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## Mission of International Agribusiness Insurance: Modern Challenges and Opportunities for Ukraine

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**Abstract.** An urgent problem today is the reproduction of a sustainable ability to meet the demand for food products in different countries of the world. The solution to this global problem lies in the search for optimal financial and economic tools for timely counteraction to agricultural risks. Many years of international experience prove that such a tool is insurance. The purpose of the study is to conceptualise the mission of international agribusiness insurance, specify modern challenges, and identify opportunities for Ukraine. The methodology of this study was based on the use of various methods, in particular: abstract and logical, epistemological, comparative, structural and functional, modelling, formalisation, induction and deduction, regression and system analysis. The uniqueness of insurance lies in its ability to accumulate the necessary financial resources and distribute them to the needs of compensation for losses in the case of insurance events distributed in space and time. Consequently, the conducted research is aimed at substantiating the mission of international agribusiness insurance, identifying current challenges and existing opportunities in Ukraine. The main advantages and disadvantages of various models of interaction of stakeholders in the international agricultural insurance market are established. The paper highlights the world experience in positioning classic and index insurance products on the market. It was found out that the current level of agribusiness insurance in Ukraine does not correspond to its potential opportunities. Based on the parameters of the constructed regression model, it is established that the basis for further expansion of insurance coverage of agricultural risks is an increase in the number of concluded and renegotiated agricultural insurance contracts, an increase in the liability limit (insurance amounts) of companies, ensuring actuarial balance, and an increase in the amount of state subsidies. The practical implementation of these measures should be considered in the context of food security at the regional, national, and global levels

**Keywords:** agricultural insurance, agricultural risks, market stakeholders, insurance interests



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## INTRODUCTION

One of the fundamental, vital needs of humanity is the consistent provision of broad access to high-quality food products. The solution to this problem depends on the ability to increase productivity while reducing the risk of agricultural production. The relevance of this study is based on deep awareness and comprehensive assistance to the processes of timely counteraction to various risks with extensive application of potential opportunities of agricultural insurance. The scientific originality of the study consists in: conceptual substantiation of the mission of international agribusiness insurance; disclosure of optimal forms, methods, and tools of interaction between stakeholders of the insurance market; modelling of probable scenarios for further development of increasing the share of insured areas of agricultural crops in the total area of crops; development of proposals for further functioning of the agricultural insurance market in Ukraine on the basis of balancing financial and economic interests and increasing social responsibility of participants in the insurance process.

As of 2020, agricultural insurance is successfully developing in 125 countries around the world (Vyas *et al.*, 2021). A significant variety of available opportunities for obtaining insurance coverage has become more accessible due to the expansion of the insurance field and the diversification of services. Agricultural insurance is perceived in the international community as a creative tool for countering real and potential risks in the agricultural sector.

The European Union countries use a variety of insurance tools for risk management. According to the decision of the European Commission, the amount of state support is limited to 70% of premiums or annual payments to mutual funds (European Commission, 2017). Three-quarters of EU countries allocate subsidies from 45% to 65% for agricultural risk insurance (Schwarze & Sushchenko, 2022).

For Ukraine, which positions itself as one of the guarantors of food security in the world, agricultural risk insurance is becoming particularly relevant from the standpoint of balancing the financial and economic interests of insurance market stakeholders. In the war and post-war period, there are new threats associated with the timely production, processing, and sale of agricultural products. Obviously, the solution of these problems requires additional scientific substantiation of the process of interaction between insurance companies, policyholders, and the state, based on innovative agricultural insurance technologies that are used in different countries of the world.

*Hypothesis of this study* assumes that the accelerated process of integration of the national insurance market into the global insurance environment would contribute to a significant increase in the level of insurance protection for agricultural producers. *The purpose of this study* is a theoretical and methodological reflection of

modern guidelines for the functioning of international agribusiness insurance and substantiation of the conditions for Ukraine's adaptation to the global insurance space.

## LITERATURE REVIEW

A review of literature sources indicates that global climate changes occurring around the world have a significant impact on agricultural production. The group of international experts on climate change (*Intergovernmental Panel on Climate Change*) notes that over the past 20 years, the number of natural disasters has increased 2-fold, thereby causing multibillion-dollar losses to the agricultural sector of the economy. At the same time, it is noted that the continuation of negative trends threatens to increase the number and duration of manifestations of extreme weather events (IPCC, 2020).

During the period 1980-2019, extreme natural and climatic events caused more than 80% of total economic losses in the countries of the European Economic Area totalling EUR 446 billion. Cumulative losses amounted to almost 3% of the GDP of these countries (Schwarze & Sushchenko, 2022).

A sharp fluctuation in atmospheric temperature conditions is considered a significant factor in the instability of agricultural systems and, as expected, an increase in the frequency and intensity of risks in many regions of the world (Vyas *et al.*, 2021). In the scientific literature, various judgments have been formed regarding the likely threats associated with climate change, in particular, it is noted that extreme weather conditions cause significant food shocks to the globe (Cotrell *et al.*, 2019), abnormal weather processes reduce the quantity and quality of food products (Lesk *et al.*, 2016), and the caloric content of consumer food is reduced by 1% annually (Ray *et al.*, 2019).

