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Development of the agricultural business insurance system in Ukraine

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► **Abstract.** The research interest was driven by the limited level of insurance coverage in the agricultural sector, which reduced the ability of producers to withstand economic losses and climate impacts. The purpose of the study was to identify the features of the functioning of the agricultural insurance system in Ukraine and to justify the relevance of adapting institutional and technological practices of the European Union countries for its modernisation. The methodological framework of the study included the application of the dynamic analysis method to evaluate changes in the key indicators of the Ukrainian insurance market during 2022-2024; the comparative analysis method to contrast organisational models of agricultural insurance in France, Germany, Spain, and Poland; the structural analysis method to identify dominant elements within the insurance coverage system; the content analysis method for a systematic review of regulations, analytical reports, and technological solutions aimed at improving the efficiency of insurance protection. Also, it was used logical generalisation method for developing conclusions and recommendations based on the obtained analytical results. The findings indicated that the share of insured agricultural land in Ukraine remained significantly lower than in the aforementioned EU countries, where the coverage level reached 30-50%. It was established that the existing system did not ensure an adequate distribution of risks, creating conditions for the financial vulnerability of small and medium-sized farming enterprises. The study identified key

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barriers to the development of the national agricultural insurance system: the absence of subsidisation of insurance premiums, high costs of insurance services, and low awareness levels among agricultural producers. The effectiveness of European models was found to rely on the use of state support, reinsurance mechanisms through international structures, and the implementation of digital technologies for risk assessment. The adaptation of these instruments to the conditions of Ukraine was considered necessary for expanding access to insurance services and strengthening the financial stability of the agricultural sector. The results obtained may serve as a foundation for the development of effective public policy measures in agricultural insurance provision

▸ **Keywords:** state subsidisation; economic resilience; digital technologies; market transformation; structural analysis; European models

▸ Introduction

The relevance of the study was driven by the necessity to strengthen the financial resilience of the agricultural sector under the influence of natural-climatic, economic, and technogenic risks, which hinder the stability of agricultural production without the application of insurance protection instruments. In Ukraine, agricultural insurance remained underdeveloped due to the high cost of insurance products, the absence of effective mechanisms of state support, low awareness among agricultural producers, and limited reinsurance infrastructure. Given the effectiveness of index-based insurance models, premium subsidisation systems, and public-private partnership frameworks in the countries of the European Union, there was a need for scientific justification of the possibilities for adapting these institutional and technological solutions to the Ukrainian context.

The review of academic literature demonstrates that the development of agricultural insurance in Ukraine and its systemic impact on the transformation of the agricultural sector remain insufficiently explored. In particular, the study by N. Sirenko *et al.* (2024) focused on changes in the export structure of organic products under the influence of wartime factors, while insurance aspects were not addressed. Similarly, O. Nechyporenko *et al.* (2022) concentrated on infrastructural challenges and asset losses in the agricultural sector, yet issues of insurance provision were not included in the analysis. Digitalisation of the insurance market was covered in the study by C. Eckert & K. Osterrieder (2020) and A.A. Mustafina *et al.* (2020), where blockchain tools, artificial intelligence, and automated services were analysed. However, the specificity of agricultural insurance, methods for assessing sectoral risks, and accessibility of insurance services for agricultural producers did not receive sufficient attention. D. Lanfranchi & L. Grassi (2021) explored general trends in the development of the insurance sector without distinguishing the agricultural context. In the study by N. Sirenko *et al.* (2021), the regulation of digital currencies was addressed, yet digital mechanisms in agricultural insurance remain under-researched despite their potential role in enhancing risk management in agriculture.

The study by Z. Juhászová *et al.* (2023) analysed the relationship between the development of insurance in the agricultural sector and improvements in food security levels, establishing that the effective functioning of insurance mechanisms contributed to better agricultural performance. Nevertheless, the study lacked a detailed analysis of integrating the proposed model into the Ukrainian regulatory environment. In the paper by I. Sazonets *et al.* (2021), the focus was placed on the financial capacity of agricultural producers and the importance of developing reinsurance mechanisms, but the role of state involvement in ensuring the accessibility of insurance services remained unexplored. Transnational interaction in agricultural insurance was addressed in the study by O. Vilenchuk *et al.* (2022), where the potential of international insurance cooperation in agribusiness was outlined against the backdrop of contemporary challenges. The study emphasised the importance of access to global reinsurance instruments and collaboration with international financial institutions. However, the mechanisms for adapting this experience to the regulatory environment of the Ukrainian market and the role of the state in compensating insurance costs remained outside the scope of analytical consideration.

Aspects of institutional development of the agricultural sector under contemporary transformations were examined in the study by O. Pavelko *et al.* (2024). The authors analysed trends in changes to the production structure, financial support, and export orientation of the agricultural complex. Despite the comprehensive approach to assessing sectoral prospects, insurance as a tool for mitigating production risks was not explored in detail, creating a gap between financial mechanisms and risk-oriented management. The study by L. Voytovych & D. Voytovych (2024) focused on the digital foundations of modernising the insurance sector. The study addressed the creation of an innovative environment, automation of insurance processes, and the implementation of information and communication technologies. However, the application of digital solutions within agricultural insurance was not analysed, which limits the possibility of extrapolating the findings to a sector-specific context. Financial and marketing shifts in the functioning of the insurance market during wartime conditions were examined by Yu. Aleskerova *et al.* (2024). The study presented company adaptation strategies, evolving consumer demands, and behavioural patterns. Nevertheless, the agricultural dimension remained beyond the analytical framework despite its heightened vulnerability to crisis factors and its strategic value for the national economy.

The analysis of academic sources demonstrated the lack of comprehensive research in the field of agricultural insurance. Authors tend to focus on individual components such as digitalisation of the insurance market, marketing strategies, institutional changes, or the broader economic context. Nevertheless, comprehensive approaches to analysing insurance protection instruments, mechanisms of

state regulation, and opportunities for adapting the experience of the European Union to the specific conditions of the Ukrainian agricultural sector remain insufficiently developed. The purpose of the study was to substantiate the areas for improving the system of agricultural insurance in Ukraine based on the analysis of organisational models implemented in France, Germany, Spain, and Poland.

