

REVIEW PAPER

Business Adaptation to Climate Change: Developing Strategies to Adapt Business Processes to Changing Climate Conditions and Reduce Risks

Iryna Maksymova^{1*}, Vitalii Velhas², Anastasiia Tokunova³, Mykola Pugachov⁴ and Kseniia Chichulina⁵

¹Department of International Relations, State University of Economics and Technology, Kryvyi Rih, Ukraine

²Interregional Academy of Personnel Management, Kyiv, Ukraine

³Department of Economic and Legal Studies of the Economic Security Problems, State Organization "V. Mamutov Institute of Economic and Legal Research of the National Academy of Sciences of Ukraine", Kyiv, Ukraine

⁴Food Department, Institute of Agrarian Economics, Kyiv, Ukraine

⁵Department of Economics, Entrepreneurship and Marketing, National University "Yuri Kondratyuk Poltava Polytechnic", Poltava, Ukraine

*Corresponding author: maksymova_ii@kneu.dp.ua (ORCID ID: 0000-0001-9754-0414)

Received: 11-06-2024

Revised: 25-08-2024

Accepted: 06-09-2024

ABSTRACT

Currently, there is a growing global trend of climate change, resulting in an increase in increasing extreme weather events. These changes can cause significant damage to infrastructure, rendering their operation impossible. The purpose of this article is to develop a strategy for adapting business processes to climate change and reducing risks. The research employed various methods including analysis, synthesis, induction, deduction, systemic, legal, and systemic-analytical, as well as systemic-structural. The study focuses on the development of climate change adaptation strategies for businesses, emphasizing the importance of proactive planning and understanding specific climate risks. The findings indicate that a strategy for adapting business processes to climate change and mitigating associated risks assists in identifying the required adaptation solutions, particularly in light of the uncertainty surrounding the extent of climate change and its impacts. By employing a systematic framework, the strategy allows for the integration of updated information and consideration of evolving socio-economic conditions. Importantly, the adaptation strategy formulated in this study can be seamlessly integrated into enterprise management practices, offering qualitative advantages in enhancing the stability of specific business processes post-implementation of the proposed measures. The research clarifies that adaptability is an inherent aspect of business structures. This is why in order to ensure their functioning and development, they must align with their entrepreneurial goals and be able to easily adapt to changing external conditions. It is important to include an assessment procedure of available resources (finances, goods) and resources (investments, innovations) necessary for the implementation of the adaptation strategy when choosing measures to implement the strategy of change for risk reduction and climate change.

HIGHLIGHTS

- ① Business adaptation is essential in achieving positive social and environmental change due to the growing role of digitalization in the relationship between climate change and human rights.
- ② The impact on society is multifaceted because business adaptation is essential to achieving positive social and environmental change due to the growing role of digitalization in the relationship between climate change and human rights.

Keywords: Adaptation strategy, risk reduction, Green bonds, green bond market, environmental projects, social responsibility of business

How to cite this article: Maksymova, I., Velhas, V., Tokunova, A., Pugachov, M. and Chichulina, K. (2024). Business Adaptation to Climate Change: Developing Strategies to Adapt Business Processes to Changing Climate Conditions and Reduce Risks. *Econ. Aff.*, 69(03): 1299-1309.

Source of Support: None; **Conflict of Interest:** None



Climate change is a significant global issue that affects the sustainable functioning of natural and economic spaces. It is important to acknowledge that the level of awareness regarding climate change and its specific adaptation challenges is limited among society and stakeholders. This is due to the uncertainty surrounding the level of temperature rise, the regulatory pathways that will be chosen by the Ukrainian government, and the potential impact on the financial performance of businesses, economic sectors, and markets. Therefore, assessing the vulnerability of business processes to these changes is uncertain.

The development of general recommendations for adaptation within respective industries by participants in the economic segment is a significant achievement towards successfully adapting their business processes to future changes (Ivanyuta *et al.* 2020). Thus, extreme weather events can have significant consequences, such as the deterioration of financial assets or worsening working conditions for employees, which can affect the economic prosperity of the country. These risks can have either direct or indirect impacts, such as directly affecting the activities of a particular enterprise or causing disruptions in markets and logistics.