Modern realities of agricultural business require management decisions in an aggressive environment under the influence of various dangerous factors, namely: biological (diseases, insects, pests, weeds), environmental (weather conditions, water quality, soil condition), institutional (legislation, market conditions) (Raimondo *et al.*, 2021). The studies by American researchers from the University of Oregon (USA) warn about a sharp increase in extreme climatic conditions in the world (Ripple *et al.*, 2019).

According to the Global Sustainable Development Goals until 2030 declared by the UN, it is planned to overcome poverty (*Sustainable Development Goal* – SDG 1), hunger (SDG 2), and the consequences of climate change (SDG 13), the solution of this problem is carried out, among other things, through the use of the agricultural risk insurance mechanism (Siwedza & Shava, 2020). Agricultural insurance is becoming increasingly important as an instrument of agricultural policy (Rural insurance around the world..., 2021).

The positive impact of insurance on the development of the agricultural sector of the economy and the protection of farmers' property interests in the event of unforeseen events is mentioned in many studies. In particular, the objects of research are processes related to the formation of insurance's ability to combine and neutralise risks (Komadel *et al.* 2018), demand for insurance services, (Santeramo *et al.*, 2016), financial and economic relations between the insurance market stakeholders (Ivashkiv *et al.*, 2021) pricing and subsidies (Lusk, 2017), government regulation and institutional support (Shibaeva & Baban, 2020).

The world economic literature focuses on reflecting the role of insurance in promoting the safety and continuity of the agricultural sector. The defining mission of insurance is to neutralise risks in conditions of extreme weather events, in particular, such as drought, flood, etc. (Eze *et al.*, 2020), stabilise farm incomes, promote conditions for the growth of investment inflows to the industry, increase the competitiveness of agricultural products (Mârzaa *et al.*, 2015), reduce unforeseen expenses in conditions of uncertainty of results (Russo *et al.*, 2022), and promote sustainable land use (Goodwin & Hungerford, 2015, Claassen *et al.*, 2017).

Among many economic scientists, there is a constant discussion about options for improving the types, forms and methods of agricultural risk insurance (Nguyen & Jolly, 2019). In this context, attention is focused on the feasibility of additional substantiation for the process of coordination of insurance interests between insurance market stakeholders (Yanuarti *et al.*, 2019), the problems of legal and institutional support for participants in the insurance process (Aleskerova, 2015), the development and use of modern information technologies in the insurance sector (Yanyshyn *et al.* 2019), there is a need to further adapt the agricultural insurance market of Ukraine to the international system of insurance relations (Nesterchuk *et al.*, 2018). Consequently, a critical review of literature sources gives grounds to assert the expediency and necessity of further research in a given line.

## MATERIALS AND METHODS

The methodology of research is based on a systematic combination of principles, methods, and approaches in the process of identifying the most important triggers in the organisation and functioning of international agribusiness insurance. The establishment of mutually beneficial insurance relations in the agricultural sector should be based on compliance by all market stakeholders with the fundamental principles of agricultural insurance. These principles include: insurance risk, insurance interest, concentration of funds in the insurance fund, maximum integrity, reality, completeness and availability of insurance coverage, compensation. Compliance with the above principles creates the basis for balancing financial and economic interests between participants in the insurance process.

The process of scientific knowledge requires the consistent use of various research methods. Combination of *abstract and logical, structural and functional methods* formulated the mission of international agribusiness insurance, determined the evolution of its development, and substantiated the role and necessity of strengthening and diversifying insurance protection of agricultural producers at the national and global levels. The application of *epistemological and logical methods* contributed to the substantiation of the terminology of the presented study.

The study uses general scientific methods, in particular, *induction and deduction* – to compare features of positioning of insurance services in different countries of the world; *concretisation* – to investigate the innovative foreign experience of organising an agricultural insurance system; *formalisation* – to reveal the existing advantages and disadvantages of existing models of interaction between stakeholders in the international agricultural insurance market; *system analysis* – to substantiate dynamic changes in key parameters of agricultural insurance development; *structural and functional method* – to reflect the conceptual provisions of the development of agribusiness insurance in Ukraine in the post-war period; *comparative studies method* – to summarise the multifaceted phenomena and processes that are currently taking place in the national and international markets of agricultural insurance; *graphical method* – to visualise the main results of the study.

To achieve the purpose of this study, the prospects of increasing the share of insured agricultural crops in their total volume were modelled by the linear regression equation using the *regression analysis method*. The initial data of the forecast model were the indicators of the size of crop areas, the number of concluded contracts, the amount of insurance payments and subsidies for the period 2005-2020. The choice of these parameters is determined by their objective reflection of existing trends in the field of agricultural insurance.

The regression model was built using the Data Analysis tool in Microsoft Excel software suite, and the validity of the inclusion of absolute indicators using logarithmisation was checked in the R-Studio environment. The simulation results allowed: first, to confirm the hypothesis about the existence of a relationship between the key indicators of the agricultural insurance market and establish a mathematical relationship between them; second, to present promising scenarios for the possible expansion of insurance coverage in relation to agricultural acreage.