▸ Materials and methods

The conducted study adopted a theoretical and analytical focus, concentrating on the examination of the evolution of the agricultural insurance system, the identification of key dynamic characteristics, and the assessment of possibilities for improving relevant mechanisms. The analysis covered the period 2022-2024, which enabled the tracking of changes in the structure and scale of agricultural insurance in Ukraine and facilitated a comparative assessment with the practices of the European Union countries, including France, Germany, Spain, and Poland. Particular attention was devoted to identifying the factors influencing the functioning of the market, assessing the effectiveness of existing state regulation instruments, and examining prospects for the implementation of international experience. The analytical framework was based on the systematisation of official insurers' reports, materials of regulatory bodies, and publications of international institutions engaged in analytical monitoring of insurance markets. The primary sources consisted of data from the National Bank of Ukraine (n.d.), which reflected indicators of agricultural insurance coverage, volumes of insurance premiums, and payouts. Supplementary statistical data were obtained from the Forinsurer portal (n.d.), which provides detailed analytical reviews of the development of the agricultural insurance segment and the activities of leading companies operating in this field.

A separate group of sources comprised financial statements of insurance organisations providing agricultural insurance services in Ukraine and demonstrating the highest levels of activity in the market during 2022-2024. Annual reports of companies such as PZU (n.d.), ARX (n.d.), Oranta (n.d.), Etalon (n.d.), TAS (n.d.), UPSK (n.d.), and Universalna (n.d.) were analysed. The selection of these companies was based on their representativeness in the agricultural insurance segment, the volume of concluded contracts, the stability of insurance payouts, and the availability of open financial reporting. These reports contain data on the dynamics of contract conclusion, the structure of insurance products, levels of financial stability, and changes in demand for insurance services from the agricultural sector, allowing an evaluation of the competitive environment and the identification of transformational trends in the market. The analysis of the Polish practice was conducted using data from the Polish Reinsurance Company (n.d.), providing a more detailed characterisation of the mechanisms of agricultural insurance in markets similar to Ukraine in terms of agricultural structure, the development of small and medium-sized farming, and the regulatory framework. The Polish case was examined as a potential model for adaptive application, given its institutional similarity and the active implementation of a subsidised insurance system. The analysis of reinsurance mechanisms was based on the examination of the activities of international companies Munich Re (n.d.), Swiss Re (n.d.), and Hannover Re (n.d.), which protected local markets against catastrophic risks through the conclusion of reinsurance agreements. The experience of these institutions was considered as a potential reference point for developing a national reinsurance system capable of ensuring the financial stability of the agricultural insurance segment of Ukraine under conditions of high risk in agricultural production. The application of statistical methods for the analysis of time series, including the calculation of growth rates, absolute and relative deviations, mean values, and graphical interpretation of indicators, enabled the assessment of structural and quantitative changes in the agricultural insurance market of Ukraine during 2022-2024. Average values of premiums, the share of insured areas, and the level of payouts were determined, which facilitated the identification of structural trends, the evaluation of insurance coverage levels, and the examination of the impact of the economic and regulatory environment on the respective segment.

Content analysis was applied to examine the regulatory framework governing agricultural insurance in Ukraine, particularly the Law of Ukraine No. 4391-VI (2012) and the Law of Ukraine No. 1909-IX (2021). The interpretation of the findings was based on logical generalisation, which ensured the systematisation of the collected data and the identification of the key factors shaping the conditions for market functioning. Based on these generalisations, the advantages and limitations of existing insurance protection mechanisms were outlined, and their effectiveness in mitigating risks for agricultural producers was assessed. Structural analysis enabled the identification of interrelations between the level of state regulation, the financial stability of insurers, and the accessibility of insurance products for agricultural businesses. These findings form the foundation for developing practical recommendations aimed at improving the functioning of the agricultural insurance market, particularly through the expansion of subsidised insurance programmes and the implementation of digital tools for risk monitoring.

▸ Results

The insurance system in the agricultural sector was examined as a key risk management instrument supporting the economic activities of agricultural enterprises. The agricultural sector of Ukraine during 2022-2024 remained highly vulnerable to natural and climatic fluctuations, including droughts in the southern regions, excessive moisture in the western areas, and the consequences of the full-scale war, which resulted in the loss of arable land and disruptions to logistics. The utilisation of insurance instruments helped reduce direct losses associated with crop failure or destruction. According to the Ministry of Agrarian Policy and Food of Ukraine, the total losses of the agricultural sector in 2022 exceeded USD 9.3 billion. Of which approximately 25% could have been potentially covered under conditions of full-scale implementation of insurance mechanisms (UN estimates losses in…, 2025). Within the framework of the state-supported agricultural insurance programme launched in a pilot format in 2023, a share of agricultural producers received compensation of up to 60% of insurance premiums for insuring winter cereal crops.

From an economic perspective, agricultural insurance involves the establishment of centralised financial reserves, formed through insurance premiums and utilised to compensate losses in the event of risk materialisation. In 2023, the volume of collected insurance premiums in the agricultural insurance segment amounted to approximately UAH 480 million, while total payouts exceeded UAH 270 million, indicating an increase in the share of insured areas compared with 2022 (UN estimates losses in…, 2025). The financial model of insurers' operations was based on the accumulation of premiums and the distribution of payouts in accordance with contractual terms. The effectiveness of insurance mechanisms depended on the accuracy of risk assessment, the quality of actuarial calculations, and the solvency of insurance companies. According to PZU (n.d.), the average compensation rate under crop insurance contracts in 2023 reached 62 per cent, reflecting a dependence of outcomes on weather conditions during April-June. The introduction of insurance coverage contributed to enhancing the economic security of agricultural enterprises by reducing the risk of production disruptions, delays in loan repayments, and the destabilisation of cash flows.

