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MANAGING CLIMATE RISKS IN BUSINESS USING THE PRECAUTIONARY PRINCIPLE

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The article states that the functioning of business in a changing environment associated with the aggravation of the climate crisis requires increased attention to uncertainty, identification and neutralization of possible climate risks that may adversely affect its functioning and further development, as well as the implementation of measures to adapt to climate change. It is emphasized that adaptation to climate change is a process of business adaptation in response to actual or expected destructive climate impacts, which allows to reduce their negative effects and take advantage of favorable opportunities. It is emphasized that climate risks are difficult to predict due to their radical uncertainty and unique properties, including unpredictability, difficulty of forecasting, complex dynamics and chain reaction effects. In addition, climate risks are irreversible and non-linear, so even minor climate change can lead to significant and even catastrophic consequences for businesses. Therefore, managing business climate risks is crucial, as the impact of secondary effects can affect the company's operations, leading to financial losses due to fluctuations in asset values. It is substantiated that forecasting of climate risks to business should be based on the results of studying the background of natural disasters that have affected the viability of business in previous years and the results of assessing its vulnerability to climate change. The methods for assessing climate risks to business, adapted for use in Ukrainian practice, are considered. A search for ways to manage business climate risks on the basis of the precautionary principle is carried out. It is proved that the proposed additions to the Methodological Recommendations for Assessing Risks and Vulnerability to Climate Change in Socio-Economic Sectors and Natural Components will allow clearly observing the trends in the priority of climate risks and promptly making decisions on their neutralization or minimization of their impact on economic activity. At the same time, they will simplify modelling of the impact of climate change on business in the short and long term, which will facilitate early adaptation measures and the creation of reserves to cover losses resulting from the occurrence of difficult to manage and/or unmanageable climate risks.

Keywords: climate crisis, climate risks, climate change adaptation policy, physical risks, liability risks, transitional (transit) risks.

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Introduction and problem statement

Anthropogenic climate change is increasingly accompanied by challenges and risks that affect almost all aspects of life on Earth. Droughts, heavy rains and floods, heat waves, extreme fires and coastal flooding are steadily increasing in frequency and intensity with each tenth of a percent of global warming. Therefore, the scale of their consequences is constantly growing. According to the S&P Global Sustainable Physical Risk Exposure Scores, by the 2050s, business losses

due to climate threats and risks are expected to average between 3.3% and up to 28% per year of the value of real assets, depending on the territorial location of companies [1]. Therefore, with the deepening of the climate crisis, each business will "survive" in its own way. However, at the moment, it is not about "survival", but about caution, since business in Ukraine has so far been reluctant to respond to climate change, forgetting, however, that storms, floods, forest fires or other serious dangers can lead to an instant loss of assets, and therefore, and to the instant loss of its vitality. Avoiding such a sad situation is possible only with full readiness for climate change, a clearly formed adaptation policy and an effective climate risk management system.

Analysis of recent research and publications

The exceptional importance and relevance of the problems related to climate change has led to the extraordinary activity of the world and Ukrainian scientific community in finding ways to adapt to the challenges and threats of the climate crisis. In particular, Linnerooth-Bayer J. and Hochrainer-Stigler S. [2] call for a new balance between reducing the risks associated with extreme climate change and transferring them as means to effectively prepare for and manage the consequences of disasters in a changing climate. The authors address this balance in detail with an overview of disaster risk financing mechanisms and how they contribute to disaster risk reduction and climate change adaptation in developing countries. Reviewing traditional financial mechanisms, scientists justify how risk financing can complement and stimulate the adoption of climate change adaptation measures [2]. The choice of climate change adaptation measures should be based on an assessment of climate risks and business sustainability, as suggested by Hallegatte S. and Engle N. [3] their proprietary method for measuring resilience benefits for climate risk management involves a single metric or indicator/ index that allows comparison and aggregation of outcomes related to climate crisis challenges. Of particular concern is the fact that any imperfect indicator – with its inability to measure exactly what we want it to – can easily create perverse incentives for practitioners and contribute to outcomes that are very different from those intended. It is therefore important to consider the potential pitfalls of over-relying on imperfect quantitative indicators to measure progress and prioritize future investments to develop resilience [3].