The development of strategies for adapting business processes to climate change and reducing risks is currently gaining relevance.

The purpose of this article is to devise tactics for adjusting business processes to changing climate conditions and reducing risks.

The research objectives include to define the essence of the strategy of business process adaptation to climate change and risk reduction:

- ♦ to characterize the key positions of the strategy of business processes adaptation to climate change and risk reduction
- ♦ to conduct a SWOT analysis of the impact of climate change to develop an adaptation strategy;
- ♦ to disclose the issues of stakeholder engagement on climate change and risk reduction.

LITERATURE REVIEW

A significant contribution to the study of the development and implementation of enterprise

adaptation strategies, particularly in the context of climate change, has been made by domestic and foreign scholars, including notable figures such as Arefieva, Basiuk, Bilykh, Holych, Honchar, Zhukova, Ivaniuta, Kyrylenko, Kolomiets, Kostetska, Kruhlova, Malynovska, Manyk, Nechyporenko, Nikolaienko, Prots, Tkachenko, Chorna, Yakovenko, Yakushenko, Izaguirre, Losada, Camus, Vigh, Stenek, and others.

For example, Holych (2021) conducted research on enterprise adaptation as a sustainable process involving adjustment. She stated that it begins with the establishment and ends with the liquidation of a legal entity, aiming to achieve efficiency and stability in enterprise operations through strategic adaptive actions. The theory of adaptation that underlies her research makes it possible to understand the process of interaction between an enterprise and the environment, identify key success factors, and determine strategic directions for development.

Yakovenko (2020) notes that strategy is a system of activities that ensures balance and equilibrium in the execution of internal processes through specially designed tools, aiding the enterprise in achieving its objectives. In the study, the theory of strategic management defines the key principles of strategy formation, the methods of their implementation, and the effectiveness of their implementation to achieve competitive advantage and sustainable development for the enterprise.

Kostetska (2020) characterizes strategic planning of enterprise activities as a set of actions necessary to maintain market position in competitive conditions and to implement adaptation capabilities for new societal challenges and changes in the external environment. The study is based on the theory of strategic planning, which defines the principles of forming strategic goals, analyzing the competitive environment, and choosing optimal development strategies to achieve the successful competitiveness of an enterprise.

Zhukova (2021), examining comprehensive enterprise strategy, emphasizes the importance of analysing various alternative decisions regarding all business processes within the enterprise, and accordingly developing strategic sets for each stage of enterprise operation. The theory of integrated strategic management defines methods

for integrating strategic goals and analyzing alternative ways to achieve success.

Chorna (2022) studied business processes and noted that they are unique to an organization. These processes are revealed through the systematic and sequential separation of specific operational tasks, resulting in the desired outcome. Based on the theory of business process management, the paper identifies methods of organizing and optimizing processes to achieve efficiency and effectiveness.

Shkurenko and Chorna (2023) focus on the tool for revealing development opportunities and analysing innovations, such as implementing measures for adaptation to changes, in their study of the peculiarities of enterprise development strategy in modern conditions. The study's authors draw on the concept of strategic management to examine tactical approaches for adapting, with the goal of ensuring the long-term viability of a business.

Prots (2018) highlights the significance of implementing measures to develop individual adaptation potential for each enterprise in the context of climate security issues. It is important to consider the existing and potential resources required for this purpose. Based on the theory of strategic resource management, the author emphasizes the importance of an individual approach to adaptation strategies for each enterprise.

Tkachenko, Lytvyn, Reshetchenk, and Olenyk (2022) characterize the risks associated with climate change, drawing on the theories of risk management and climate adaptation. They note that such changes generate 'secondary' threats, such as floods, droughts, fires, and other emergencies, which need to be considered when developing appropriate adaptation strategies.

Nikolaenko, Khmara and Manyk (2022) describe the impact of climate risks on the transport sector and emphasize its crucial role in any enterprise. They argue that the threat to the transport sector extends to all enterprises and infrastructure facilities. The authors utilize the theories of risk management and strategic management to scrutinize the impact of climate risks on the transportation sector and contemplate potential adaptation strategies to ensure the resilience of enterprises.