Various types of insurance products were employed in agricultural insurance to mitigate risks specific to agricultural production. Crop insurance covered losses caused by natural hazards such as drought, hail, or frost. Protection of perennial plantations applied to long-term crops vulnerable to climate-related damage. Income insurance provided compensation to producers in cases of reduced profitability due to unfavourable market conditions or operational challenges. Reinsurance functioned as an intra-industry risk redistribution mechanism, alleviating the burden on individual companies and strengthening the overall resilience of the insurance sector. Index-based insurance was regarded as an alternative model of risk protection, involving the use of standardised indicators such as precipitation levels, air temperature, or satellite-based vegetation indices (Koval, 2023). This approach removed the need for individual damage inspections, thereby optimising the decision-making process regarding payouts. The adoption of this model contributed to greater transparency, reduced administrative burdens, and accelerated the fulfilment of insurance obligations. Under conditions of increasing climate variability, index-based insurance gained growing importance in global practices of protecting the agricultural sector.

The effectiveness of the agricultural insurance system was determined by the level of coordination between state authorities and private insurance institutions. In France, Spain, Italy, and Poland, public-private partnership models were implemented, combining partial state financing of insurance premiums with stabilisation funds and supervision of insurers' financial stability (Bucheli *et al.*, 2022). The application of such approaches facilitated broader access to insurance services and reduced the agricultural sector's vulnerability to exogenous risks. In these countries, multi-level insurance systems were established, integrating classical products with innovative approaches to risk assessment and management. Subsidised models enabled producers to access insurance coverage on more favourable terms, while digital tools – including satellite monitoring, weather indices, and automated algorithms – enhanced the accuracy of actuarial calculations and shortened claims processing times. Evidence demonstrated the positive impact of these elements on the stability of financial flows within agriculture.

The development of agricultural insurance in Ukraine required the adaptation of institutional and technological solutions tested in France, Germany, Spain, and Poland, while considering the specific characteristics of the national regulatory environment, financial infrastructure, and level of digital readiness. Priority areas included harmonising legislation, engaging global-level reinsurance companies, and establishing effective mechanisms for budgetary subsidies of insurance premiums. The analysis of the activities of PZU (n.d.), ARX (n.d.), Oranta (n.d.), Etalon (n.d.), TAS (n.d.), UPSK (n.d.), and Universalna (n.d.) provided insights into the effectiveness of applied risk management tools, the diversification of insurance products, and the potential for developing innovative forms of insurance coverage. The assessment of the dynamics of key agricultural insurance indicators in Ukraine for 2022-2024 enabled the identification of the main areas of transformation within this segment of the insurance market under conditions of economic turbulence and increasing external risks (Table 1).

Table 1. Key indicators of agricultural insurance in Ukraine, 2022-2024

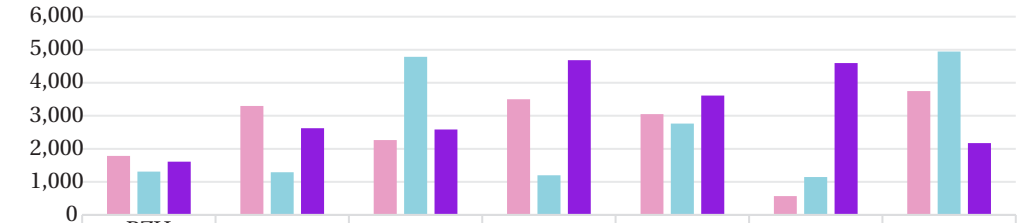
Indicator	2022	2023	2024
Number of insurance companies providing agricultural insurance services	10	8	7
Total insurance premiums, thousand UAH	81.061	75.000	70.000
Total insurance payouts, thousand UAH	29.830	25.000	20.000
Payout ratio, %	36.8	33.33	28.57

Source: based on S. Vlasiuk *et al.* (2023), O. Vilenchuk & A. Savytska (2024), Forinsurer (n.d.)

Between 2022 and 2024, a reduction was observed in the number of insurance companies operating in the field of agricultural insurance, from 10 active participants in 2022 to 7 in 2024. This trend may indicate ongoing market consolidation and the withdrawal of certain companies due to an unfavourable economic environment, heightened operational risks in agriculture, and declining profitability of related services. The volume of collected insurance premiums demonstrated a gradual decrease, falling from UAH 81,061 thousand in 2022 to UAH 70,000 thousand in 2024. This pattern may reflect lower demand for insurance products among agricultural producers or tighter restrictions on insurance terms, which reduced their attractiveness. The decline in total insurance payouts during the same period, from UAH 29,830 thousand to UAH 20,000 thousand, was accompanied by a decrease in the payout ratio from 36.8% to 28.57%. Such dynamics may indicate both a reduction in the number of insured

events and a transformation in insurers' compensation policies. These findings point towards a trend of market contraction, restricted accessibility of insurance products for agricultural enterprises, and a decline in the overall level of insurance coverage. This situation resulted from a combination of economic factors and characteristics of the regulatory environment, which defined the operating conditions of market participants. A critical aspect involved assessing the degree of competition among insurers, their financial stability, and the effectiveness of reinsurance mechanisms as a tool for risk diversification.

During 2022-2024, activity in the agricultural insurance market remained concentrated among companies such as PZU (n.d.), ARX (n.d.), Oranta (n.d.), Etalon (n.d.), TAS (n.d.), UPSK (n.d.), and Universalna (n.d.), which were included in the study sample. The majority of insurance operations were performed by large companies, particularly PZU (n.d.), ARX (n.d.), Oranta (n.d.), Etalon (n.d.), TAS (n.d.), and UPSK (n.d.), which possessed sufficient reserves, stable financial reporting, access to international reinsurance structures, and effective distribution channels for insurance products. Reduced activity or complete withdrawal of certain companies from the agricultural insurance segment was associated with limited financial resources, insufficient capitalisation, and difficulties in managing risks under conditions of heightened agricultural losses. The development of the agricultural insurance market in Ukraine is shaped by a combination of economic, regulatory, and climatic factors. Variability in weather conditions, market instability, and changes in state financing of the agricultural sector underscore the relevance of insurance as a tool for risk mitigation. However, limited competition among insurers, the high cost of insurance products, and insufficient levels of subsidies create barriers to accessing insurance coverage, particularly for small and medium-sized producers. The analysis of the number of agricultural insurance contracts concluded by key insurance companies between 2022 and 2024 provided insights into shifts in demand structure, the activity levels of individual market players, and prevailing trends within the segment. The resulting dynamics reflect the response of the market to evolving economic conditions and regulatory pressures, enabling the formulation of evidence-based conclusions regarding the prospects for further development of agricultural insurance in Ukraine (Fig. 1).