Supporting foreign colleagues, Shevchenko O., Vlasyuk O., Stavchuk I., Vakolyuk M., Ilyash O., Rozhkova A. [4], Tkachenko A., Levchenko N. [5], Dvigun A., Datsii O., Levchenko N., Shyshkanova G. and Dmytrenko R. [6] and others. a number of methodological approaches to the management of climate risks, their assessment and minimization are proposed. Each of them is certainly useful, because it provides not only an understanding of risk, but also the power of its influence on the life of companies. However, the various proposed approaches differ significantly in their complexity, level of analysis, lists of indicators, algorithms used to obtain quantitative estimates, and set tasks. It is necessary to determine the most effective approach that can truly form the basis for identifying potential measures for adapting to climate change. This process is quite complex and requires further research.

The purpose of the article

The purpose of the article is to find ways to manage business climate risks based on the precautionary principle, the application of which in practice will make it possible to clearly observe climate change trends, threats and risks to the viability of companies, and therefore quickly make decisions about their neutralization or minimization of the impact on the business entity.

Presentation of the main material of the study with a full justification of the obtained scientific results

Climate change has long been a visible and obvious fact. The only question is how much it will affect the business and how destructive its consequences will be. Even according to very conservative estimates, in Ukraine by 2030, an increase in the average annual temperature within the range of 0.8-1.1°C and an increase in the redistribution of precipitation during the year within the range of ± 20% with their increase is expected. Therefore, under the influence of climate change, the hydrological cycle will continue to change, thus increasing the intensity of natural disasters, which is convincingly evidenced by the steady growth of natural disasters in Ukraine over the last decade. If in 2011 natural disasters accounted for about 35% of all recorded emergencies in the country, in 2020 this figure will rise to over 55%, resulting in losses almost six times higher, mainly due to drought in the Odesa and Vinnytsia regions and catastrophic flooding in the western regions of Ukraine, etc. Therefore, it becomes clear that in combating climate change, an important direction of business actions is not only mitigating the consequences of climate change by limiting greenhouse gas emissions, but also taking measures to adapt to the consequences of the deepening climate crisis [7, p. 3].

Adaptation to climate change is the process of adapting business in response to actual or expected destructive climate impacts, which will reduce their negative consequences and take advantage of favorable

opportunities. A critical step for effective adaptation is a clear understanding of the expected impacts, vulnerabilities and risks associated with climate change in the short, medium and long term [8]. However, forecasting climate risks is quite difficult due to their radical uncertainty and special properties inherent only to them, in particular: unpredictability, difficulty in forecasting and radical uncertainty, complex dynamics and causing chain reactions, irreversibility and non-linearity (when small climate changes can lead to much larger changes, and even cataclysms, in any spheres of activity). Nevertheless, this is absolutely necessary, since climate risks through the effects of secondary consequences affect the activities of companies, causing financial losses from changes in the value of assets [9].

According to the specifics of the impact, the Task Force on Climate-related Financial Disclosures of the Financial Stability Board tentatively identified the following main categories of climate risks:

– physical risks directly related to the physical impacts of climate change on companies, namely physical asset risks and business disruption risks. For example, damage to assets, disruption of logistics chains, lack of access to resources, floods and changes in water levels caused by natural disasters and climate change;

– liability risks are risks that reflect how the company is perceived and evaluated by consumers, investors, communities and other stakeholders in relation to climate events, strategies and pace of transition to a low-carbon economy. These are the risks that investors consider when forecasting the company's medium- and long-term performance [10];

– transitional risks associated with the transition to a low-carbon economy. For example, increasing prices for greenhouse gas emissions, capital expenditures for the introduction of "green" technologies, etc. Transitional risks have a medium-term and strategic nature (Fig. 1).