Romanko (2019) investigated the eco-legal aspects of state policy regarding climate change, using

the theories of environmental and legal regulation and strategic management. The author notes that the current legal framework to counteract these changes is minimally implemented locally, resulting in a lack of basic programs to adapt enterprises to new conditions. The approved Strategy for Environmental Security and Climate Change Adaptation until 2030 (Decree of the Cabinet of Ministers of Ukraine, 2021) lacks the necessary measures to counteract the researched changes. However, the development of adaptation strategies for business processes to climate change and risk reduction has not received adequate attention.

RESEARCH METHODS

This study adopts a comprehensive approach to developing adaptation strategies for businesses amidst climate change challenges, highlighting the significance of proactive planning and tailored risk assessment. The research population encompasses businesses and enterprises vulnerable to climate change impacts. Sampling involves a meticulous review of literature and regulatory documents pertinent to business adaptation strategies. The sample size of the research is determined by the breadth and depth of the available literature on climate change adaptation strategies. It encompasses a diverse array of sources, including academic journals, policy documents, reports, and case studies. Data collection entails a multifaceted approach, incorporating literature reviews, case studies, and the analysis of existing adaptation strategies to ensure a comprehensive understanding of the subject. The deduction method was applied to analyze the level of emissions per person, highlighting the accounting nature of emissions based on relative population size. The study employed contrasting approaches, considering both total and cumulative emissions, yielding notably different results. The sample size was determined based on the emissions per individual for the top five countries. Qualitative methods, notably SWOT analysis, are employed to scrutinize the effects of climate change on businesses and formulate tailored adaptation strategies. The findings are meticulously interpreted to discern critical vulnerabilities, capitalize on opportunities, and address inherent strengths and weaknesses. Acknowledged limitations include the inherent

uncertainty surrounding climate change projections, variability in business adaptability, and constraints in resource allocation for implementing adaptation measures. Furthermore, the efficacy of adaptation strategies may be contingent upon contextual factors and industry-specific nuances.

RESEARCH RESULTS

Businesses face the important task of adjusting their strategic plans to adapt to climate change. The problem is complex and does not have a simple solution. To do so, they must demonstrate flexibility and agility in responding to new challenges and actively mobilize their capabilities and resources to meet consumer needs. This is because they must align with their entrepreneurial goals and easily adapt to changing external conditions in order to ensure their functioning and development (Zghurska *et al.* 2022).

As Holych (2021) rightly emphasizes, business structures possess inherent adaptability. Adapting to change is a key strategy for businesses, enabling them to remain competitive both externally and internally. The strategy for adapting business processes to climate change should consist of a register of pre-existing solutions related to emerging risks due to climate change. This register should encompass a wide range of potential threats that could destabilize the operations of a specific enterprise. The sources cited (Maryuk *et al.* 2021; Bilykh & Dunska, 2022) provide valuable insights into this topic. Moreover, it is important to consider the potential of the business structure and material resources for implementation.

In 2021, Carbon Brief conducted a global study of per person emissions of hazardous substances. The issue of accounting for the relative size of the

population is approached in two different ways, considering, on the one hand, total and, on the other hand, cumulative emissions (Table 1).

One conspicuous observation arising from the population analysis is the noticeable omission of several major emitters among the top 5, notably China, India, Brazil, and Indonesia, from the presented data table. Despite their significant contributions to the global cumulative emissions, these nations boast substantial populations, consequently mitigating their per capita emissions impact. Remarkably, these four nations collectively represent 42% of the global populace, yet their combined contribution to cumulative emissions amounts to a mere 23% (Evans, 2021).

Digitalization is crucial for accelerating the climate movement. The process of digital transformation involves the transition to digital technologies across all areas of activity, and plays a key role in the implementation of strategic measures to combat climate change (Hrustek, 2020). Digitalization has a great potential to achieve climate neutrality aimed at mitigating the effects of climate change through the neutralization of carbon emissions. It is impossible to avoid CO₂ emissions, especially given the size and environmental intensity of industrial complexes. According to Maris & Flouros (2021), carbon emissions in each country depend on the main sectors of the national economy and their specializations (Maris & Flouros, 2021). In China, for example, up to 70% of greenhouse gas emissions are caused by the widespread use of solid fuels and energy sources in the manufacturing sector. Similar trends are observed in Ukraine, where this figure is 52%. In addition, in Uzbekistan, Armenia, and Switzerland, up to 33% of CO₂ emissions come from households, both private and commercial, as well