	PZU Ukraine	ARX	Oranta	Etalon	Universalna	UPSK	TAS
2022	1,785	3,298	2,267	3,501	3,051	569	3,748
2023	1,309	1,292	4,787	1,201	2,766	1,146	4,945
2024	1,611	2,623	2,586	4,684	3,612	4,595	2,175

Figure 1. Number of agricultural insurance contracts concluded (2022-2024)
Source: based on PZU (n.d.), ARX (n.d.), Oranta (n.d.), Etalon (n.d.), TAS (n.d.), UPSK (n.d.), Universalna (n.d.)

The indicators of the number of agricultural insurance contracts concluded in 2022-2024 indicate variation across individual insurance companies, which was likely driven by a combination of internal managerial factors and the influence of the external economic environment. In 2023, for instance, Oranta recorded an increase in the number of concluded contracts to 4,787, nearly double the figure of the previous year (2,267), while in 2024 this indicator declined to 2,586. A similar trend was observed in TAS, where 4,945 contracts were signed in 2023, yet only 2,175 in 2024. These fluctuations may have been linked to changes in insurance programme conditions, the level of financial accessibility of products, regulatory policy adjustments, or the degree of state support. Different companies exhibited distinct dynamics in maintaining their client bases. For example, PZU (n.d.) demonstrated relative stability throughout the analysed period, with 1,785 contracts concluded in 2022, 1,309 in 2023, and 1,611 in 2024. This reflected the consistency of its operational strategy and the existence of an established clientele. In contrast, UPSK showed a significant rise in 2024, reaching 4,595 contracts compared with 569 in 2022 and 1,146 in 2023. This trajectory may indicate a strengthening of the company's market presence, the introduction of more competitive insurance terms, or growing demand for its products among agricultural producers.

The consolidated analysis of contract dynamics confirmed the overall instability of the agricultural insurance market. Likely contributing factors include intersectoral competition and broader macroeconomic influences, such as limited access to state support, shifts in reinsurance policies, fluctuations in market conditions, and the high level of climate-related risks. The absence of a systemic mechanism for public financing of agricultural insurance remained one of the key obstacles to the stable development of this segment. Unlike the situation in Ukraine, the countries of the European Union possess a far more advanced institutional framework for managing agricultural risk insurance, which integrates public subsidies, diversifies insurance products, and adopts modern risk assessment technologies. State involvement in market operations enabled a reduction in the financial burden on agricultural producers, expansion of insurance coverage, and mitigation of the likelihood of market destabilisation.

Within the European Union, a range of compensatory instruments are actively employed, including partial premium subsidisation, the operation of insurance stabilisation funds, and state reinsurance programmes that enhance insurers' resilience to large-scale losses.

The comparative analysis of agricultural insurance models in the European Union enabled the identification of the principal characteristics of state support mechanisms, particularly in terms of compensation procedures, regulation of insurance conditions, and the integration of digital technologies into risk assessment processes. The examination of these mechanisms provides insights into the factors underpinning their effectiveness within highly developed systems of insurance protection and establishes a foundation for assessing the prospects of their adaptive implementation within the Ukrainian context (Table 2).

Table 2. Models of state support for agricultural insurance in selected European countries

Country	Insurance model	Mechanism of state support
France	Combined insurance with partial coverage of premiums	The state subsidises a portion of insurance premiums, reducing the financial burden on producers
Germany	Combined insurance with an emphasis on private insurers	State support is provided through subsidies on insurance premiums and tax incentives for farmers
Spain	Combined system involving both the state and private insurers	The state co-finances insurance premiums and provides reinsurance through state-managed funds
Poland	Insurance programmes backed by financial guarantees	The state provides financial guarantees to compensate for losses in the event of catastrophic events

Source: based on A.I.D. Rus & I. Brici (2021), A. Bilochenko & I. Gushcha (2022)

In France, Germany, and Spain, combined models of agricultural insurance operate, based on the interaction between state institutions and the private insurance sector. This approach reduced the financial burden on agricultural producers, increasing the accessibility of insurance services and stimulating their wider adoption among farming enterprises. The use of mechanisms for subsidising insurance premiums and granting tax incentives contributes to expanding insurance coverage, which in turn strengthens the overall stability of agricultural production. In Spain, state involvement extended beyond subsidising premiums and includes reinsurance functions implemented through specialised public funds. This provided additional guarantees for insurance companies and agricultural producers in cases of significant losses, particularly those resulting from natural disasters. In Poland, agricultural insurance programmes were based on mechanisms of state financial guarantees. These programmes envisage partial compensation of losses in the event of catastrophic risks, including droughts, floods and other extreme events, thereby ensuring stability in the agricultural sector even under unfavourable climatic conditions. The diversity of approaches to state support for agricultural insurance in the European Union arises from the need to adapt to national agroclimatic and economic conditions. The implementation of combined models, premium subsidies, and systems of financial guarantees enhanced the resilience of the agricultural sector and ensures its long-term competitiveness.

The integration of digital technologies into agricultural insurance had become one of the key approaches for improving the efficiency of risk assessment systems. The automation of premium calculations, application processing, and crop monitoring through satellite imagery, meteorological models, and remote sensing systems improve both the speed and objectivity of decision-making. Within the European Union, such technologies were integrated directly into insurance products, reducing transaction costs and improving the quality of insurance services. International reinsurance companies played a significant role in maintaining the financial stability of agricultural insurance systems, particularly under conditions of high catastrophic loss probability. The study examined the activities of three leading reinsurance structures – Munich Re (n.d.), Swiss Re (n.d.) and Hannover Re (n.d.) – whose experience was considered relevant for adaptation to the national agricultural insurance market. Their involvement in supporting local insurers in Poland, France, Germany, and Spain facilitated risk diversification, reduced the financial burden on primary insurers, and expanded the range of available insurance products for agricultural producers (Kramer *et al.*, 2022).

