Theoretical and Practical Research in Economic Fields

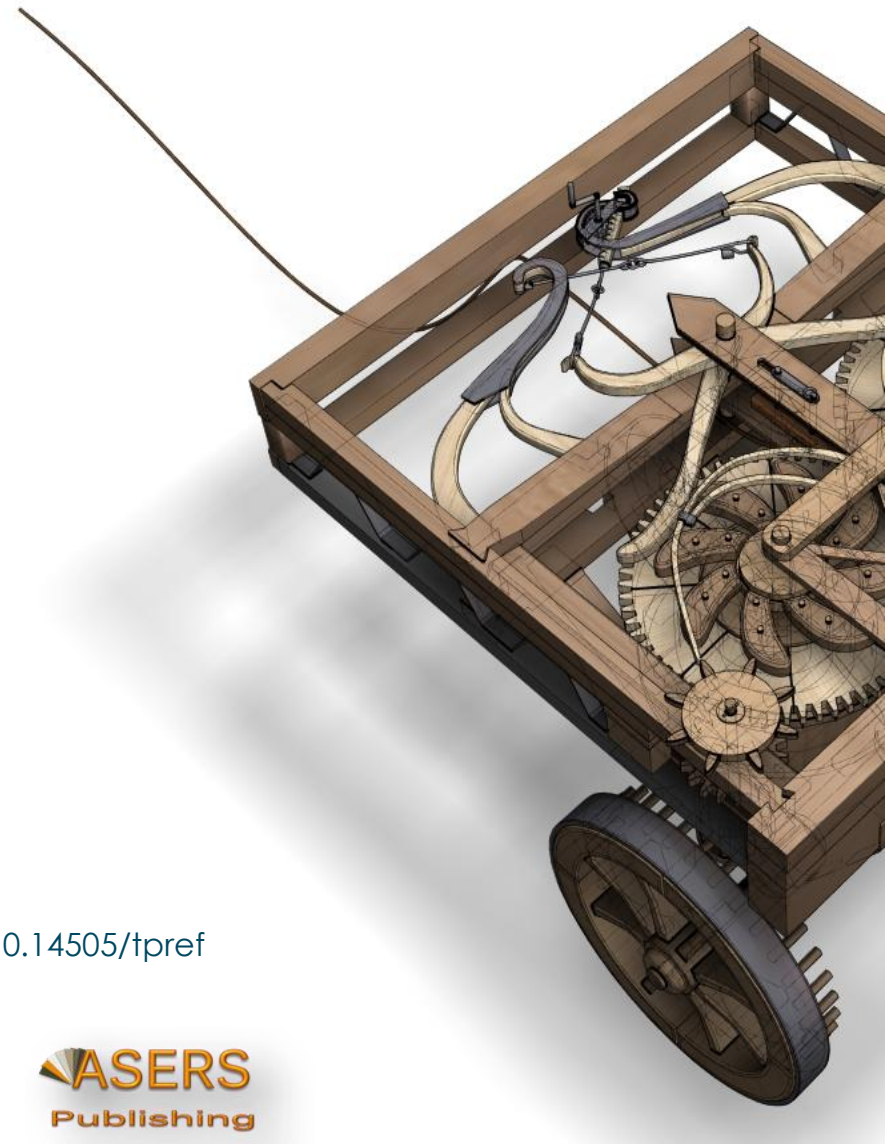

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Table of Contents

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Call for Papers
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Theoretical and Practical Research in Economic Fields

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The Role of Financial Technologies in Ensuring the Sustainable Development of Agricultural Businesses

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Abstract: The role of financial technologies (FinTech) in ensuring the sustainable development of agricultural businesses is gradually becoming relevant for the agricultural sector, especially in view of the problems and obstacles facing small and medium-sized agricultural companies. The aim of the study is to assess the impact of the use of FinTech on the sustainable development of the agricultural sector.

A structured online questionnaire with ten questions was developed to collect data covering the level of implementation, usage frequency, and the impact of FinTech on the sustainable development of agricultural businesses. Quantitative correlation analysis was used to assess the statistical relationship between the FinTech usage rate and sustainable development indicators. The analysis of variance (ANOVA) determined the strength and direction of the impact of FinTech on the economic, social, and environmental aspects of sustainable development.

The study showed that the active use of financial technologies among agricultural companies remains limited. Mobile payments, online banking, and automation of financial processes are the most common financial instruments. It was found that insufficient awareness of companies, financial barriers, and technical difficulties hinder the active implementation of financial technologies.

For the first time, an assessment of the level of implementation of FinTech in the agricultural sector of Poltava region was carried out and the main tools used by agricultural companies were identified. Further research may focus on studying the impact of individual FinTech innovations on the productivity of agricultural businesses.

Keywords: financial technologies; financial instruments; agricultural; sustainable development; online banking.

JEL Classification: Q01; Q14; Q16; C12; E44.

Introduction

Agriculture is the backbone of the global economy, supporting millions of lives and playing a key role in ensuring food security and economic development, especially in developing countries (Fan and Rue 2020). Smallholder farmers, who account for about 84% of all farms in the world (Ricciardi *et al.* 2021), play a crucial role in meeting the growing demand for food, thereby significantly contributing to the achievement of the Sustainable Development Goals (SDGs). However, their ability to invest is severely limited by a lack of financial capacity, which hampers agricultural development. The defining condition for modern management is the realization that the production potential of agricultural enterprises should be used rationally, considering the limited number of available resources (Vinichenko *et al.* 2023)

So, in this context, FinTech is changing agriculture in many ways, going beyond Ensuring financing for essential investment in irrigation, mechanization, and land expansion is crucial to fostering the development of the agricultural sector (Chavas and Nauges 2020).