The development of the methodological core of the study determines the need to reveal modern approaches to organising interaction between agribusiness insurance stakeholders. Their essence is to increase the motivation of potential market participants to be jointly responsible for possible risks, using microinsurance, insurance, and reinsurance mechanisms, diversify the

opportunities of farmers to access insurance coverage, expand the range of insurance services, minimise the likely risks of agricultural production and increase food security guarantees in Ukraine. The expected results of the implementation of these approaches should be recognised as the expansion of insurance coverage of agricultural risks and the use of the existing potential for the development of agricultural insurance in Ukraine.

The information base of the study is established from official data, in particular, the World Bank (Disaster Risk Financing for Agriculture, 2020), the Ministry of Agrarian Policy and Food of Ukraine in cooperation with the project "Development of financing of the agricultural sector in Europe and Central Asia", which is implemented with the help of the World Bank and the International Finance Corporation (IFC) (Agrarian Union of Ukraine, 2018), reporting on the development of the national insurance market of Ukraine in the agricultural insurance segment (TOP-10, 2020; TOP-10, 2021). In addition, scientific publications of American, Italian, German, Ukrainian researchers and scientists from other countries of the world were used, including analytical, review, and research materials from the Internet.

## RESULTS AND DISCUSSION

The very idea of insurance originated as a form of mutual assistance to farmers during crop failures, natural disasters, and unforeseen circumstances. The first organisational and legal form of insurance relations in the company is mutual insurance companies. Their professional activity was based on the principles of non-profit, solidarity, and unity of financial and economic interests

of its participants. Starting in 1720, Germany provided insurance services in case of animal deaths due to diseases, and later insurance extended to various agricultural crops (Roth, 1960).

Since the late 1930s and until now, agricultural insurance has been considered from the standpoint of an integral infrastructure element of the functioning of many national market-type economies. Its key mission is to implement a balanced distribution (redistribution) of risks and responsibilities among all stakeholders of the insurance process. In international practice, various options for interaction of agricultural risk insurance participants are used, in particular, "providing insurance services by private insurance companies without state assistance (Sweden), state participation in reinsurance pools (Spain), subsidising insurance premiums for certain insurance risks, for example from hail (France, Austria), providing financial assistance to cover catastrophic losses (Germany, Italy, USA, Canada), creating a special state institution for implementing the policy in the field of agricultural insurance (Spain, Canada, USA)" (Slobodyanuk, 2016).

Each country has a specific model (or combination of several models) of the organisation of the agricultural risk insurance system (Table 1). The differences in the presented models lie in the levels of state intervention in the insurance process. Admittedly, each of the models has its own advantages and disadvantages. But the development of a system of insurance relations based on public-private partnership in the agricultural sector is the most adequate and acceptable from the standpoint of the need for timely and effective counteraction to possible risks in the agricultural sector.

**Table 1.** A set of advantages and disadvantages of existing models of interaction between stakeholders on the international agricultural insurance market

Key advantages and disadvantages of basic organisational and legal models of agricultural insurance functioning in the world	
Advantages	Disadvantages
<i>A liberal model based on the principles of market competition</i>	
Australia, Argentina, Germany, Netherlands, New Zealand, South Africa, Uruguay, Sweden	
<ul style="list-style-type: none"> <li>– development of commercial insurance in the agricultural economy;</li> <li>– pricing is formed solely under the influence of supply and demand for insurance services;</li> <li>– absence of fiscal expenditures from the state and municipal budgets</li> </ul>	<ul style="list-style-type: none"> <li>– insufficient level of agricultural risk insurance coverage;</li> <li>– high cost of insurance services;</li> <li>– lack of a centralised system of state subsidies</li> </ul>
<i>A model based on the principles of public-private partnership</i>	
Austria, Brazil, Israel, Spain, Italy, Canada, Luxembourg, South Korea, Poland, Portugal, USA, Turkey, France, Chile, Sweden, Switzerland	
<ul style="list-style-type: none"> <li>– diversity of sources of insurance coverage;</li> <li>– expansion of the insurance field for agricultural risks;</li> <li>– increase in accumulated insurance premiums and corresponding formed insurance reserves;</li> <li>– joint social responsibility of state and non-state institutions for the consequences of insurance events</li> </ul>	<ul style="list-style-type: none"> <li>– additional burden on state and municipal budgets;</li> <li>– complexity of combining the financial and economic interests of all PPP participants;</li> <li>– probability of new risks that are not coordinated with PPP participants</li> </ul>
<i>Compulsory insurance model (under full state control)</i>	
Greece, India, Iran, Cyprus, Philippines	
<ul style="list-style-type: none"> <li>– comprehensive insurance coverage of agricultural risks;</li> <li>– broad involvement of potential policyholders (farmers) in the insurance process</li> </ul>	<ul style="list-style-type: none"> <li>– lack of competition in the insurance market;</li> <li>– rigidity of insurance services to the needs of potential policyholders</li> </ul>

**Source:** (Slobodyanuk, 2016; Jisang Yu et al., 2018; Russo et al., 2022)

The combination of financial resources of state and non-state institutions allows increasing the volume of accumulated insurance payments, and therefore, the possibility of making insurance payments in the case of insurance events. Such cooperation between stakeholders in the insurance market contributes to improving the reliability and safety of the insurance system as a whole. In addition, the use of the public-private partnership model provides for the possibility of reducing the cost of insurance services, which is a significant motivational factor for potential policyholders to conclude and renegotiate

agricultural insurance contracts. Despite the diametrically opposite approaches that are used in world practice regarding the forms and methods of organising agricultural insurance, the volume of accumulated payments in the global dimension increases annually. For the 2019-2020 underwriting year, the amount of insurance premiums amounted to USD 35 billion, which is more than 2 times higher than in 2007 (Table 2). However, there is a rather high concentration of payments on the global agricultural insurance market: 10 countries of the world account for more than 90% of collected payments.