Table 1: These approaches produce markedly different results, emphasizing the complexity of interpreting cumulative per person emissions

Rank	Country	Cumulative emissions per population in 2021, tCO ₂	Rank	Country	Cumulative per capita emissions, tCO ₂
1	Canada	1,751	1	New Zealand	5,764
2	United States	1,547	2	Canada	4,772
3	Estonia	1,394	3	Australia	4,013
4	Australia	1,388	4	United States	3,820
5	Trinidad and Tobago	1,187	5	Argentina	3,382

Source: Compiled by the author based on (Evans, 2021).

as public services. The current circumstances make it possible to achieve climate neutrality by reducing the volume of environmentally harmful production in the country as well as its gradual transformation (Maksimova & Kurylyak, 2022).

In today's business paradigm, given the drive for sustainable development and the need to adapt to the negative impacts of climate change, the strategy of dual digital and green transition is becoming a priority for businesses. This concept is based on the integration of digital technologies with green initiatives to achieve competitiveness and reduce negative environmental impacts. As an example, the utilization of digital technologies, including a mini-CHP plant equipped with a gas turbine and a heat recovery boiler, as well as the automated control of heating and air conditioning systems, has significantly reduced expenses and enhanced the efficiency of the "Land Rover" SUV production facility (TIC Ukraine, 2022). This approach allows businesses not only to adapt to climate change, but also to ensure sustainable and cost-effective development in line with modern environmental requirements and challenges. The dual digital-green transition encompasses a number of strategies and methods aimed at optimizing and efficiently using resources. The collection, analysis and utilization of substantial quantities of data pertaining to climate change and environmental indicators are enabled by digital technologies. This transition presents an opportunity to accurately monitor the environment, anticipate changes, and devise efficient measures to mitigate the adverse effects of climate change on business. This will help reduce CO₂ emissions and conserve energy resources (Dziamulych & Reikin, 2024).

The development of environmentally sustainable initiatives can be ensured through the issuance of green bonds and support for the relevant projects financed by them. The establishment and implementation of a green bond market facilitates the adoption of environmentally friendly technologies and practices, thereby aiding in the adaptation to climate change and the digital-green transition. For example, in Ukraine, the legal framework for the introduction and development of the green bond market was created in 2022 (Verkhovna Rada of Ukraine, 2022) and provides for financing the implementation of environmental projects.

The goal of the adaptation strategy is formulated based on the desired outcomes of the changes. Specific priorities for implementing concrete measures regarding business processes should be identified, and corresponding parameters (temporal and quantitative) should be established to be implemented in conditions of the most probable risks. The strategic objectives include improving the organizational policy to adapt to climate change at all stages of activity, strengthening institutional capacity through expertise, monitoring, and training to support adaptation activities, and creating conditions for resilience to climate change by strengthening management mechanisms and protecting infrastructure objects as much as possible (Nechiporenko, 2020). It is important to note that these objectives are aimed at achieving a balanced approach without bias towards any particular perspective. To reduce risks and adapt to climate conditions, it is important to assess available resources such as finances and goods, as well as investments and innovations necessary for implementing the adaptation strategy.

The strategy's key pillars include the following:

1. **Risk management:** Climate change poses a huge list of risks to business structures, ranging from material to logistical obstacles. This requires each company to assess the risks it may face in the context of global natural changes to help develop adaptation plans that take into account possible threats (Sumets *et al.* 2022).
2. **Sustainability of business structures:** Searching for new, even environmentally friendly, models for business activities, abandoning the traditional approach in favour of a "circular" approach will allow to retain resources for the longest time.
3. **Adaptation of business organisation:** Looking ahead, it is advisable to take measures for future adaptation now, to consider opportunities to change the location of the enterprise, placement and implementation of certain business processes, working methods, development of new goods or services (Hrinchenko *et al.* 2023).
4. **Cooperation with other business structures and stakeholders:** It is important to emphasise