So in this context, FinTech is changing agriculture in many ways, going beyond financial services. Global access to mobile phones is fundamentally changing the way farmers access price information, find buyers, and build brands as they try to move up the value-added chain. New technologies in risk management, such as index insurance, are often marketable. Therefore, some of the enthusiasm for new fintech solutions for agriculture, such as blockchain, remains unproven (Green 2023).

The Fourth Industrial Revolution, together with technological advances, is transforming the global economy (Sharma *et al.* 2024a; Nikonenko *et al.* 2022), emphasizing the importance of social entrepreneurship, supported by digital technologies (Guo, Yan & Zhuan 2025). Agricultural technologies are considered essential to ensure sustainable development and meet consumer needs for safe and quality food (FAO, WHO, WFP, UNICEF, IFAD, 2020).

The development of financial technologies (FinTech) in Ukraine has enormous potential for the agricultural sector, especially given the positive trends in investment in this industry. According to the Vestbee report (2024), financial technologies have become an important investment direction in Central and Eastern Europe, accounting for 20% of the 50 largest financing rounds. This indicates that investors consider financial innovations promising, which also applies to the Ukrainian market, where 256 FinTech companies currently operate, 47% of which operate internationally (UAFIC 2024).

So, FinTech not only facilitate financial processes, but also open up new opportunities for innovation, business model transformation, and greater integration into the market economy (Wang 2025).

The aim of this study is to assess the impact of FinTech in ensuring the sustainable development of agricultural businesses using the example of the Poltava region of Ukraine. The aim involved the fulfilment of the following research objectives:

1. Analyse data from agricultural companies in the Poltava region of Ukraine regarding the use of FinTech in their practical activities;

2. Identify the main barriers to the implementation of FinTech in the activities of agricultural companies in the Poltava region:

3. Determine the impact of the use of FinTech on the sustainable development of companies.

The scientific novelty of the study lies in identifying and quantifying the relationship between the level of use of financial technologies and indicators of sustainable development of agricultural enterprises. Unlike the vast majority of previous works that focus on individual aspects of the impact of FinTech or are exclusively qualitative in nature, this study uses a combination of correlation analysis and ANOVA to comprehensively measure the economic, social and environmental effect. The proposed approach can be adapted for further comparative studies in different sectors of the economy, which increases its theoretical value.

1. Literature Review

FinTech play an important role in ensuring the sustainable development of agricultural companies, which is confirmed by the analysis of recent studies. The researchers Rayhan *et al.* (2024) emphasized the importance of implementing FinTech solutions among smallholder farmers, because FinTech, according to the authors, reduce transaction costs and increase the transparency of financial processes, which contributes to the overall efficiency of agricultural value chains. The authors found that Agri-FinTech solutions is an important way to improve living standards and promote the sustainability of agriculture in developing countries. The authors state that the integration of FinTech solutions for agricultural credit mechanisms and product market promotion accelerates opportunities for pre-production financing and ensures fair prices for smallholder farmers at the post-production stage, while neutralizing the potential for exploitation in the value chain.

A similar conclusion was made by other researchers Gonzalez-Ruiz *et al.* (2024), who studied social financial instruments and their impact on farmers' economic opportunities, which emphasized the importance of social responsibility and support for sustainable development in this area.

Further analysis showed that digital finance also facilitated the adoption of green technologies. The authors Liu *et al.* (2024) demonstrated that the use of digital financial services helped farmers to adopt environmentally friendly practices, which positively impacted the sustainability of the agricultural sector and contributed to green development. Besides, Tikku and Singh (2023) focused on the role of mobile banking in the financial inclusion of agricultural traders in India. Their study demonstrated that the availability of mobile financial services increased financial inclusion, allowing farmers to more easily engage in financial markets and expand their economic opportunities. Su *et al.* (2021) supported this thesis by examining how the adoption of e-commerce facilitated farmers' participation in digital financial markets, thereby facilitating market access and improving sales efficiency. Reznik *et al.* (2025) analysed innovative approaches to managing foreign economic activities of agro-food enterprises, focusing on digital transformation tools that indirectly include financial technologies. The authors emphasized the role of ERP systems, digital platforms for international trade, and data-driven risk analysis in optimizing financial and operational decisions.

On the other hand, Putra *et al.* (2023) showed that the successful use of agricultural applications developed based on the UTAUT2 method depended on positive user experience and community behaviour. Such digital tools contributed to the improvement of farmers' activities, ensuring the sustainable development of agricultural companies. The authors found that experience with agricultural applications helps to modulate the behavioural intention variable, which affects the usage intention variable, and also contributes to building confidence in using opportunities for agribusiness development.

The study of Hrosul *et al.* (2023) focuses on the impact of digital solutions on the efficiency of agricultural companies in Ukraine. The authors found a direct relationship between activity in the information and communication technologies segment and investment in software. However, it is worth noting that the results of their study do not take into account possible negative aspects of the implementation of digital technologies, such as cybersecurity risks or the need for specialized knowledge that may limit farmers' access to new technologies.

The study by Sharma *et al.* (2024b) presents a systematic review of the impact of financial technology on the agricultural economy in India, focusing on Fin-Tech products and services such as mobile banking and digital insurance. While the authors highlight the potential of these technologies to transform financing in agriculture, it is important to note that their analysis may be limited by the specifics of the Indian context, which does not fully reflect the situation in other countries, in particular in Ukraine.