**Table 2.** Indicators of accumulated insurance payments and allocated subsidies in the top 10 countries of the world for the 2019-2020 underwriting year

Countries	Total amount of insurance premiums, (billion USD)	Share globally, (%)	Total amount of subsidies, (billion USD)	Share of subsidies in insurance premiums, (%)
USA	11,063	32	7,191	65
China	10,200	29	8,160	80
India	4,000	11	3,400	90
France	1,509	4	0.906	60
Canada	1,400	4	0.840	60
Japan	1,200	3	0.600	50
Spain	0.910	3	0.287	32
Italy	0.665	2	0.399	60
Brazil	0.571	2	0.166	29
South Korea	0.468	1	0.383	82
<b>Top 10 countries</b>	<b>31,986</b>	<b>91</b>	<b>22,331</b>	<b>70</b>
<b>Other countries of the world</b>	<b>3,014</b>	<b>9</b>	<b>n.a.</b>	<b>-</b>
<b>Total</b>	<b>35,000</b>	<b>100</b>	<b>-</b>	<b>n.a.</b>

**Source:** (Disaster Risk Financing for Agriculture, 2020)

The undisputed leaders of the global agricultural insurance market are the United States, China, and India, the share of these countries in the global distribution of insurance premiums is 32%, 29%, and 11%, respectively. Among the countries of the European Union, it is worth highlighting the agricultural insurance markets of France, Spain, and Italy, their payment contribution was in the range of 2%-4% of the total amount of

accumulated insurance premiums in global terms. The high level of concentration of insurance payments is conditioned by the different financial capabilities of farmers to invest in insurance coverage. The solution to this problem lies in expanding the access of agricultural producers to various insurance products. The key features of insurance services used in various countries around the world are shown in Table 3.

**Table 3.** Key features of insurance services used in the global agricultural insurance market

Types of insurance services (insurance products)	Key features (characteristics) of insurance services	Countries where insurance services are positioned
Classic	Provides the ability to choose insurance coverage for agricultural risks depending on the effective demand of consumers of insurance services. The variable series is formed from anthropogenic, natural and climatic, industrial and economic, institutional, financial and economic, and other risks. Under the terms of the insurance contract, protection can extend in a wide range from 1 to 15 risks	Austria, Belgium, Great Britain, Canada, China Luxembourg, Portugal, Romania, Slovakia, Slovenia, USA, France, Sweden, Japan
Index	Insurance coverage is provided in case of changes in a certain index (namely: weather indices, regional yield and income Index). Payment of insurance indemnities is made in case of changes in the indicators of the specified indices	India, Spain, Canada, USA, countries of South America and Africa
Microinsurance	Insurance coverage applies to a limited range of risks (natural and climatic). This insurance coverage is mainly designed for private peasant and family-type farms	India, countries of Africa, Central Asia, and South America

**Source:** (Slobodyanuk, 2016; Jisang Yu et al., 2018; Russo et al., 2022)



In the international practice of agricultural insurance, three groups of insurance services are used, namely: classical, index, and microinsurance. Among the classic types, it is worth highlighting the following available insurance options: against one or several risks at the same time, that is, it becomes possible to combine different insurance coverage options. The advantages of classic types of agricultural insurance are the wide possibilities (in particular, insurance terms, insurance rates, insurance coverage, etc.) of choosing the best option for insurance protection and the objective solvency of policyholders. Usually, the cost of these services is quite high, which somewhat narrows the availability of insurance for low- and middle-income farmers.

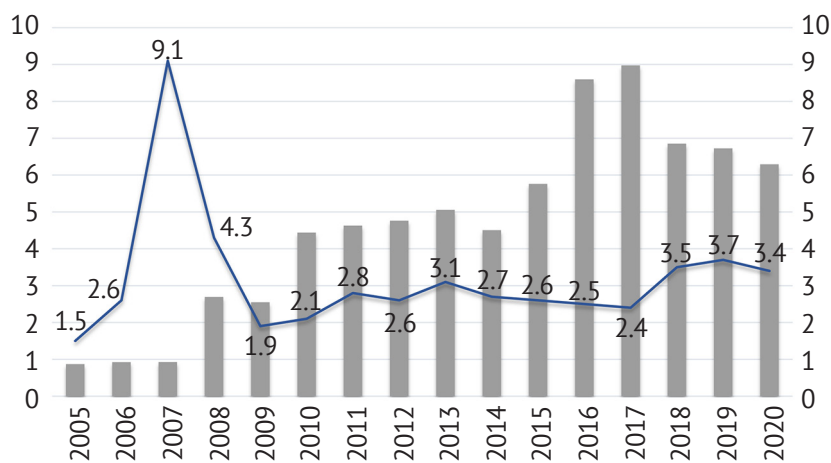
The solution to this problem is possible due to the introduction of index insurance. The conceptual foundations of this insurance product are based on the establishment of a certain parameter (index) from its threshold value. An index, as a rule, is the yield of agricultural crops in the region, the amount of precipitation for a certain period, the number of days with a certain air temperature, wind speed, humidity level, and the sufficiency of sunlight during the growing season (Samoshkina, 2019). Deviation from the maximum pre-determined value of the index is considered an insured event, and then the insurance company pays compensation regardless of whether the damage was caused to the policyholder or not.