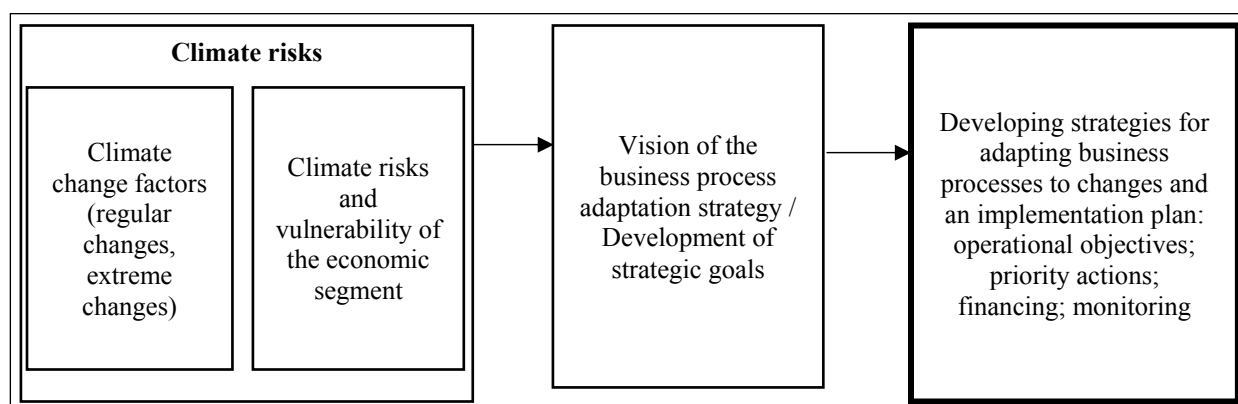
that no company can cope with climate change alone, and therefore, in order to successfully overcome these problems, it is necessary to cooperate with these entities (Sytnyk *et al.* 2022).

Business adaptation to climate change and business respect for human rights, including environmental rights, are becoming an integral part of modern corporate responsibility. The present strategy for the sustainable development of Ukraine is based on a method of thinking that emphasizes the importance of safeguarding the environment and generating revenue, while simultaneously ensuring that all individuals are provided with the necessities of the present and the future. In general, the concept of sustainable development is based on the principles of responsibility for the future, equality of opportunities, balance between the economy and the environment, and harmonization of population growth with natural resources (UNDP Ukraine, 2017). It is imperative that economic growth does not disrupt the ecosystem, as environmental sustainability holds the key to positive growth. This entails raising awareness of the impact of business on environmental sustainability and the living conditions of society. It is important to consider the human right to life and a healthy environment when developing a socially and environmentally responsible business. Therefore, businesses are actively implementing environmentally sustainable technologies and using renewable energy sources to reduce emissions of harmful substances. At the same time, businesses must adhere to social responsibility and avoid using low-paid labor and

harmful materials (Klarin, 2018). This approach ensures not only the success of the company but also the well-being of society as a whole.

The key positions identified should form the basis for developers of adaptation strategies. These strategies will be successful if they are prepared in advance (Fig. 1). It is important to note that stakeholders (Wang *et al.* 2020) must fully understand climate risks specific to their territories and infrastructure, and therefore, know how to reduce the level of impact and uncertainty. Adaptation measures should include the development of a strategy and implementation plan. These should consider temporal and substantive changes in natural phenomena and analyse possible consequences for socio-economic, climate, and technological spheres (Gonchar, 2023).

It is important to note that the development of adaptation strategies is typically based on cost and outcome analysis in the context of slow climate changes. This is particularly relevant for complex technical systems such as structures and equipment, as well as information systems with short lifecycles. The strategy's components involve a gradual approach, dividing relevant business processes into mini-cycles (Snizhko *et al.* 2021), which are applied under specific climate risks. However, decision-making may be untimely due to forecast uncertainty regarding the manifestation of specific types of risks (Grosul *et al.* 2017). By assessing the vulnerability of the enterprise to meteorological phenomena such as floods, hurricane winds, snowstorms, and high environmental temperatures (Arefieva *et al.* 2022), potential risks for relevant business processes can



Source: Formulated by the author.