Finally, the study by Saruchera and Mpunzi (2023) focuses on the impact of digital capital on the efficiency of small and medium-sized agricultural companies, as well as its role in reducing social and economic inequalities. However, the authors did not examine in detail the barriers to access to digital tools, which may reduce the overall effectiveness of their implementation.

So, despite the large number of studies on FinTech in the agricultural sector, their impact on sustainable development in the current conditions of digital transformation requires additional studies.

2. Methodology

2.1. Research Design

The first stage of the research involved determining the main objectives, developing the research design, and preparing data collection tools. It was decided to use a quantitative correlation approach to analyse the relationship between the FinTech usage rate and indicators of sustainable development of small businesses. The questionnaire structure was also developed at this stage. At the second stage, the data were collected through a questionnaire. Each enterprise filled out an online questionnaire, which assessed the rate of use of FinTech solutions and sustainable development indicators (economic, social, and environmental aspects). The final stage included the analysis of the collected data.

2.2. Research Methods

Survey. A structured online questionnaire was developed, including ten questions to determine the impact of FinTech on the sustainable development of companies. The first question asked respondents to assess the level of implementation of fintech technologies in their companies on a scale from 1 to 5, which made it possible to determine the overall level of use of technologies such as mobile payments, blockchain, e-wallets, etc. The following questions examined the frequency of use of FinTech solutions, the types of technologies used, as well as their impact on the efficiency and sustainable development of companies. Questions about the level of

knowledge of employees about FinTech and the possibility of their training were aimed at identifying the companies' readiness to adapt to new technological challenges. The questionnaire also examined the factors that influenced the implementation of FinTech and the problems that companies faced during this process. The last question about the prospects of FinTech provided an opportunity to assess the respondents' expectations regarding the development of FinTech in their companies in the future.

Quantitative correlation analysis was used to determine the statistical relationship between the level of use of FinTech and sustainable development indicators.

ANOVA was used to assess the strength and direction of the relationship between the independent variable (use of FinTech solutions) and the dependent variables (economic, social, and environmentally sustainable development indicators).

2.3. Sample

A sample of 30 small businesses from the Poltava region of Ukraine was selected for the study. The selection of thirty small agricultural companies from the Poltava region of Ukraine is determined the fact that the Poltava region is one of the main granaries of the country, occupying leading positions in the production of grain, sugar beet, soybeans, as well as livestock products, in particular milk and meat. This makes this region important for studying the implementation of FinTech in the context of agricultural production. The selection criteria included: the company scale (small companies), the field of activity (agricultural sector), as well as geographical location (Poltava region). The total number of small agricultural companies in this region is more than 200. Thirty enterprises were selected, in particular, because a significant part of small business representatives refused to participate in the study for various reasons, in particular because of time constraints or insufficient understanding of issues related to FinTech. Despite these refusals, it was possible to form a sample that provides the necessary representativeness for the analysis.

2.4. Instruments

Five-point Likert scale was used to assess the respondents' attitude to various aspects of FinTech (Winter and Dodou 2010). Each respondent had to assess the FinTech usage rate and the corresponding indicators of sustainable development of the company on a scale from 1 to 5 (1 - "strongly disagree", 5 - "strongly agree"). The survey was conducted anonymously, and respondents could fill out the questionnaire independently at a convenient time. Calculations were performed in Microsoft Excel, which ensured the accuracy and clarity of the results (Table 1).

Table 1. Relationship between the FinTech Usage and Sustainable Development Indicators of Small Businesses in the Agricultural Sector

Company	FinTech Usage (X)	Sustainability Indicators (Y)	Product (XY)	FinTech Squared (X^2)	Sustainability Squared (Y^2)
1	X_1	Y_1	XY_1	X^2_1	Y^2_1
2	X_2	Y_2	XY_2	X^2_2	Y^2_2
3	X_3	Y_3	XY_3	X^2_3	Y^2_3
...	...	...	...	...	...
30	X_{30}	Y_{30}	XY_{30}	X^2_{30}	Y^2_{30}
Total	ΣX_n	ΣY_n	$\Sigma X_n Y_n$	ΣX_n^2	ΣY_n^2

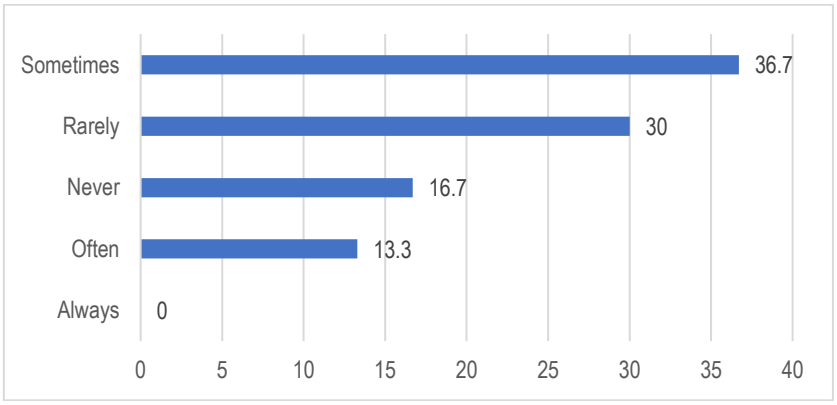
Source: developed by the author

The obtained results give grounds to draw conclusions about the relationship between the FinTech usage and sustainable development indicators of small businesses in the agricultural sector of the Poltava region.