In France and Spain, Munich Re (n.d.) provided reinsurance coverage for agricultural risks based on weather indices, employing fixed triggers that enabled insurance payouts without the need for individual loss assessments. The application of parametric insurance was integrated into state reinsurance mechanisms and used for the prompt compensation of losses caused by natural hazards. The use of standardised indicators was found to contribute to reducing the duration of the decision-making process regarding payouts and to enhancing the transparency of insurance operations in the agricultural sector. In Poland, France, and Spain, Swiss Re (n.d.) implemented reinsurance programmes in the form of public-private partnerships, encompassing subsidised models of agricultural insurance. The application of digital tools for modelling agricultural risks was recorded, including satellite monitoring, predictive algorithms, and automated loss assessment. The company's activities contributed to the stabilisation of reinsurance reserves, which maintained the solvency of primary insurers in the event of large-scale occurrences.

In Poland and Germany, Hannover Re (n.d.) introduced weather index-based reinsurance models using meteorological data, satellite observations, and geospatial indicators. The analysis demonstrated that the company's reinsurance programmes were adapted to regional variations in climatic conditions, enabling differentiation of coverage structures according to the profile of agricultural risk. This structure facilitated the effective redistribution of risk among insurers and reduced the likelihood

of excessive concentration of liabilities in the agricultural sector. Implementation of European models of agricultural insurance within the Ukrainian context required the adaptation of effective practices in accordance with institutional characteristics. Priority areas include the integration of innovative approaches to agricultural risk assessment, expansion of budgetary subsidies for insurance premiums, and the establishment of stabilisation insurance funds to cover unforeseen losses.

The development of a national system of agricultural insurance necessitates a comprehensive approach combining financial, regulatory, and organisational components. A key task involved conducting a systematic assessment of the effectiveness of existing insurance mechanisms to identify vulnerable areas and develop measures for their optimisation. Collection and analysis of statistical data on payouts, coverage of agricultural land, and the structure of insurance premiums provide the foundation for an objective evaluation of the market. Comparative analysis of statistical data on agricultural insurance in Ukraine and the European Union enabled identification of the level of engagement of agricultural producers with the insurance system, tracking of coverage trends over recent years, and assessment of the effectiveness of state support programmes (Table 3). Such indicators were crucial for determining the financial stability of insurance companies, the level of trust among farming enterprises, and the effectiveness of regulatory interventions by state institutions.

Table 3. Comparative analysis of agricultural insurance indicators in Ukraine and selected EU countries

Indicator	Ukraine (2024)	Poland (2024)	Germany (2024)	France (2024)	Spain (2024)
Share of insured agricultural land, %	4	25	30	35	50
Volume of insurance premiums, UAH billion	70	95.4	120.3	160.2	175.6
Volume of insurance payouts, UAH billion	20	60.5	85.2	115.4	130.8
Share of insurance premiums in GDP, %	0.7	2.3	2.5	2.8	3.1
Subsidisation of insurance premiums, %	0	60	50	65	75

Note: GDP – Gross Domestic Product
Source: based on National Bank of Ukraine (n.d.), Polish Reinsurance Company (n.d.)

In 2024, the proportion of insured agricultural land in Ukraine remained minimal, accounting for less than 4% of the total area, substantially lagging behind the levels observed in European Union countries. In Germany and France, coverage exceeded 30%, while in Spain it reached up to 50%, indicating active utilisation of insurance instruments by agricultural producers. Such levels were largely supported by state programmes, which compensated a significant portion of insurance costs, reducing the financial burden on producers. The absence of mechanisms for state subsidies of insurance premiums in Ukraine hinders access to insurance protection, as farmers are required to cover the full cost of insurance themselves. In contrast, the degree of subsidy in European Union countries varies according to national policy: in Germany it reached 50%, in France 65%, and in Spain 75%. This level of support creates additional incentives for farmers to adopt insurance-based risk management mechanisms.

The ratio of insurance premiums to gross domestic product in Ukraine amounted to 0.7%, several times lower than the corresponding figures in European Union countries. In Poland, the ratio reached 2.3%, in Germany 2.5%, and in France 2.8%. Higher values reflect greater integration of insurance into the financial infrastructure of the agricultural sector and a higher level of trust in insurance instruments among farming enterprises. The results of comparative analysis confirm the necessity of transforming the Ukrainian system of agricultural risk insurance. Priority measures include the introduction of budgetary programmes for compensation of insurance premiums, the establishment of financial guarantee systems to cover losses from large-scale risks, and the expansion of access to insurance products for small and medium-sized agricultural producers, who remain most vulnerable to unforeseen losses.

Interpretation of statistical data allowed for the assessment of the level of trust of agricultural producers in insurance companies. High levels of agricultural insurance coverage in European Union countries indicate effective collaboration between the state and private sector, providing farmers with predictability of financial outcomes. In Ukraine, however, the low number of contracts and the limited area of insured land indicate weak integration of insurance mechanisms into the risk management system of the agricultural sector. Analysis of insurance premiums, payout volumes, and the proportion of insured land identified key factors influencing the effectiveness of agricultural insurance. Among these are the availability of state financial support, the level of trust in insurance companies, the affordability of insurance products, and the implementation of digital tools for risk assessment. Improvements in procedures for concluding insurance contracts, ensuring transparency in payouts, and the digitalisation of loss assessment processes could stimulate demand for insurance services in the agricultural sector.

International experience confirms that the effectiveness of agricultural insurance depends on a combination of factors, including state support, reinsurance mechanisms, and the accessibility of insurance instruments. The use of subsidised models, the development of index-based insurance, and the integration of digital technologies positively influence the level of insurance coverage of agricultural land. Comparison of structures and approaches in France, Germany, Spain, and Poland highlighted the specific organisation of the insurance market and enabled assessment of the feasibility of adapting selected models to the Ukrainian context. Evaluation of European practices of agricultural insurance allowed the identification of key institutional features of the organisation of insurance protection, the effectiveness of state policy implementation, and the robustness of risk management instruments in agriculture. Comparison with the Ukrainian model provided grounds for identifying structural differences and formulating proposals for improving the Ukrainian

system, drawing on the experience of European Union countries. The data summarised in Table 4 enabled analysis of the characteristics of national approaches to agricultural insurance and facilitated assessment of their relevance in the context of Ukrainian economic and institutional conditions.