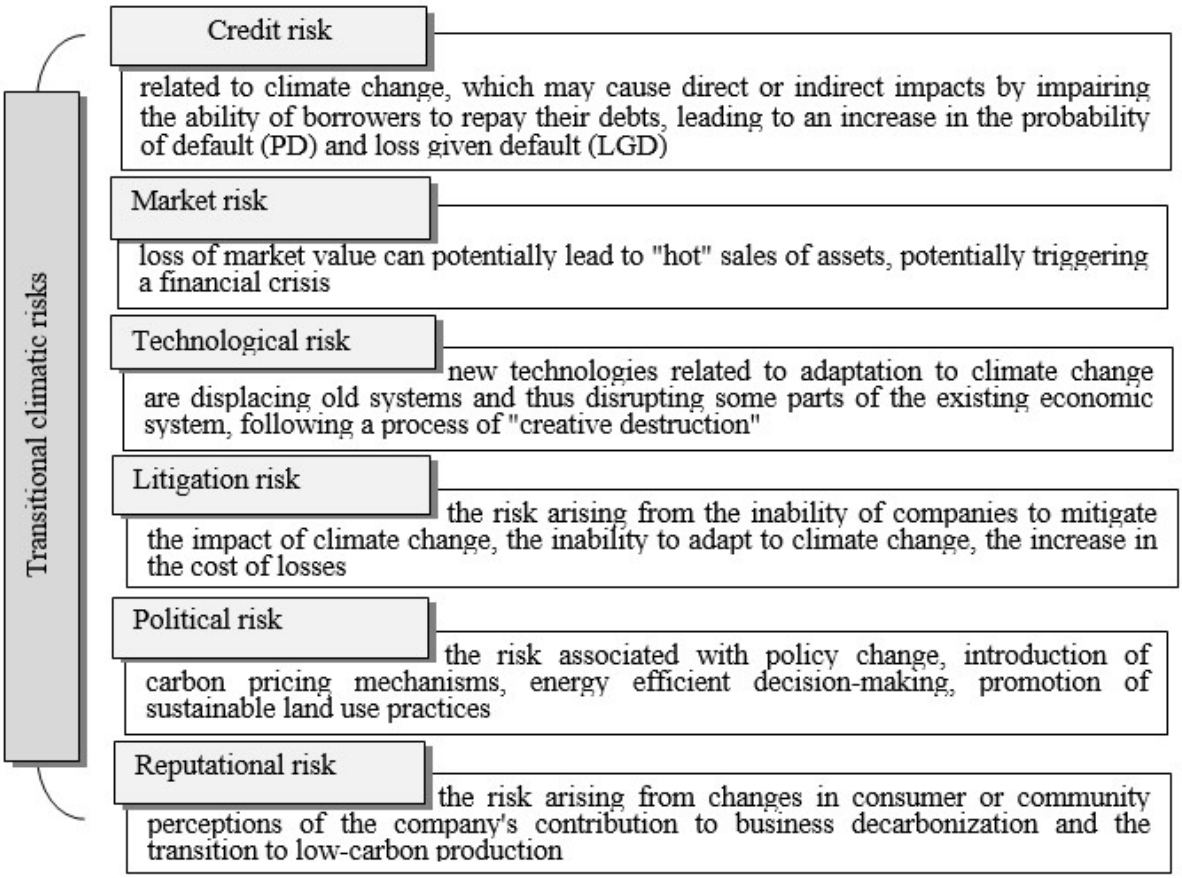


Fig. 1. A set of the transitional climate risks [8]