3. Results

Agriculture is the basis of the agro-industrial complex of the Poltava region, which is distinguished by a high level of production of grain and industrial crops, as well as livestock products. The agro-industrial complex of the Poltava region is increasingly using FinTech, as this is determined by the need to adapt to the growing level of market digitalization and increase its competitiveness. Figure 1 graphically depicts the fintech use frequency by agricultural companies of the Poltava region.

Figure 1. FinTech Use Frequency by Agricultural Companies in the Poltava Region, %



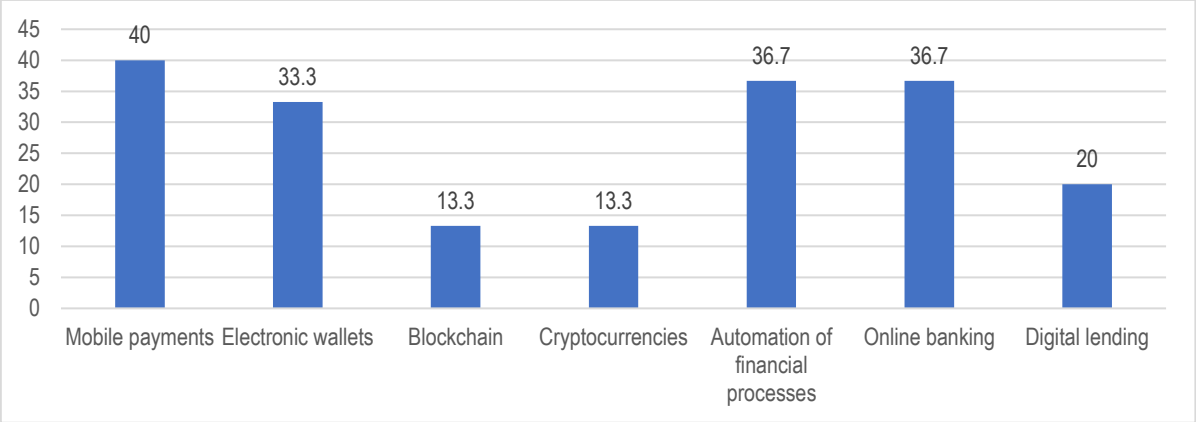
Source: developed on the basis of Appendix 1

The analysis of the FinTech use among agricultural companies in the Poltava region showed that a significant part of companies uses FinTech irregularly: the majority (66.7%), and only 13.3% of companies use FinTech in their activities often, and no company uses them on a permanent basis. This indicates that FinTech have not yet become an integral part of the activities of the agricultural sector in the region. However, the favourable conditions of the Poltava region for agricultural business and the growing demand for digital solutions indicate the potential for expanding the use of FinTech, which can contribute to more effective management and increased productivity of companies.

An analysis of the FinTech use among agricultural companies in the Poltava region revealed that the most common tools are mobile payments (40%), online banking (36.7%), and automation of financial processes (36.7%). Online banking, which some companies have chosen, also plays an important role, providing access to banking services without the need for a physical presence in the bank (Figure 2).

Digital lending used by 20% of companies has great potential for further development, as it can significantly facilitate access to financing for small and medium-sized agricultural companies, which often face difficulties in attracting traditional loans. Although blockchain and cryptocurrencies occupy a smaller share (13.3% each), their use still indicates a strive for more secure and decentralized financial transactions and may indicate attempts by some companies to ensure data security and explore the possibilities of new technologies.

Figure 2. Distribution of the Most Common FinTech Tools Used by Agricultural Companies in the Poltava Region, %



Source: developed on the basis of Appendix 1, Appendix 2

Therefore, it can be argued that agricultural enterprises in Poltava region are at the initial stage of implementing financial technologies, but their gradual use can positively affect the development of the industry.

Analysis of the impact of financial technologies on the efficiency of agricultural enterprises in Poltava region showed that 30% of enterprises noted a low impact of fintech on their business processes, which indicates their insufficient use. At the same time, 43.3% of enterprises indicated an average impact, which demonstrated partial integration of financial technologies, but without achieving optimal results. Only 26.7% of enterprises noted a high impact of fintech, emphasizing that, although the majority of agricultural enterprises recognize a certain level of positive impact of financial technologies on their efficiency, only a small part of them maximally realizes their potential in their activities.

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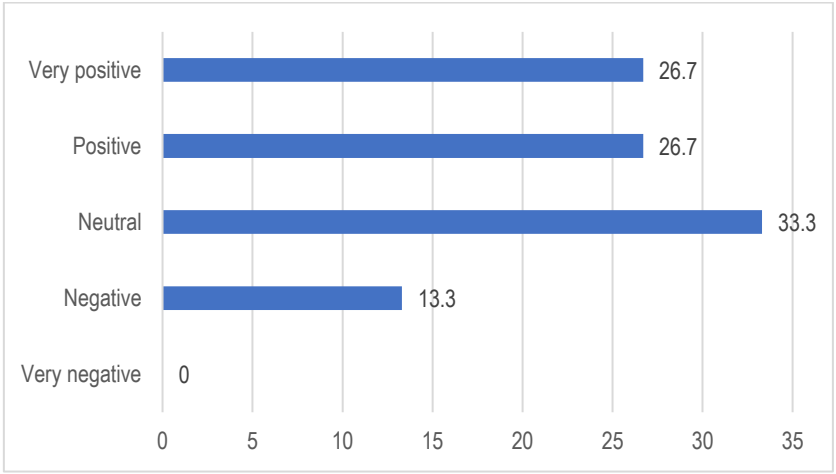
Agricultural companies in the Poltava region are implementing FinTech for various reasons, the most significant of which are market needs, high competition, and technological progress. A significant number of companies focused on market needs, which indicates the importance of adapting business processes to market requirements. Companies that implement FinTech in response to market needs have the opportunity to increase their competitiveness by reducing their costs. It should also be noted that support from management is a key factor in the implementation of FinTech, as the management initiatives stimulate the implementation of new technologies and provide resources for their implementation. Technological progress also plays an extremely important role in this process, as companies that are aware of the advantages of advanced technologies are ready to implement them to improve their activities.