Table 4. Comparative analysis of agricultural insurance models in Ukraine and selected EU countries

Country	Insurance model	State support	Level of participation of private insurers	Use of index-based insurance
Ukraine	Voluntary insurance without subsidies	None	High, though financial stability is limited	Low, at the stage of implementation
Poland	Subsidised insurance	60% of premiums covered by the state	High	Moderate, regional indices are applied
Germany	Combined insurance	50% of premiums subsidised by the state	High	High, weather index insurance widely used
France	Combined insurance with reinsurance	65% of premiums subsidised by the state	High	High, satellite data are widely applied
Spain	State and private insurance	75% of premiums covered by the state	Moderate, state control via dedicated funds	High, advanced technological platforms used

Source: based on A.I.D. Rus & I. Brici (2021), A. Bilochenko & I. Gushcha (2022), S. Vlasiuk *et al.* (2023)

The system of agricultural insurance in Ukraine operated voluntarily without state participation in financing insurance premiums, which limited its accessibility for agricultural producers. This model contrasted with the approaches adopted in European Union countries, where partial subsidy instruments were employed to reduce farmers' expenses and encourage their participation in insurance schemes. Contemporary challenges caused by armed aggression require the introduction of innovative approaches to agricultural business, including the development of insurance mechanisms. As noted by A. Berxolli *et al.* (2023), "innovation plays a key role in ensuring the resilience of the agricultural sector to disruptive external impacts, particularly those related to military threats". This highlights the necessity of adapting the agricultural insurance system to conditions of heightened turbulence.

In France and Germany, reinsurance mechanisms are widely applied, enabling insurance companies to reduce the risk of catastrophic losses. In Spain, by contrast, key risk management functions are centralised within state funds, ensuring the stability and accessibility of insurance products. The broader implementation of index-based insurance in European Union countries compared with Ukraine is attributed to the availability of satellite monitoring infrastructure, automated platforms for loss assessment, and the use of weather indices as an objective basis for payout decisions. In Spain, such instruments are integrated into digital insurance ecosystems, which ensures operational efficiency and reduced transaction costs.

Between 2022 and 2024, agricultural insurance in Ukraine operated under heightened market instability, which led to a decrease in the number of active insurers, a reduction in insurance premiums and payouts, and a decline in the coverage of agricultural land by insurance. The structure of insurance products was dominated by classical forms of protection, particularly crop and perennial plantation insurance, while index-based models remained at the stage of limited implementation. The majority of contracts were concluded by companies with developed infrastructure, access to reinsurance, and stable financial indicators, which ensured relative resilience in certain segments of the market. Comparative analysis demonstrated a disparity between the level of development of agricultural insurance in Ukraine and in France, Germany, Spain, and Poland, where combined models were applied, incorporating state subsidies for premiums, centralised reinsurance, and digital risk monitoring systems. In these countries, the proportion of insured land and the share of premiums in gross domestic product significantly exceeded the corresponding Ukrainian figures, supported by effective state participation and a high level of trust in insurance instruments.

Analysis of the activities of international reinsurance companies, such as Munich Re (n.d.), Swiss Re (n.d.), and Hannover Re (n.d.), identified key approaches to ensuring financial stability within the agricultural insurance systems of the European Union. In France and Spain, Munich Re actively introduced weather-indexed products based on satellite data and automated payout parameters, which reduced the time required for loss settlement and lowered administrative costs. In Poland and Germany, the reinsurance programmes of Swiss Re were adapted to national state subsidy schemes, ensuring stable coverage even under conditions of substantial loss exposure. Hannover Re, in turn, implemented multi-tier reinsurance liability models using weather indicators and spatial risk modelling. A common feature of all three companies was the application of digital tools for agricultural modelling, risk forecasting, and the efficient transfer of data between insurers and regulators. This experience demonstrates the effectiveness of reinsurance as a component of long-term stability in the agricultural insurance market, offering a framework that could be adapted in Ukraine to mitigate systemic risk and strengthen trust in insurance instruments within agricultural production.

▸ Discussion

The analysis of the obtained results confirms that the coverage of agricultural insurance in Ukraine remains at a low level, primarily due to the absence of state subsidy mechanisms, the high cost of insurance premiums, and limited reinsurance opportunities. Similar challenges were outlined in the study by B. Kramer *et al.* (2022), which highlighted that conventional insurance instruments are largely inaccessible to most farming enterprises due to their high costs and the difficulties associated with

accurately assessing losses. The study examined the feasibility of implementing innovative approaches, including mechanisms of social insurance protection, as a means of expanding access to insurance and compensating for catastrophic losses. This study underscored the necessity of developing a comprehensive system of state support for agricultural insurance, particularly through the introduction of guarantee mechanisms, the subsidisation of insurance premiums, and the creation of tailored products for small and medium-sized producers.

The instability in the dynamics of insurance contract conclusions during 2022-2024 reflects the sensitivity of the market to regulatory changes and fluctuations in demand. Comparable decision-making factors influencing farmers' insurance choices were identified in the study by E. Nshakira-Rukundo *et al.* (2021), which determined six key determinants: the quality of insurance services, product design features, price affordability, the level of awareness, sociocultural barriers, and institutional support from the state. The relevance of these findings to the Ukrainian context was reinforced by the identified limitations in access to insurance products, weak state involvement, and an insufficient number of adapted insurance programmes. The integration of technological innovations into agricultural insurance processes was considered one of the most effective approaches to enhancing the accuracy of risk assessment. The study by V. Moysiadis *et al.* (2021) analysed the potential of smart farming technologies, including drones, image processing systems, sensor networks, and machine learning algorithms, which demonstrate their effectiveness in strengthening the functionality of insurance products. The results of this study align with previously obtained findings, which emphasised the feasibility of using satellite data, meteorological models, and large-scale datasets to automate loss assessment, improve transparency, and accelerate insurance payouts.