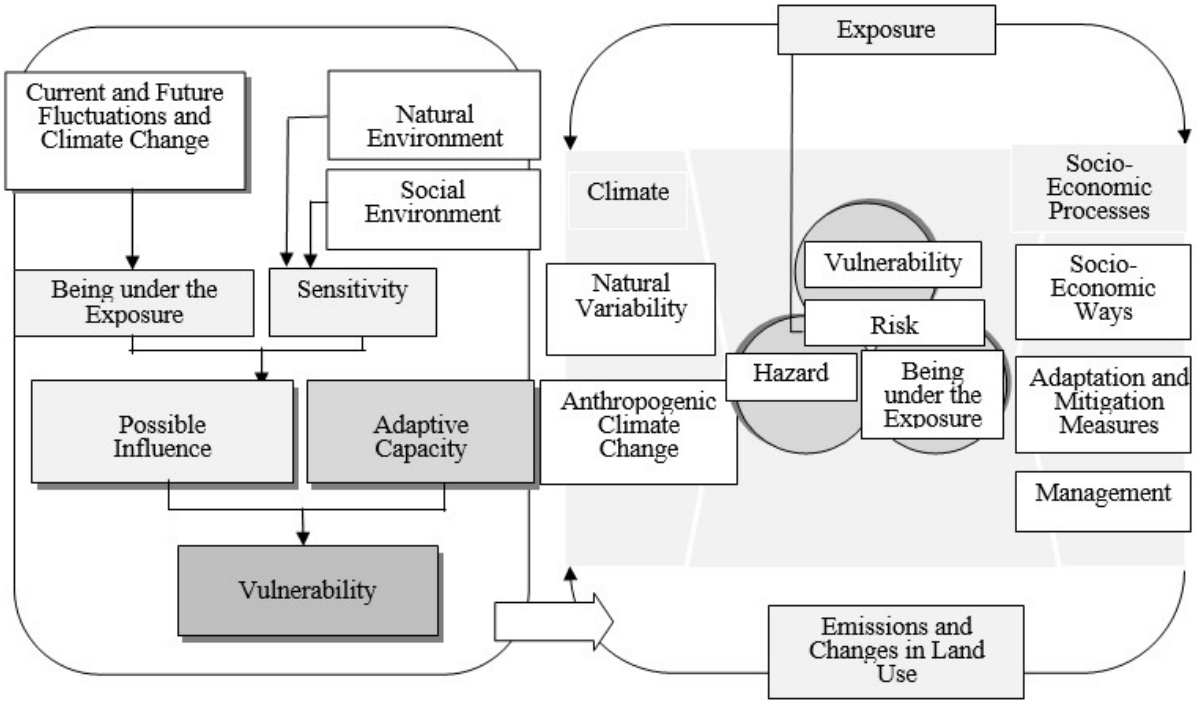
Based on the totality of the listed categories, the precautionary management of business climate risks is obvious, since effective management is able not only to minimize losses, but also to increase the value of the business and increase its ESG rating, signaling to stakeholders that the business effectively manages its risks and quickly adapts to climate change [11].

The first steps to effectively prepare for the future risks associated with climate change should be an understanding of the consequences of climate change, which is possible if an assessment of risks and vulnerabilities to climate change (ARVCC) is carried out.

One of the most structured and objective approaches to carrying out an ARVCC is proposed by GIZ in the Guidelines for Business Vulnerability Assessment (Vulnerability Sourcebook) [13], which summarize the concept of vulnerability presented in AR4 and AR5 [13] (Fig. 2a and 2b).

According to the AR4 [13] concept (see Fig. 2.1a), the impact of climatic factors (Exposure), the business sensitivity (Sensitivity) and its Adaptive Capacity are recognized as key components of the Vulnerability. At the same time, the Exposure is considered as a variable that shows the nature, magnitude and level of changes or variations in climatic indicators – temperature, precipitation, water balance, as well as dangerous natural phenomena (heavy rains, droughts, floods, etc.). The Sensitivity is considered as a degree of negative or favorable impact, which the business experiences from climate change. Moreover, the Adaptive Capacity, as the ability to adapt to potential damage, use opportunities or respond to the consequences of climate change.

According to AR5 [13], the concept of vulnerability underwent a certain transformation and evolved towards the definition of risk as an integral



a b

Fig. 2. Vulnerability Assessment Guidelines (Vulnerability Sourcebook) AR4 (a) and AR5 (b) [13]

indicator consisting of indicators of climatic threats (Hazard), presence of valuable objects under the influence of climatic threats (Exposure) and Vulnerability of valuable objects (fig. 2b) [12].

AR5's [13] focus is on the system in action rather than the business impacts of threats, and this is seen as an advantage over the AR4 [13] concept. The concept of vulnerability in AR5 [13] is action and threat independent. The AR5 [13] framework helps identify adaptation measures based on existing system vulnerabilities and shows climate-resilient pathways that can reduce the impacts of climate change, both current and future. A complementary analysis of the concepts of risk and vulnerability to climate change according to AR4 and AR5 [13] is presented in Fig. 3.