The analysis of the impact of FinTech on the sustainable development of agricultural companies revealed a variety of assessments, which indicates a different level of awareness of these innovations in the industry. Most companies believe that FinTech either do not affect their sustainable development or have a positive effect. This indicates that agricultural producers are beginning to realize the potential of FinTech as a tool that can contribute to their sustainable development (Figure 3).

Figure 3. The Impact of Using FinTech on the Company's Sustainable Development



Source: developed on the basis of Appendix 1, Appendix 2

This statement is confirmed by a quantitative correlation approach, which was used to study the relationship between the FinTech usage rate and sustainable development indicators of small businesses (Table 2, Table 3).

Table 2. Results of the Analysis of the Relationship between the FinTech Usage Rate and Sustainable Development Indicators for Agribusinesses of the Poltava Region

Company	FinTech Usage (X)	Sustainability Indicators (Y)	Product (XY)	FinTech Squared (X^2)	Sustainability Squared (Y^2)
1	4	4	16	16	16
2	3	3	9	9	9
3	5	5	25	25	25
...	...	...	...	...	...
30	3	3	9	9	9
Total	104	103	385	388	383

Table 3. Results of ANOVA Correlation Analysis

Regression statistics					
Multiple R	0.983540977				
R-squared	0.967352854				
Normalized R-squared	0.966186884				
Standard error	0.18504226				
Number of observations	30				
ANOVA					
	Df	SS	MS	F	Significance of F
Regression	1	28.4079288	28.4079288	829.6553586	2.37158E-22
Residual	28	0.958737864	0.034240638		
Total	29	29.36666667			
	Coefficients	Standard error	t-statistics	P-value	
Y-intersection	-0.09223301	0.12697645	-0.726378865	0.473635536	
Coefficient for X 1	1.016990291	0.035307579	28.80373862	2.37158E-22	

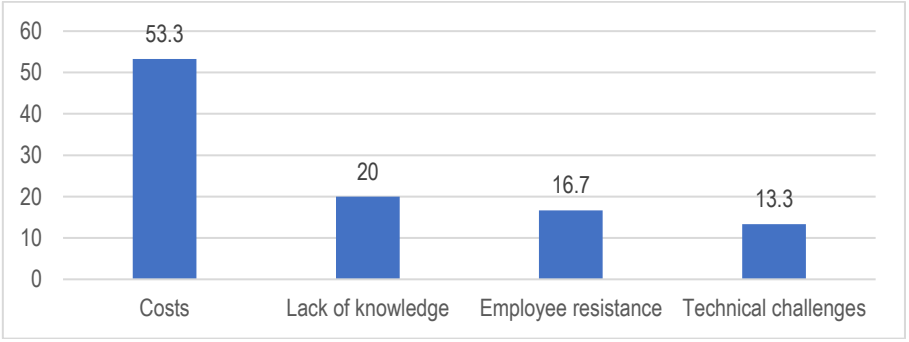
The results of the regression analysis confirm that financial technologies have a positive impact on the sustainable development of agricultural companies: the multiple correlation coefficient (0.9835) indicates a strong relationship between the use of FinTech and sustainability indicators. The R-squared value (96.74%) indicates that almost all the variation in sustainability indicators can be explained by changes in the FinTech implementation. The high F value (829.6554) and very low probability of chance confirm the significance of the model. The coefficient of 1.0170 indicates an increase in sustainability indicators with increasing use of FinTech, emphasizing the importance of these technologies for achieving SDGs in the agricultural sector.

Analysis of the results of a survey of agricultural companies in the Poltava region on the FinTech implementation revealed important aspects related to the level of knowledge, training, and existing problems. The average level of companies' knowledge about FinTech is estimated at 68.3%, which indicates moderate awareness. At the same time, 16.7% of respondents assessed their knowledge at the maximum level, and 33.3% of companies have a medium level of knowledge, which emphasizes the need for advanced training in this area.

The majority of businesses confirmed that they had received training in FinTech or were familiar with its basics. This positively affects their readiness to implement new technologies, as the average level of knowledge of those who had received training was 72%, which is higher than the 62.1% of those who had not received training. This emphasizes the importance of educational initiatives in creating awareness of the opportunities of FinTech.

The survey also identified a number of challenges that businesses face when implementing FinTech (Figure 4). A total of 53.3% of respondents indicated costs, noting that financial barriers are significant. Lack of knowledge was indicated by 20%, employee resistance - by 16.7%, and technical challenges - by 13.3%.