Fig. 1: Key elements for developing a climate change adaptation strategy

Table 2: Global E-commerce Growth Forecast

Strengths	Weaknesses
1. Concentration on the core business, which is the most profitable for the business structure 2. Expanding the scope of training 3. The ability to be flexible and respond quickly to market changes and internal factors 4. Maximum proximity to the consumer	1. Dependence on a centralised power supply 2. Use of water as a cooling element 3. Quality of raw materials; presence of pests and diseases 4. Dependence on water resources 5. Dependence on transport logistics
Opportunities	Threats
1. Uniting enterprises in the same industry to overcome problems 2. State support for business structures through the creation of legal frameworks and financial support	1. Risks of changes in electricity supply 2. Risks of flooding, flooding of crop fields 3. The risk of reduced water resources; etc

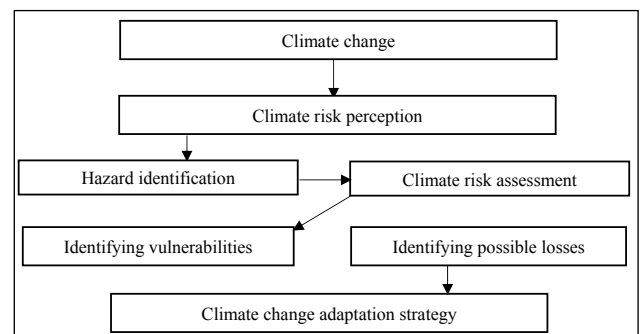
Source: Author's own conception.

be identified. This forms the basis for strategy development. The next step involves analysing existing adaptation options and formulating a program to implement necessary measures.

A basic SWOT analysis template for the impact of climate change on adaptation strategy development (Table 2) is provided. When conducting this analysis, a specific business structure should be developed it considering each type of climate impact. The criteria for this analysis include temperature increase, wind speed, and increase or decrease in precipitation. Therefore, it is important to highlight the benefits of climate change impact as a means of gaining a competitive advantage, such as creating new products (Basok *et al.* 2021). Weaknesses can be addressed by investing in energy-efficient sources or developing more efficient products or services to mitigate the negative effects of climate change. The results of implementing the adaptation strategy for each enterprise are unique and depend on the plan's content. The plan may involve either radical innovative changes in business processes or slow and stable measures (Mironova *et al.* 2022).

Research on the SWOT analysis of the impact of climate change for the development of an adaptation strategy has shown that in the short term, the changes will be minimal but are expected to increase in the long term (Tymoshenko *et al.* 2022). Therefore, their impact on business processes may gradually escalate and adapt (Izaguirre *et al.* 2021). Identified weaknesses indicate a complete reliance on centralized water and electricity systems. This issue could potentially be resolved by implementing autonomous renewable energy power stations and water resource storage systems

(Dvigun *et al.* 2022a). Furthermore, as the Earth's temperature increases, the climate becomes drier, which affects the quality of cultivated raw materials, increases pest infestations, and causes various plant diseases to occur more frequently. However, it is important to note that all business process chains are directly dependent on transportation logistics (Chobitok & Shelest, 2021). Therefore, any disruption to transportation logistics could lead to a complete halt in business operations. Implementing measures to protect transportation infrastructure requires significant investment in the short term (Mahpour, 2021; Trypolska, 2023). However, this investment will help prevent substantial expenses in the future for re-equipping. Simultaneously, it is advisable to evaluate the cost-effectiveness of the implemented adaptation measures in relation to the projected benefits.



Source: Author's own conception.

Fig. 2: Scheme of forming a strategy for adaptation to climate change

Studies have shown that climate change significantly increases the probability of hazardous natural phenomena, which can cause severe emergencies that endanger human life and health, disrupt

transportation logistics, cause material losses, and even environmental damage (Dvigun *et al.* 2022b). The strategy's adaptation measures should be reviewed and updated, considering forecasts of hazards, vulnerabilities of specific objects, and socio-economic consequences (Fig. 2).