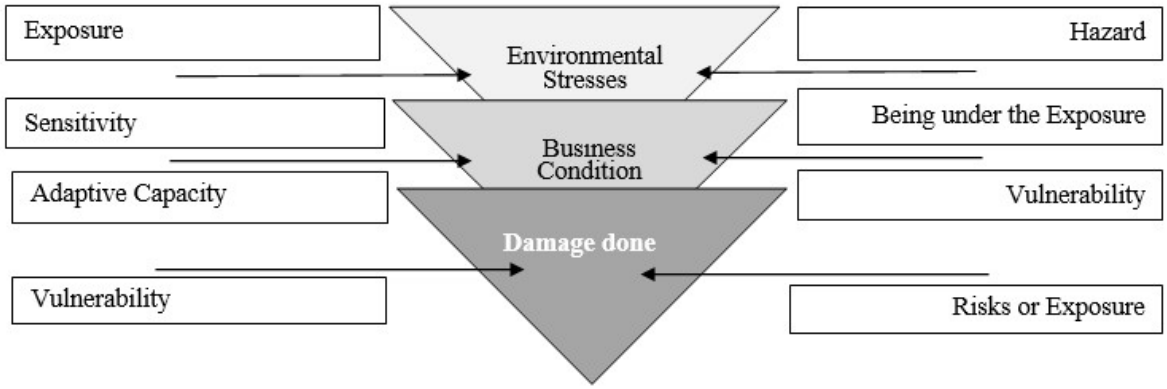


Fig. 3. Complementary analysis of the concepts of risk and vulnerability to climate change according to AR4 and AR5 [13]

Based on the above-mentioned concepts, the international European standard ISO 14091:2021 Adaptation to climate change – Guidelines on vulnerability, impacts and risk assessment was released in 2021 [14]. This document gives guidelines for assessing the risks related to the potential impacts of climate change. It describes how to understand vulnerability and how to develop and implement a sound risk assessment in the context of climate change. Risk assessment according to this document provides a basis for climate change adaptation planning, implementation, and monitoring and evaluation for any organization, regardless of size, type and nature [14].

ISO 14091:2021 standard assesses adaptability in slightly different dimensions: organizational capabilities; technical potential; financial potential; ecosystem potential [14].

The risk assessment approaches standardized in it make it possible to obtain a meaningful justification for determining adaptation measures according to a three-level approach:

– the first level of risk assessment is a relatively quick process that can be carried out in the form of a qualitative assessment without the involvement of detailed local data to form a preliminary strategic understanding of the risks related to climate change faced by the business;

– the second level is a process of qualitative and quantitative assessment of risks and vulnerability, which is carried out in order to identify and assess business risks, establish the vulnerability of its main components and determine the consequences of climate change;

– the third level – the process of detailed analysis of priority and specific risks and vulnerabilities identified at the stage of the second level assessment [12, p. 15].

At the same time, the implementation of the ARVCC and adaptation planning can be carried out either from a "top-down approach" or from a "bottom-up approach". Top-down assessment involves downscaling climate projections from global circulation models under different scenarios of greenhouse gas emissions (RCP 4.5, RCP 8.5, etc.) to the scale of the business being assessed. A bottom-up assessment is more focused on examining how changes in business sensitivity can help increase resilience to climate change. Such assessments can focus on both current and future vulnerabilities [12, p. 25].

These two types of assessment can be used both separately from each other and, as far as possible, in a complementary combination. When used together, top-down and bottom-up approaches inform each other conceptually and practically, generating hybrid methods and information that are likely to be more useful in the short and long term. According to the conceptual framework, the top-down approach corresponds to the first level of assessment in the three-level approach to the ARVCC, while the bottom-up approach, according to the purpose and the available/involved information support, can be applied at the second and third levels. At the same time, both approaches can be rationally applied to all components of the three-level assessment (as a single system of ARVCC) to provide information support for decision-making [12, p. 25].