Figure 4. Distribution of Problems Faced by Companies when Implementing FinTech



Source: developed on the basis of Appendix 1, Appendix 2

The obtained results indicate the need for the development of training programmes, change management, and improvement of technical aspects for the successful FinTech implementation in the agricultural sector. Therefore, the problems identified during the survey of agricultural companies in the Poltava region directly affect their sustainable development. The costs mentioned by the respondents can significantly limit the financial resources needed for investment in modernization and implementation of new technologies. Under fierce competition, agricultural companies must ensure a high quality of their products, and financial barriers can prevent the implementation of these important investments.

The inability to adapt to new market conditions threatens to reduce the companies' competitiveness. This can lead not only to the loss of market positions, but also to general economic instability. In view of such challenges, it is important that agricultural companies have the opportunity to effectively invest in innovations and technologies, which will ensure their long-term survival and development.

Employee resistance and technical issues also seriously impact opportunities for sustainable development. Resistance to change, whether due to fear of new technologies or lack of motivation, can lead to a decrease in the effectiveness of implementing FinTech innovations. At the same time, technical issues, such as the need to update systems, can cause delays in implementing new solutions. As a result, companies may lose opportunities to optimize processes, increase productivity, and reduce costs, which directly affects their ability to develop sustainably in a competitive agricultural environment.

The prospects of FinTech for agricultural companies in the Poltava region open up new horizons that can significantly change the nature of agribusiness. The assessments give grounds to argue that companies are beginning to realize not only the economic, but also the social potential of FinTech. For example, thanks to the introduction of mobile payments and online banking, agricultural producers are able to establish closer contact with customers, directly interacting with them through new digital platforms.

4. Discussion

The results of this study showed that the use of financial technologies significantly contributes to the increase in the efficiency of small agricultural enterprises, supporting their sustainability and innovative development. This finding is consistent with the work of other authors Sari and Padmantyo (2024), who pointed out the positive impact of financial technologies on agricultural businesses in the Mojolaban region. They emphasized that FinTech extend access to finance, which contributes to increased productivity. The study by Zhao et. al. (2022) also confirmed the findings of our study. In their work, they noted that the use of digital finance has a positive impact on the adoption of sustainable agricultural practices among smallholder farmers in China. Their data reinforced the thesis of the importance of implementing financial innovations to increase the sustainability of agricultural businesses, which is also reflected in our study. However, the results of Maryam and Ahamad (2021), who studied the use of FinTech through Islamic financial institutions, indicated some limitations in access to financial services for farmers. This is not entirely consistent with the findings of our study, as this work focuses on the general availability of financial instruments for agricultural companies.

An interesting comparison can be made with the work of Buzaubayeva *et al.* (2023), who drew attention to the specific challenges of digital development in the agricultural sector of Kazakhstan. The authors identified insufficient infrastructure and the need for training as problems that hinder the further development of FinTech use by agricultural companies, which has something in common with the findings of our study.

In their study, More and Aslekar (2022) dealt with the role of ICT and FinTech in the Indian agricultural sector. Their findings demonstrated that the integration of digital tools in agriculture allows for a significant increase in the efficiency of resource management and financial flows. This coincides with the results of our study, as this work also found that FinTech play an important role in improving access to capital and reducing transaction costs.

The study by other authors Hinson *et al.* (2019) emphasized the transformative role of FinTech in supporting sustainable agribusiness development in developing countries. Their findings are reflected in our study — digital financial instruments contribute not only to economic development, but also to social and environmental benefits.

The works of Mapanje *et al.* (2023) and Benami and Carter (2021) indicate the need to expand access to financial services through innovative platforms. This coincides with the conclusion of our study on the potential of digital lending, which was found to be used by only 20% of surveyed companies.

Convenience and simplicity were also mentioned by Savitha *et al.* (2022), and Goh (2022), which correlates with the results of our study, where mobile payments and online banking are the most popular tools among agricultural enterprises in the Poltava region.

Conclusions

The financial sector plays a crucial role in enabling agriculture to contribute to economic growth and poverty reduction. The use of innovative financial instruments contributes not only to increasing the efficiency of resource management, but enhances financial inclusion, which is a key factor in strengthening the economic sustainability of the agricultural sector. FinTech solutions make it possible to overcome traditional barriers to access to finance, in particular by optimizing lending and risk sharing through the use of modern technologies, such as blockchain, digital lending, mobile platforms, etc. The introduction of financial innovations is becoming an integral element of adaptation strategies for agricultural companies in the context of growing challenges related to climate change and the need to adhere to the sustainable development principles.

The study showed that the FinTech implementation has a significant positive impact on the sustainable development of agricultural companies, increasing their efficiency and productivity. However, the active use of FinTech is constrained by the low level of awareness among companies, as well as financial and technical barriers that complicate the process of adaptation to new solutions. This emphasizes the need to overcome existing obstacles in order to fully realize the FinTech potential in the agricultural sector.

Credit Authorship Contribution Statement

The authors equally contributed to the present research, at all stages from the formulation of the problem to the final findings and solutions.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of Use of Generative AI and AI-assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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Appendix 1

Questionnaire on the implementation of financial technologies and sustainable development

1. The financial technologies (FinTech) usage rate. How do you rate the level of FinTech implementation in your company on a scale from 1 to 5, where 1 means "very low level" and 5 means "very high level"?(FinTech may include mobile payments, e-wallets, blockchain, cryptocurrencies, accounting automation, online banking, digital lending, and others).