The innovative direction of index insurance should be considered from several positions. First, the process of forming insurance coverage for agricultural producers is simplified. Second, access to agricultural insurance is being expanded by reducing the cost of services and simplifying the mechanism for recording the occurrence of an insured event. Third, the problem of information asymmetry is solved. Fourth, the range of insurance services is expanding, and therefore, there are additional arguments in favour of further development of agricultural insurance in the international context.

Microinsurance services are increasingly in demand among small-scale agricultural producers. This insurance instrument is considered as "a type of civil law relationship to protect the property interests of low-income individuals in exchange for low insurance premiums under the conditions of small insurance amounts, a simplified insurance system, a high share of insurance indemnities and a low profit of the provider of such services" (Shirinyan, 2012). Thus, positioning in the market of microinsurance services expands the range of insurance coverage for agricultural risks, creates additional opportunities for insurance protection of farmers, especially those with low and middle-income levels.

Modern international agribusiness insurance is in the conditions of constant transformational processes of search and adoption of innovative solutions to counteract potential agricultural risks. Its defining mission is to balance the financial and economic interests of market stakeholders by combining microinsurance, insurance, and reinsurance tools to achieve food security goals at the regional, national, and global levels. It is in this context that it is worth exploring the existing challenges and potential opportunities for the development of the agricultural insurance business in Ukraine.

The analysis of the functioning of the national agricultural insurance market for the period 2005-2020 provided certain conclusions and generalisations. The insurance amount (the insurer's liability limit) per 1 ha has increased almost 7-fold, which indicates the readiness of companies to bear joint responsibility for risks in the event of insurance events. An objective criterion for assessing the state of development of insurance relations in the agricultural sector is the indicator of the ratio of insured areas to sown areas. This indicator for the study period was in the range from 1.5% to 9.1% (Fig. 1). Definitely, the presented parameter indicates the untapped potential for the development of agricultural insurance in Ukraine.



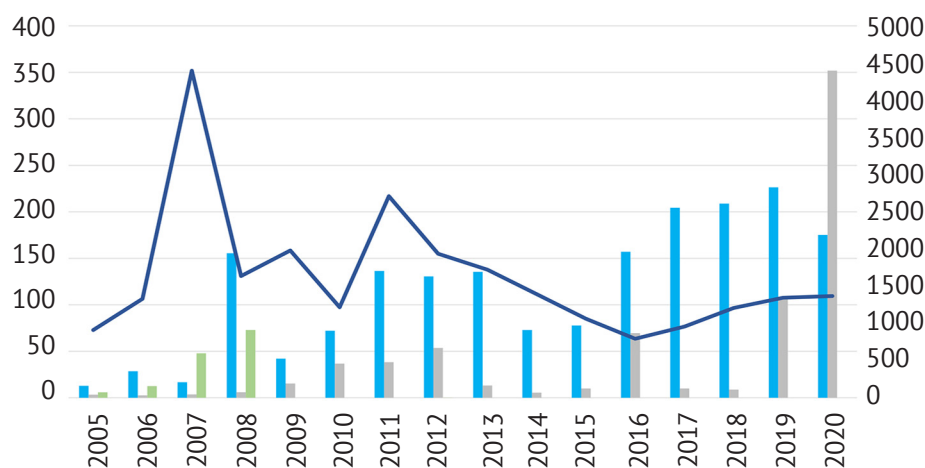
**Figure 1.** Ratio of insured to sown areas in Ukraine

**Note:** ■ insurance amount per 1 ha, mln UAH; — ratio of insured areas to sown areas, %

**Source:** (Agrarian Union of Ukraine, 2018; TOP-10, 2020; TOP-10, 2021)

But it is worth noting that during the study period, almost all indicators of business activity of the insurance market as a whole had positive dynamics of changes (Fig. 2). First of all, this applies to the amounts of accumulated insurance premiums, the number of insurance contracts concluded, and payments of insurance indemnities upon the occurrence of insurance events. Analysing the cyclical nature of changes in the agribusiness insurance, it can be argued that the most productive years in terms of

attracting payments by insurance companies were: 2007, 2009, 2011 (Chvertko *et al.* 2019). The increase in the volume of agricultural risk insurance was carried out due to the presence of favourable factors, namely: the availability of state subsidies (2005-2008 and 2012), improvement of the system of positioning services in the market, establishment of communication between participants in insurance relations, awareness by agricultural producers of the need for insurance coverage, etc.