To assess climate risks and business vulnerability to climate change, the Ministry of Environmental Protection and Natural Resources of Ukraine has developed Methodological Recommendations for Assessing Risks and Vulnerability of Economic Sectors and Natural Resources to Climate Change [12]. They contain recommendations and practical advice on assessing the risks and vulnerability of economic sectors and natural resources to climate change at the national, regional and local levels. For each sector

and natural component, these guidelines describe the context and objectives of climate change risk and vulnerability assessment, the main impacts and chains of climate change, and recommended examples of risk and vulnerability indicators, including climate hazard indicators, indicators of the impact of climate factors on the sector or component, indicators of climate sensitivity, and indicators of the adaptive capacity of the sector or component to climate change. These lists of indicators for each sector or component are not exhaustive and can be supplemented in the process of risk and vulnerability assessment, and the indicators themselves can be adjusted depending on the current conditions in the assessed area and the availability of baseline data [12].

Because climate change risks are inherently more complex and long-term than most conventional business risks, scenario analysis is absolutely necessary to understand the physical, economic and regulatory impacts of future climate conditions on operations and supply chains [15]. It should be a source of information for risk assessment, strategy development and investment decision-making, as well as be taken into account when determining the amount of compensation and incentives for employees. In addition, all financial information related to climate change should be included in the main reporting financial documents, and data on climate risks should be taken into account in estimates and assumptions used in financial statements, including in asset impairment and amortization models [1].

Thus, it is concluded that the prevailing notion of a sufficient response to natural disasters as being timely and effective needs revision in light of the recognition that measures to adapt to climate change are equally urgent. Ensuring adaptation to climate change, increasing resilience, and reducing risks related to climate change are essential components of Ukraine's obligations derived from the ratified UN Framework Convention on Climate Change and the Association Agreement between Ukraine and the European Union. The implementation of this task requires the consideration of adapting to climate change and enhancing resilience to climate-related dangers and natural calamities in state and national strategies, plans, and development programs for the economy and related industries. Hence, it is vital for businesses to adopt these measures [8].

Conclusions

Thus, according to the results of the study, it is stated that the functioning of business in a changing environment associated with the aggravation of the climate crisis requires increased attention to uncertainty, identification and neutralization of possible climate risks that may adversely affect its functioning and further development, as well as taking measures to adapt to climate change. It is emphasized that adaptation to climate change is a process of business adaptation in response to actual or expected destructive climate impacts, which will reduce their negative effects and take advantage of favorable opportunities. Climate risks are difficult to predict due to their radical uncertainty and unique properties, including unpredictability, difficulty in forecasting, complex dynamics and chain reaction effects. In addition, climate risks are irreversible and non-linear, so even minor climate change can lead to significant and even catastrophic consequences for various industries. Therefore, managing business climate risks is crucial, since the impact of secondary effects can affect the company's activities, leading to financial losses due to fluctuations in asset values or reputational damage. It is substantiated that forecasting business climate risks should be based on the results of studying the background of natural disasters that have affected the viability of business in previous years and the results of assessing its vulnerability to climate change. The methods for assessing climate risks to business, adapted for use in Ukrainian practice, are considered. A search for ways to manage business climate risks on the basis of the precautionary principle is carried out. It is proved that the proposed additions to the Methodological Recommendations for Assessing Risks and Vulnerability to Climate Change in Socio-Economic Sectors and Natural Components will allow clearly observing the trends in risk prioritization and promptly making decisions on their neutralization or minimizations of the impact on economic activity. Climate risk management based on the precautionary principle will simplify modelling the impact of changes in the short and long term, which will facilitate early adaptation measures and the creation of reserves to cover losses due to the occurrence of difficult to manage and/or unmanageable climate risks.

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УПРАВЛІННЯ КЛІМАТИЧНИМИ РИЗИКАМИ БІЗНЕСУ ЗА ПРИНЦИПОМ ЗАСТЕРЕЖЕННЯ

Григор'єва О.В.