2. FinTech use frequency. How often does your company use FinTech solutions??

(1) Never
(2) Rarely
(3) Sometimes
(4) Often
(5) Always

3. FinTech types. Which of the following FinTech does your company use? **(Select all that apply)**

Mobile payments
E-wallets
Blockchain
Cryptocurrencies
Accounting automation
Online banking
Digital lending
Other (specify): _____

4. The impact of FinTech on efficiency. What impact do you think FinTech has had on your company's performance?

(1) Negative
(2) Neutral
(3) Positive

5. Sustainable development. How do you assess the impact of implementing FinTech on the sustainability of your company?

(1) Very negative
(2) Negative
(3) Neutral
(4) Positive
(5) Very positive

6. Knowledge about FinTech. What is your assessment of the level of knowledge about FinTech in your team?

(1) Very low level
(2) Low level
(3) Medium level
(4) High level
(5) Very high level

7. Training and development. Have your company's employees been trained in the use of FinTech?

Yes
No

8. FinTech implementation factors. What factors influenced the FinTech implementation in your company? **(Select all that apply)**

Market needs
Competition
Technological progress
Management support
Other (specify)_____

9. FinTech implementation challenges. What challenges have you faced while implementing financial technologies? **(Select all that apply)**

Lack of knowledge
Costs
Employee resistance
Technical problems
Other (specify): _____

10. FinTech. How do you assess the future use of financial technologies in your company?

(1) Very pessimistic
(2) Pessimistic
(3) Neutral
(4) Optimistic
(5) Very optimistic

Appendix 2

Company	FinTech usage rate (1-5)	FinTech use frequency (1-5)	FinTech types (mobile payments, e-wallets, blockchain, cryptocurrencies, automation, online banking, digital lending)	Impact of FinTech on efficiency (1-3)	Impact of FinTech on sustainable development (1-5)	Level of knowledge about FinTech (1-5)	Learning on FinTech (Yes/No)	FinTech implementation factors	FinTech implementation challenges	FinTech prospects (1-5)	Additional comments
Company1	4	4	Mobile Payments, Online Banking	2	4	3	Yes	Market needs, competition	Costs	4	More training recommended
Company2	3	3	E-Wallets, Automation	3	3	4	Yes	Technological progress	Lack of knowledge	3	Technical support needed
Company3	5	5	Blockchain, Cryptocurrencies, Mobile Payments	1	5	5	No	Management support	Employee resistance	5	High future potential
Company4	2	2	Digital Lending, Online Banking	3	2	2	Yes	Competition	Technical problems	2	Infrastructure improvements needed
Company5	4	4	E-Wallets, Mobile Payments	2	4	4	Yes	Market needs	Costs	4	Investment needed
Company6	3	2	Automation, Online Banking	3	3	3	No	Technological progress	Lack of knowledge	3	Development strategy needed
Company7	4	4	Mobile Payments, Blockchain	1	5	5	Yes	Management support	Costs	5	High competition
Company8	3	3	Digital Lending, Automation	2	3	4	Yes	Market needs	Employee resistance	4	More time needed
Company9	5	5	Cryptocurrencies, Mobile Payments	1	5	5	Yes	Competition	Technical problems	5	High implementation costs
Company10	3	3	E-Wallets, Online Banking	2	3	3	No	Technological progress	Costs	3	Service improvements needed
Company11	2	2	Automation	3	2	2	Yes	Market needs	Employee resistance	2	Financial support needed
Company12	4	4	Blockchain, Digital Lending	2	4	4	Yes	Management support	Technical problems	4	More research needed
Company13	3	3	Mobile Payments, Cryptocurrencies	3	3	3	No	Competition	Costs	3	Government support needed
Company14	5	5	Electronic wallets, Automation	1	5	5	Yes	Technological progress	Employee resistance	5	Great potential
Company15	3	3	Online banking, Digital lending	2	3	3	No	Market needs	Costs	3	Training improvements needed
Company16	4	4	Blockchain, Mobile payments	2	4	4	Yes	Competition	Technical problems	4	Cost reduction needed
Company17	2	2	Automation	3	2	2	Yes	Management support	Employee resistance	2	More resources needed
Company18	4	4	Cryptocurrencies, Online Banking	1	5	5	Yes	Market needs	Costs	5	High demand for services
Company19	3	3	Mobile Payments, E-Wallets	2	3	3	No	Competition	Technical problems	3	Expanding capabilities needed
Company20	5	5	Automation, Blockchain	1	5	5	Yes	Technological progress	Costs	5	Developing new solutions needed
Company21	3	3	Digital Lending,	3	3	3	No	Management	Costs	3	Costs

Company	FinTech usage rate (1-5)	FinTech use frequency (1-5)	FinTech types (mobile payments, e-wallets, blockchain, cryptocurrencies, automation, online banking, digital lending)	Impact of FinTech on efficiency (1-3)	Impact of FinTech on sustainable development (1-5)	Level of knowledge about FinTech (1-5)	Learning on FinTech (Yes/No)	FinTech implementation factors	FinTech implementation challenges	FinTech prospects (1-5)	Additional comments
			Mobile Payments					support			optimization needed
Company22	2	2	E-Wallets	3	2	2	Yes	Market needs	Employee resistance	2	Investment attraction needed
Company23	4	4	Cryptocurrencies, Blockchain	1	5	5	Yes	Competition	Technical problems	5	High competition
Company24	3	3	Automation, Online Banking	2	3	3	No	Technological progress	Costs	3	Accessibility improvements needed
Company25	4	4	E-Wallets, Mobile Payments	2	4	4	Yes	Market needs	Employee resistance	4	High potential
Company26	2	2	Digital Lending	3	2	2	Yes	Management support	Costs	2	More investment needed
Company27	5	5	Blockchain, Online Banking	1	5	5	Yes	Technological progress	Technical problems	5	More research recommended
Company28	3	3	Mobile Payments, Automation	3	3	3	No	Competition	Costs	3	Technical capabilities need to be improved
Company29	4	4	Cryptocurrencies, Electronic Wallets	2	4	4	Yes	Market needs	Costs	4	The system needs to be improved
Company30	3	3	Online Banking, Automation	3	3	3	No	Technological progress	Costs	3	New technologies need to be adapted