Limited coverage of agricultural insurance, high financial barriers, and the absence of products adapted to climate change remain systemic challenges in Ukraine. Similar trends were identified in the meta-analysis by S. Vyas *et al.* (2021), which reviewed more than 796 studies dedicated to agricultural insurance. The authors established that the dominance of crop insurance themes and the focus on highly developed countries constrained attention to issues related to livestock insurance, aquaculture, and adaptation to climate risks. These findings highlighted the need to broaden both the research and practical scope of insurance solutions, including the development of index-based and multi-level risk management models under conditions of climatic instability.

The low level of insurance penetration in Ukraine is partly explained by farmers' limited awareness, financial constraints, and the absence of a stable system of state support. Comparable barriers were recorded in the study by D.A. Ankrah *et al.* (2021), which examined the acceptability of agricultural insurance among smallholder farmers in Ghana. Only 14% of respondents had active insurance contracts, although 90% recognised agricultural insurance as an effective risk management instrument. The main reasons for low participation included insufficient awareness (64%), lack of access to insurance products (23%), and high premium costs (5%). These results point to a common challenge for developing markets, including Ukraine, where crucial preconditions for stimulating agricultural insurance involve the provision of informational support, the design of affordable insurance programmes, and the implementation of effective subsidy mechanisms.

The results confirm that agricultural insurance can perform not only the function of financial risk compensation but also indirectly influence the environmental behaviour of agricultural producers. In the study by L. Tang & X. Luo (2021), it was demonstrated that the presence of insurance coverage facilitates the transition of farmers to more environmentally sustainable practices, particularly the use of biological pesticides. According to the modelling results, the likelihood of adopting such pesticides increased by 8.2% when insurance protection was available. These conclusions were relevant for Ukraine, where the potential expansion of agricultural insurance could support the implementation of technologies aimed at reducing anthropogenic pressures on the environment. The capacity of insurance mechanisms to enhance agricultural production efficiency was explored in the study by H. Li *et al.* (2022), which analysed the relationship between agricultural insurance, air pollution, and total factor productivity in Chinese agriculture. It was established that insurance encouraged investment in modern technologies and contributed to productivity growth, although it did not always coincide with improvements in environmental indicators. This dual effect was equally significant for Ukraine, where the expansion of insurance coverage should be accompanied by the integration of environmental criteria into insurance products to prevent adverse outcomes.

The influence of agricultural insurance on the adaptive capacity of the agricultural sector to climate change was examined by H. Mao *et al.* (2025). The study demonstrated that insurance mechanisms encourage the adoption of technologies aimed at reducing climate-related risks, particularly under conditions of increasing frequency of extreme weather events. Comparable conclusions can be extrapolated to the Ukrainian context, where rising vulnerability to climate change necessitates the introduction of insurance programmes focused on climate adaptation. Such programmes would involve compensatory payments for losses caused by weather anomalies and support for the implementation of adaptive practices. An analysis of the experience of the United States, presented in the study by N. Ahmed *et al.* (2022), indicated that insurance can promote environmentally sustainable agricultural development while creating risks of production intensification. The authors identified a positive effect of insurance coverage on the adoption of environmentally oriented technologies, although in some cases this was accompanied by an increase in environmental pollution. These findings underscore the importance of integrating environmental standards into the structure of insurance products in the context of Ukraine to maintain a balance between productivity and environmental safety.

One of the barriers to the development of agricultural insurance in Ukraine remains the delays in the payment of insurance compensations, explained by inefficiencies in loss verification processes. In this context, the study by T. Manoj *et al.* (2025) was noteworthy, proposing the

conceptual model AgriInsureDON based on blockchain architecture. The use of decentralised oracles and Internet of Things devices enables the automation of accurate data collection for decision-making on payouts. The proposed model ensures transparency, operational efficiency, and reduced transaction costs. The application of similar technologies within Ukrainian agricultural insurance could enhance the efficiency of market functioning, although further research was required regarding regulatory integration and economic feasibility. The findings indicated that the impact of agricultural insurance extends beyond ensuring the financial stability of farming enterprises, generating additional effects within the production sphere, particularly regarding the scale of agricultural output. Similar conclusions were reached by D. Hou & X. Wang (2025), who investigated the relationship between agricultural insurance and the expansion of grain crop planting areas in China. The analysis of panel data from 27 provinces enabled the authors to confirm that the availability of insurance coverage reduced financial risks, stimulated investment activity, and supported the expansion of agricultural land use. Nevertheless, this impact was indirect and depended on the financial capacity of farming enterprises. A comparable dependence was identified in the present study, demonstrating that access to insurance services influenced the volume of investment in production processes.

The development of agricultural insurance was accompanied by social dimensions, particularly those related to gender inclusion. The study by A. Timu & B. Kramer (2021) analysed the access of women and men to insurance coverage in the context of ensuring equal opportunities. The authors emphasised that gender equality issues within the insurance sector often remained overlooked, despite the existence of significant disparities in access to insurance services and the impact of insurance on women's economic independence. The findings of this study indicate the necessity of incorporating socio-demographic characteristics into the design of insurance programmes, aligning with international trends aimed at promoting the inclusiveness of financial instruments.

The financial impact of agricultural insurance on farm profitability was examined in the study by C. Tan *et al.* (2022), which established that the positive effect of insurance mechanisms on incomes was most evident in regions with high levels of insurance coverage. The role of state-supported measures in strengthening the economic resilience of small and medium-sized farms was also highlighted. These results partially correspond with the findings of the present research, which confirmed that the availability of insurance services and the implementation of subsidised programmes have the potential to enhance the financial security of farmers in the context of Ukraine. Financial security represents a critical factor for the stability of agricultural enterprises and forms the foundation for establishing an effective system of insurance protection. As noted in the study, "the modern model of monitoring the financial security of the state should be based on combining theoretical and praxeological approaches, enabling prompt responses to risks and the adaptation of regulatory instruments" (Poltorak *et al.*, 2023). This principle was particularly relevant for the agricultural sector, which is significantly affected by both external and internal economic factors. An analysis of regional economic development constitutes an essential component in shaping an effective agricultural insurance system, since insurance mechanisms must reflect the economic capacity of regions. As the researchers argue, "the need to assess the dynamics of regional economic development in Ukraine is driven by the necessity to identify reserves and opportunities for enhancing profitability and the efficiency of further activity" (Andrusiv *et al.*, 2020). Establishing an effective insurance system in the Ukrainian agricultural sector requires a comprehensive approach encompassing financial and economic dimensions, together with organisational and legal mechanisms. In particular, the researchers note that "agricultural business insurance in the context of Ukraine should account for the specific characteristics of agricultural production, the high level of risks, and the need for state support during the transformation of the agricultural insurance market" (Babenko *et al.*, 2021). The synthesis of the findings demonstrated the multifaceted role of agricultural insurance in ensuring both economic and environmental stability within the agricultural sector. Insurance mechanisms were found to contribute not only to reducing financial risks, but also to supporting the implementation of ecological practices, adaptive technologies, and improvements in production efficiency. However, persistent barriers included the limited coverage of insurance schemes, high premium costs, lack of subsidies, and insufficient awareness among agricultural producers.