Констатовано, що функціонування бізнесу в мінливому середовищі, пов'язаному із загостренням кліматичної кризи, потребує підвищеної уваги до невизначеності, ідентифікації та нейтралізації можливих кліматичних ризиків, які можуть негативно вплинути на його функціонування та подальший розвиток, а також на вжиття заходів з адаптації до змін клімату. Підкреслено, що адаптація до зміни клімату є процесом пристосування бізнесу у відповідь на фактичні або очікувані деструктивні кліматичні впливи, який дозволяє знизити їх негативні наслідки та скористатися сприятливими можливостями. Наголошено, що кліматичні ризики важко передбачити через їх радикальну невизначеність та унікальні властивості, включаючи непередбачуваність, складність прогнозування, складну динаміку та ефекти ланцюгової реакції. До того ж, кліматичні ризики демонструють незворотність і нелінійність, тож навіть незначні зміни клімату можуть призвести до значних і навіть катастрофічних наслідків для бізнесу. Відтак, управління кліматичними ризиками бізнесу має вирішальне значення, оскільки вплив вторинних ефектів може вплинути на діяльність компанії,

призводячи до фінансових втрат через коливання вартості активів. Обґрунтовано, що прогнозування кліматичних ризиків бізнесу має базуватися на результатах вивчення передісторії надзвичайних ситуацій природного характеру, які мали вплив на життєздатність бізнесу у попередні роки та результатах оцінювання його вразливості до зміни клімату. Розглянуто методи оцінювання кліматичних ризиків бізнесу, адаптовані до застосування в українській практиці. Здійснено пошук шляхів управління кліматичними ризиками бізнесу за принципом застереження. Доведено, що запропоновані доповнення до Методичних рекомендацій щодо оцінки ризиків і вразливості до зміни клімату в соціально-економічних секторах і природних компонентах дозволять чітко спостерігати тенденції пріоритетності кліматичних ризиків і оперативно приймати рішення щодо їх нейтралізації або мінімізації їх впливу на економічну діяльність. Водночас спростять моделювання впливу змін клімату на бізнес у короткостроковій та довгостроковій перспективі, що сприятиме завчасному вжиттю адаптаційних заходів та створенню резервів для покриття втрат внаслідок виникнення важко керованих та/чи некерованих кліматичних ризиків.

Ключові слова: кліматична криза, кліматичні ризики, політика адаптації до змін клімату, фізичні ризики, ризики відповідальності, перехідні (транзитні) ризики.

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The article states that the functioning of business in a changing environment associated with the aggravation of the climate crisis requires increased attention to uncertainty, identification and neutralization of possible climate risks that may adversely affect its functioning and further development, as well as the implementation of measures to adapt to climate change. It is emphasized that adaptation to climate change is a process of business adaptation in response to actual or expected destructive climate impacts, which allows to reduce their negative effects and take advantage of favorable opportunities. It is emphasized that climate risks are difficult to predict due to their radical uncertainty and unique properties, including unpredictability, difficulty of forecasting, complex dynamics and chain reaction effects. In addition, climate risks are irreversible and non-linear, so even minor climate change can lead to significant and even catastrophic consequences for businesses. Therefore, managing business climate risks is crucial, as the impact of secondary effects can affect the company's operations, leading to financial losses due to fluctuations in asset values. It is substantiated that forecasting of climate risks to business should be based on the results of studying the background of natural disasters that have affected the viability of business in previous years and the results of assessing its vulnerability to climate change. The methods for assessing climate risks to business, adapted for use in Ukrainian practice, are considered. A search for ways to manage business climate risks on the basis of the precautionary principle is carried out. It is proved that the proposed additions to the Methodological Recommendations for Assessing Risks and Vulnerability to Climate Change in Socio-Economic Sectors and Natural Components will allow clearly observing the trends in the priority of climate risks and promptly making decisions on their neutralization or minimization of their impact on economic activity. At the same time, they will simplify modelling of the impact of climate change on business in the short and long term, which will facilitate early adaptation measures and the creation of reserves to cover losses resulting from the occurrence of difficult to manage and/or unmanageable climate risks.

Keywords: climate crisis, climate risks, climate change adaptation policy, physical risks, liability risks, transitional (transit) risks.

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