**Figure 1.** Ratio of insured to sown areas in Ukraine

**Note:** ■ amount of bonuses, mln UAH; ■ subsidy, mln UAH; ■ insurance payments, mln UAH; — bumper of contracts, units

**Source:** (Agrarian Union of Ukraine, 2018; TOP-10, 2020; TOP-10, 2021)

The level of the ratio of insurance payments to premiums for the study period was in the range of up to 50%, which is quite acceptable from the standpoint of regulating financial and economic relations of market participants. However, in 2020, this ratio was 200%. This level of payments indicates the need to use a risk management system aimed at ensuring the solvency of insurance companies, that is, fulfilling their financial obligations under existing agricultural insurance contracts.

The urgency of taking anti-crisis measures is compounded by the military aggression of the Russian Federation against Ukraine and certain risks (fire, crop shortages, occupation of territories, etc.) that it can entail. However, in the war and post-war periods, the need for food will not disappear, but on the contrary, will only increase. Hence, there is a scientific need to substantiate possible options for strengthening the insurance protection of national agricultural producers.

The logic of further research is based on the assumption that the activation of agricultural insurance, which can be expressed through the indicator of increasing the share of insured crops in the total area of crops, is possible with a synergistic combination of the influence of a number of direct factors, such as an increase in the volume of insurance amounts, insurance payments and subsidies, an increase in the number of concluded contracts. Based on this hypothesis, the

necessary parameters for the development of agricultural insurance in Ukraine are modelled. The basic indicator of the forecast model is the ratio of insured areas to the total volume of sown areas ( $Y$  – dependent variable in %), the determining factors of which are:

- number of insurance contracts concluded ( $x_1$ ), in connection with the assumption that the expansion of agricultural insurance depends directly on the activity of concluding new contracts for certain types of crops;
- insurance amount per 1 ha, thous UAH ( $x_2$ ), as a result of the assumption that the larger the insurance amount per 1 ha, the higher the interest of agricultural producers to conclude insurance contracts due to the full expected coverage of possible risks;
- insurance payments, mln UAH ( $x_3$ ), due to the assumption that the larger payments were made by insurance companies in previous periods, the higher the confidence of potential policyholders in them;
- subsidy volumes, mln UAH ( $x_4$ ), which is associated with the possibility of state support both for the development of the insurance market and agricultural production in general through partner financing of expenses of agricultural producers.

The matrix of paired correlation coefficients (Table 4) shows that such indicators as the number of concluded contracts and the volume of state subsidies for compensation of insurance costs have a noticeable and

strong influence of direct (+) action on increasing the share of insured acreage in their total aggregate. The other two indicators – the insurance amount per 1 ha

and the total amount of insurance payments – do not have a significant reverse (-) impact on the expansion of the share of insured areas.

**Table 4.** Matrix of paired correlation coefficients (*r*)

	y	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>
y	1	0.8027	-0.2623	-0.00394	0.6418
x <sub>1</sub>	0.8027	1	-0.4683	-0.1199	0.4544
x <sub>2</sub>	-0.2623	-0.4683	1	0.3204	-0.4867
x <sub>3</sub>	-0.00394	-0.1199	0.3204	1	-0.2106
x <sub>4</sub>	0.6418	0.4544	-0.4867	-0.2106	1

**Source:** compiled by the authors

The expediency of including these factors in this model is justified by the results of the analysis of their logarithmised equivalents in the R-Studio environment

(Table 5), which confirm the significance of existing relationships.

**Table 5.** Substantiation of the feasibility of including the selected indicators in the model

Coefficients:	Estimate	Std. Error	t value	Pr (> t )	
(Intercept)	1.651726	0.613885	2.691	0.019648	*
Sum insured	0.001242	0.000355	3.499	0.004392	**
Amount of bonuses	-0.032272	0.010133	-3.185	0.007850	**
Subsidies	0.069127	0.013790	5.013	0.000303	***
Signif. codes:	0 '***'	0.001 '**'	0.01 '*'	0.05 '.'	0.1 '' 1

**Source:** compiled by the authors

Based on the results of regression analysis of the selected factors influencing the development of agricultural insurance (Table 6), linear equations are constructed:  $Y = -0.4424 + 0.00144x_1 + 0.187x_2 + 0.00185x_3 + 0.03823x_4$  with Fischer's criterion  $F = 11.921$ . On this basis, it can

be argued that the coefficient of determination of the constructed model of agricultural insurance development ( $R^2 = 0.901415$ ) is statistically significant, and the equation is statistically reliable.

**Table 6.** Estimation of parameters and main characteristics of the regression equation

Indicator	Y	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>
Coefficients	-0.4425	0.00144	0.18701	0.00185	0.03823
Standard error	0.84282	0.0003	0.11041	0.00276	0.01295
t-statistics	-0.525	4.73496	1.6938	0.67078	2.95107
P-Value	0.61003	0.00061	0.1184	0.5162	0.01318

**Source:** compiled by the authors

Thus, the coefficient of determination of the obtained regression equation  $R^2 = 0.901415$  and the weighted coefficient of determination  $R = 0.812549$  confirm the hypothesis about the close dependence of agricultural insurance on the factors included in the model, and the constructed equation reflects the following regularities:  $a_0 = -0.4425$  – if the selected factors are constant, the share of insured agricultural areas in Ukraine will decrease by -0.4425 percentage points annually, starting from 2022.;  $a_1 = 0.00144$  – if an increase in the number of contracts is achieved, each of them will provide an

increase in the share of insured areas by 0.00144 percentage points, and every 100 additional contracts will contribute to an increase in the share of insured areas by 0.14 percentage points, while other signs remain unchanged;  $a_2 = 0.18701$  – if the volume of insurance amounts per 1 ha increases by UAH 1,000, then the share of insured areas will increase by 0.187 percentage points;  $a_3 = 0.00185$  – if the amount of insurance payments increases by UAH 1 million, the share of insured areas will grow by 0.00185 percentage points;  $a_4 = 0.03823$  – if the volume of subsidies for insurance of agricultural producers



in Ukraine is increased, then every UAH 1 million will increase the share of insured areas by 0.03823 percentage points.