So, the formula for the Pearson correlation coefficient is presented below:

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$

where:

- rrr — Pearson correlation coefficient,
- nnn — number of pairs of observations,
- xxx — value of the first variable (*e.g.*, FinTech usage),
- yyy — value of the second variable (*e.g.*, sustainability indicators),
- Σxy\Sigma xyΣxy — sum of products of pairs of observations,
- Σx\Sigma xΣx — sum of values of the first variable,
- Σy\Sigma yΣy — sum of values of the second variable,
- Σx2\Sigma x^2Σx2 — sum of squares of values of the first variable,
- Σy2\Sigma y^2Σy2 — sum of squares of values of the second variable.

This formula determines the degree of linear relationship between two variables. The value of rrr ranges from -1 to +1, where:

- r=1r = 1r=1 indicates a perfect positive correlation,
- r=−1r = -1r=−1 indicates a perfect negative correlation,
- r=0r = 0r=0 indicates no correlation.

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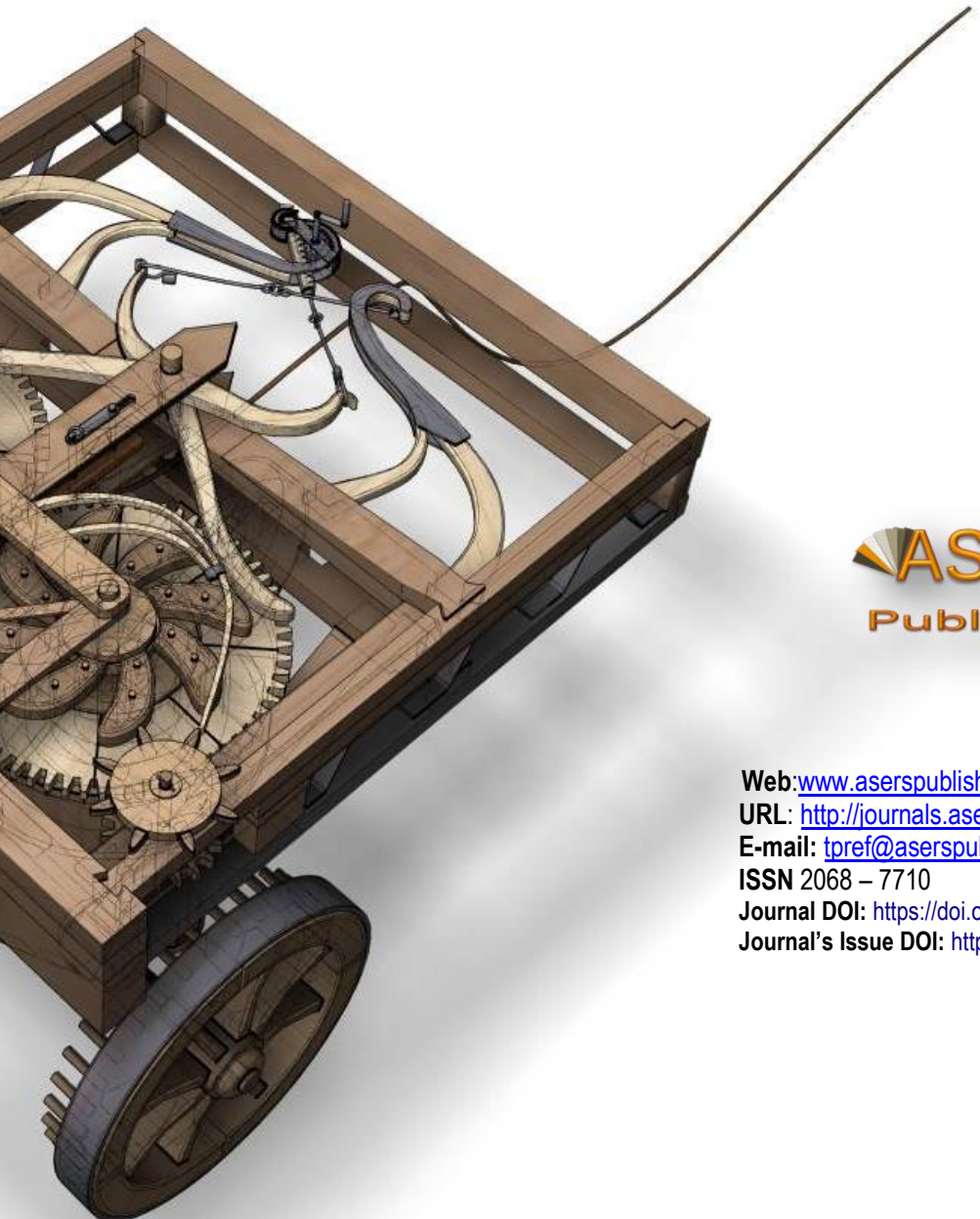

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