The comparison with practices within the European Union confirmed the effectiveness of several key elements of the insurance market, including reinsurance, index-based insurance models, state-subsidised premiums, and digital tools for risk assessment. The implementation of these approaches facilitated stronger trust in insurance providers and contributed to the expansion of insurance coverage. The analysis of international experience also highlighted the potential of advanced technologies, such as satellite monitoring, big data analytics, and blockchain solutions, in accelerating procedures and enhancing the transparency of insurance operations. In this context, the reform of the Ukrainian model of agricultural insurance was becoming increasingly relevant. Necessary measures included the introduction of mechanisms for state support, the adaptation of insurance products to the needs of different producer groups, and the integration of innovative technologies into risk assessment and claims settlement processes. Particular attention should be directed towards ensuring equal access to insurance services for small-scale farmers, promoting the wider use of index-based insurance, and developing an institutional framework capable of supporting the sustainable growth of the agricultural insurance market.

▸ Conclusions

The study conducted a comprehensive assessment of the state and dynamics of the agricultural insurance system in Ukraine during 2022-2024. A decline was recorded in the number of active participants in the insurance market from 10 to 7 companies, a decrease in the volume of collected insurance premiums from UAH 81,061 thousand

to UAH 70,000 thousand, and a reduction in the amount of insurance payouts from UAH 29,830 thousand to UAH 20,000 thousand. The decrease in the payout ratio from 36.8% to 28.57% confirmed the limited coverage of agricultural producers by insurance protection. It was established that the key barriers to the development of agricultural insurance remain the absence of mechanisms for state subsidisation, the high cost of insurance products, the low level of farmers' awareness regarding risk management instruments, and the underdeveloped reinsurance infrastructure. The highest activity in the market was demonstrated by the companies PZU, ARX, TAS, and UPSK, which had access to international reinsurance resources and maintained financial stability.

The comparative analysis of agricultural insurance models in France, Germany, Spain, and Poland identified effective practices, including combined models with state subsidisation of insurance premiums within the range of 50-75%, the application of index-based insurance, the use of digital platforms for loss assessment, and the integration of satellite technologies into the insurance monitoring process. In these states, the share of insured agricultural land ranged from 25% to 50%, significantly exceeding the indicator in Ukraine, which remains at 4%. The share of insurance premiums in the GDP structure of the analysed countries reached 3.1%, indicating a high level of institutionalisation of the insurance market and its importance for the agricultural sector. The potential for introducing adapted models into the Ukrainian market was identified, considering the financial capacity of farming enterprises and the regulatory specificities. The assessment of the activities of the international reinsurance companies Munich Re, Swiss Re, and Hannover Re demonstrated the effectiveness of implementing weather indices, parametric insurance models, and multi-level risk distribution mechanisms, which ensure the financial stability of primary insurers in cases of catastrophic losses. Applying this experience in Ukraine provides grounds to consider reinsurance as an instrument for the long-term stabilisation of the agricultural insurance market. Further research should focus on developing models of insurance premium subsidisation, improving regionally oriented reinsurance schemes, adapting digital platforms for index-based insurance, and examining the impact of insurance mechanisms on the social resilience of rural areas.

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Розвиток системи страхування аграрного бізнесу в Україні

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► **Анотація.** Дослідницький інтерес зумовлювався обмеженим рівнем страхового покриття в аграрному секторі, що знижувало здатність виробників протистояти економічним втратам і кліматичним впливам. Метою проведеного дослідження було виявлення особливостей функціонування системи аграрного страхування в Україні та обґрунтування доцільності адаптації інституційних і технологічних практик країн ЄС для її модернізації. Методологічна база дослідження охоплювала застосування методу динамічного аналізу для оцінки змін ключових показників українського страхового ринку впродовж 2022-2024 років; методу компаративного аналізу для зіставлення організаційних моделей аграрного страхування у Франції, Німеччині, Іспанії та Польщі; методу структурного аналізу для ідентифікації домінантних елементів у системі страхового покриття; методу контент-аналізу для системного вивчення нормативно-правових актів, аналітичних звітів і технологічних рішень, спрямованих на підвищення ефективності страхового захисту. Також, було використано метод логічного узагальнення для формування висновків і рекомендацій на основі отриманих аналітичних результатів. За результатами дослідження встановлено, що частка застрахованих сільськогосподарських угідь в Україні залишалася істотно нижчою, ніж у аналізованих країнах ЄС, де рівень охоплення сягав 30-50 %; при цьому виявлено, що наявна система не забезпечувала належного розподілу ризиків, що створювало передумови для фінансової вразливості малих і середніх фермерських господарств. Ідентифіковано ключові бар'єри розвитку національної системи агрострахування: відсутність субсидування страхових премій, висока собівартість страхових послуг і низький рівень обізнаності аграріїв. Визначено, що ефективність європейських моделей забезпечувалася використанням державної підтримки, перестрахувальних механізмів через міжнародні структури та впровадженням цифрових технологій оцінки ризиків. Актуалізовано необхідність адаптації таких інструментів до умов України з метою розширення доступу до страхових послуг та підвищення фінансової стабільності агросектору. Отримані результати можуть стати основою для формування ефективних заходів державної політики у сфері страхового забезпечення сільського господарства

► **Ключові слова:** державне субсидування; економічна стійкість; цифрові технології; трансформація ринку; структурний аналіз; європейські моделі