Based on the parameters of the constructed regression model for expanding the scale of agricultural insurance in Ukraine and focusing on world experience, it is possible to form probable scenarios for achieving

the required level of the ratio of insured areas to sown areas (Table 7). Further expansion of insurance coverage of agricultural risks is based on increasing the number of concluded and renegotiated agricultural insurance contracts, increasing the liability limit (insurance amounts) of companies, adhering to the principle of actuarial balance when forming the tariff policy for insurance services.

**Table 7.** Scenarios of prospects for increasing the share of insured agricultural areas in the total sown areas

Indicators	Designation	Options for increasing the share of insured crop areas in the total sown area			
		15%	25%	40%	50%
Ratio of insured area to sown area, %.	Y	15%	25%	40%	50%
Number of contracts	X <sub>1</sub>	5,000	9,500	18,000	24,000
Insurance amount per 1 ha, thous UAH	X <sub>2</sub>	30	45	55	60
Insurance payments, mln UAH	X <sub>3</sub>	100	170	230	270
Subsidy, mln UAH	X <sub>4</sub>	65	80	100	110

**Source:** compiled by the authors

An important argument for further activation of insurance relations in the agricultural sector is the availability of state subsidies, which is provided for by the current legislation (in particular, the resolution of the Cabinet of Ministers of Ukraine "On Approval of the Procedure for Providing State Support for Insurance of Agricultural Products" dated December 9, 2021 No. 1342) (2021). If the share of insured persons in the structure of sown areas increases, the probability of occurrence of insurance events will increase, which is associated with the need to increase payments under agricultural insurance contracts.

The generation of optimistic forecasts for the development of agribusiness insurance requires the adoption of systematic, interrelated measures of an institutional, legal, financial, economic, moral, and ethical nature. Undoubtedly, military operations in Ukraine significantly complicate the process of managing agricultural risks and transferring them to insurance. However, the relevance of food security at the local, national, and global levels is constantly becoming more acute, which determines the need for reliable insurance protection of agricultural producers.

With Ukraine acquiring the status of an associate member of the European Union in 2022, it obliges Ukraine to gradually adapt to pan-European requirements and traditions in organising and conducting insurance activities. First of all, this refers to compliance with basic values in the interaction of agribusiness insurance stakeholders, among which it is worth highlighting: transparency of insurance activities, solvency of insurance companies, and corporate governance. A significant step to this was the adoption in 2021 of the new version of the Law of Ukraine "On Insurance" (Law of Ukraine, 2021). This Law significantly increases the requirements for insurance and reinsurance activities

in the market, while strengthening the protection of consumer rights to insurance services.

The vast majority of researchers (agricultural economists) share the identity of positions regarding the expediency of using the agricultural insurance system as an effective tool for countering agricultural risks. This opinion is shared by Aleskerova (2015); Siwedza & Shava (2020); Ivashkiv (2021); Raimondo (2021). Paying tribute to the best practices of researchers from different countries of the world, the authors of the study support the scientific position on the validity of a gradual increase in the amount of state subsidies in the field of agricultural insurance (Slobodyanuk, 2016; Lusk, 2017; Russo, 2022), the need to diversify services in the insurance market (Yanyshyn, 2019; Siwedza & Shava, 2020). At the same time, issues related to the scientific substantiation of the role of insurance in the system of ensuring sustainable land use remain controversial (Goodwin & Hungerford, 2015; Claassen *et al.*, 2017). Since the achievement of "sustainability" in the production and processing of agricultural products in the context of the establishment of insurance relations in the agricultural sector provides for maximum insurance coverage of natural, anthropogenic, economic, environmental, social, and other risks. Admittedly, such a development is the most desirable from the standpoint of the development of agricultural insurance, although it is unlikely in the medium term for Ukraine.

However, the results of the conducted research indicate the objective possibility of a gradual expansion of insurance coverage of agricultural risks. The driving force for the development of agricultural insurance should be the growth of the institutional capacity of participants in the insurance process. For insurance companies, this concept is associated with the development

and implementation of innovative insurance products (classical and index) that can fully meet the needs of agricultural producers in insurance protection; the use of creative management and marketing technologies in the field of purchase and sale of insurance services; ensuring the solvency, liquidity, and profitability of insurance operations. At the same time, for policyholders, the process of increasing their institutional capacity is based on awareness of the role of agricultural insurance in the process of minimising agricultural risks; mastering the necessary array of knowledge and forming an insurance culture among potential consumers of insurance services, and increasing effective demand for insurance coverage. The growing institutional maturity of key stakeholders in the agricultural insurance market will indicate an increase in their integration capabilities into the pan-European insurance space.

