming requires not only knowledge in the field of agriculture, but also the ability to interact with electronic services. Of course, there are obstacles along the way: a lack of IT competencies among individual farmers, the risk of cyberattacks, or the difficulty of complying with

data protection regulations. However, the increasing level of digital literacy and the emergence of increasingly sophisticated platforms can overcome these obstacles over time. As a result, the benefits of the symbiosis of the agricultural sector and fintech technologies are becoming obvious: quick access to the necessary resources, fair credit terms, and reduced risks - all this contributes to the dynamic development of agriculture and increased competitiveness in the global market.

It is clear that the synergy between financial and digital technologies will become even more pronounced in the coming years. Already, global trends point to an expansion of the range of online services, automation and in-depth data analysis. The next stage is the mass implementation of smart contracts based on blockchain and more active use of artificial intelligence to predict climate change and associated risks for the agro-industrial complex.

Digital solutions create conditions for transparency, efficiency and sustainable growth, while farmers receive tools that were not available ten years ago. The success of the agricultural sector, which underpins food security in many countries, increasingly depends on the ability of markets and institutions to adapt to technological realities. Where electronic platforms have already become commonplace, there is accelerated growth in production and an improvement in the well-being of the rural population.

Of course, full-fledged digitalization of credit processes requires concerted efforts: from the private sector, which develops and offers innovative solutions, and from the state, which creates the legislative framework and infrastructure, and from international organizations promoting the ideas of sustainable development. But progress in this direction is undeniable, and further unification of knowledge, resources and technical innovations promises even more large-scale changes in agriculture.

As a result, we can state that digital technologies in agricultural lending do not just simplify the process of issuing loans, but create a qualitatively new ecosystem of interaction. Slow and opaque schemes are being replaced by convenient services operating in real time, allowing farmers to quickly and without unnecessary barriers to access financial resources. Investment growth, improved solvency of farmers, increased competitiveness in world markets - all these are the realities of the new digital order, which are already setting the tone in global agribusiness and will certainly remain relevant for the long term.

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**Umut Abdylidaeva**

Kyrgyz State Technical University  
named after I. Razzakov, 720000  
Bishkek, Kyrgyz Republic  
**ORCID:** 0000-0003-2149-2959

**Elvira Satyrganova**

Kyrgyz National University named  
after J. Balasagyn, 720000 Bishkek,  
Kyrgyz Republic  
[elvira8@gmail.com](mailto:elvira8@gmail.com)  
**ORCID:** 0009-0007-1854-6617

**Gulmira Baiterekova**

Kyrgyz Economic University named  
M.Ryskybekov, 720000 Bishkek,  
Kyrgyz Republic  
[bgs403@mail.ru](mailto:bgs403@mail.ru)  
**ORCID:** 0000-0001-7670-9188

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