In the scientific literature, insufficient attention is paid to the issues of increasing social responsibility by all participants in the insurance process. Although it can obviously be argued that moral, ethical, and socio-psychological factors acquire special weight in the process of distributing risks and responsibilities between agricultural insurance entities. The formulated statement is based on the position that social responsibility increases trust, and therefore, increases the business and investment activity of interested parties in the insurance process. The authors of this study agree with the thesis that "the driving force of the development of insurance relations in society on the basis of corporate social responsibility should be considered the reproduction of a high level of trust, the manifestation of insurance culture, ensuring information awareness and actuarial balance of consumers and sellers of insurance services" (Skydan *et al.*, 2022). Thus, the growth of social responsibility should be considered an innovative factor in the intensive development of insurance relations in the agricultural sector in the medium and long term.

Summarising the results of the study, it is worth focusing on the key positions of further development of agricultural insurance in Ukraine. This refers to the establishment of broad access (in terms of the price and volume of insurance coverage) of agricultural producers to classical and index insurance services. Separately, it is necessary to emphasise the expediency of activating the process of insurance and reinsurance of risks associated with: food exports to international agricultural markets, production of organic products, and increase of ecological and economic responsibility for land pollution. Consequently, the continued use of microinsurance,

insurance, and reinsurance tools allows minimising agricultural risks and maintaining an appropriate level of food security at the national and global levels.

## CONCLUSIONS

For the vast majority of civilised countries of the world, agribusiness insurance is an integral element of an integral system of financial and economic relations in rural areas. The fundamental advantage of the insurance system lies in its ability to effectively distribute risks and liability among interested market stakeholders and provide a mechanism for compensation of losses in the case of an insured event. The success of implementing insurance relations in the agricultural sector largely depends on the ability to accumulate funds in the insurance fund in a timely manner and direct them to insurance payments distributed in space and time.

Against the background of the widespread use of agricultural insurance in many countries of the world, this financial instrument is not used sufficiently in Ukraine to neutralise possible risks. The achievement of the set mission of development of agribusiness insurance is seen in a significant expansion of coverage of agricultural risks by insurance, strengthening, and diversification of options for property protection of producers, while strengthening the guarantees of financial security of insurance companies. Balancing the insurance interests of market stakeholders is possible in conditions of increasing their institutional capacity, stimulating effective demand with the parallel establishment of a competitive supply for insurance services.

The functioning of the modern model of agribusiness insurance requires a significant concentration of intellectual, technological, and financial resources aimed at consistently neutralising the risks of agricultural production. In the post-war period, more advanced methods of cooperation between agricultural insurance market participants should be used to increase business and investment activity. This refers to organising the insurance process on the basis of public-private partnerships, spreading the practices of mutual insurance companies in the agricultural sector, etc. Consequently, the establishment of joint liability for agricultural risks in the coordinate system of insurance relations in society creates safe conditions for the production, transportation, and sale of products in the domestic and foreign agricultural markets. Prospects for further study are aimed at substantiating strategic guidelines and modelling the processes of implementing the potential of agricultural insurance in Ukraine.

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### **Місія міжнародного страхового агробізнесу: сучасні виклики та можливості для України**

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**Анотація.** Актуальною проблемою сьогодення є відтворення стійкої спроможності задовольнити попит на харчові продукти у різних країнах світу. Розв'язання даної глобальної проблеми перебуває у площині пошуку оптимальних фінансово-економічних інструментів своєчасної протидії сільськогосподарським ризикам. Багаторічний світовий досвід доводить, що таким інструментом виступає страхування. Метою дослідження є концептуальне обґрунтування місії міжнародного страхового агробізнесу та конкретизація сучасних викликів й визначення можливостей для України. Методологія даного дослідження базувалася на використанні різноманітних методів, зокрема: абстрактно-логічного, гносеологічного, компаративістики, структурно-функціонального, моделювання, формалізації, індукції та дедукції, а також регресійного та системного аналізу. Унікальність страхування полягає у його здатності акумулювати необхідні фінансові ресурси та розподіляти їх на потреби відшкодування збитків у разі настання страхових подій, розподілених у просторі й часі. Відтак, проведені дослідження спрямовані на обґрунтування місії міжнародного страхового агробізнесу, окреслення сучасних викликів і виявлення наявних можливостей в Україні. Встановлено основні переваги та недоліки різних моделей взаємодії стейкхолдерів на міжнародному ринку аграрного страхування. Висвітлено світовий досвід у позиціонуванні класичних та індексних страхових продуктів на ринку. З'ясовано, що сучасний рівень страхового агробізнесу в Україні не відповідає його потенційним можливостям. Базуючись на параметрах побудованої регресійної моделі, встановлено, що в основі подальшого розширення страхового покриття сільськогосподарських ризиків є нарощування кількості укладених та переукладених договорів аграрного страхування, збільшення ліміту відповідальності (страхових сум) компаній, забезпечення актуарної збалансованості, зростання сум державних субсидій. Практичну реалізацію окреслених заходів варто розглядати у контексті формування продовольчої безпеки на регіональному, національному та глобальному рівнях

**Ключові слова:** аграрне страхування, сільськогосподарські ризики, стейкхолдери ринку, страхові інтереси