In this context, developing strategies for adapting business processes to climate change and risk reduction requires fostering interaction among stakeholders. These stakeholders include business owners, public authorities, local government bodies, civil society organizations, and other external entities. It is important to ensure that all stakeholders are involved in the process. This research outlines a plan of action to protect infrastructure assets during extreme weather conditions. For instance, hurricane winds may cause damage to power lines, leading to power outages. Similarly, transportation routes may be disrupted due to tree collapses and snowstorms (Kyrylenko *et al.* 2020). Therefore, businesses armed with information about their vulnerabilities can comprehensively assess and identify the most significant threats and circumstances that need to be minimized in the short term for further adaptation activities. Collaborative efforts among business structures and other stakeholders will contribute to mitigating negative impacts and forming the basis for developing proactive strategies to overcome potential threats.

Therefore, it can be concluded that climate change acts as a catalyst for developing strategies to adapt business processes and define goals for risk mitigation. The adaptation strategy should include an implementation plan that outlines actions for each type of risk associated with climate change. It is important to note that financial support is a constraining factor in implementing such strategies, which businesses allocate towards addressing threats.

DISCUSSION

To prevent maladaptation, it is crucial to conduct an objective assessment of options in both the short and long term. The implementation plan for adapting business processes should be carried out sequentially, reducing the overall risk level to an acceptable level due to climate change with each step. However, the adaptation strategy differs from the traditional approach to executing action plans.

It is triggered for implementation over time only when the climate risk reaches a certain threshold (defined for the organization as a red line), which is determined through predictive assessments and meteorological condition monitoring processes (Kryvokhyzha *et al.* 2023). Once the appropriate measures for adapting to climate change and reducing risks have been selected, they can be implemented according to the execution plan. The evaluation of the effectiveness of these measures influences each subsequent stage, enhancing the quality of the results (Maksymova *et al.* 2023; Maksymova, 2023).

In summary, the assessment of potential outcomes from implementing the strategy for adapting business processes to climate change and risk reduction involves the following: the strategy is a useful tool for raising awareness among business structures about threats from climate change and the need for management processes of appropriate adaptation measures. Currently, organizations do not prioritize addressing issues related to meteorological phenomena, as they are focused on achieving entrepreneurial goals. There is no software available that could forecast strategic measures and calculate the costs of adapting businesses to climate change.

CONCLUSION

Therefore, a strategy for adapting business processes to climate change and mitigating risks is developed based on a SWOT analysis. This analysis helps to identify the necessary adaptation solutions, given the uncertainty of the scale of climate change and its consequences. The use of a consistent framework enables the incorporation of updated information and consideration of new socio-economic conditions. The adaptation strategy developed in the study can be integrated into the enterprise management process. This will provide qualitative advantages in the stability of specific business processes after the implementation of proposed measures.

The study introduces a novel approach to developing adaptation strategies for businesses facing climate change challenges. It outlines four key pillars: risk management, sustainability, organizational adaptation, and stakeholder cooperation. Practically, it provides actionable insights for businesses to enhance resilience and mitigate environmental

impact. Socially, it emphasizes businesses' responsibility in promoting sustainability and respecting human rights. Overall, the study demonstrates the importance of aligning business operations with sustainable development goals and engaging stakeholders to address climate-related risks.

REFERENCES

- Arefieva, O., Vovk, O. and Dmytryk, Kh. 2022. Strategic guidelines for realizing the innovative potential of transport enterprises in economic recovery. *Eastern Europe: Economy, Business and Management*, **36**: 40-44. <https://srd.pgasa.dp.ua:8080/handle/123456789/9808> Last Accessed on 15th July, 2024.
- Basok, B., Bazylev, Ye. and Kuraieva, I. 2021. Adaptation of municipal heat energy to climate change. *Bulletin of the National Academy of Sciences of Ukraine*, **4**: 60-75. <https://doi.org/10.15407/visn2021.04.060> Last Accessed on 13th July, 2024.
- Bilykh, M. and Dunska, A. 2022. *Features of development strategy of the enterprise on the international market*. III International scientific and practical conference "Business, innovation, management: problems and prospects". <https://confmanagement.kpi.ua/proc/article/view/271410> Last Accessed on 21st April, 2024.
- Chobitok, V. and Shelest, T. 2021. Management system of industrial enterprises in the context of innovative development: scientific and practical aspects of evaluation. *Problems of Economy*, **2**(48): 169-180. https://www.problecon.com/export_pdf/problems-of-economy-2021-2_0-pages-169_180.pdf Last Accessed on 21st April, 2024.
- Chorna, N. 2022. Theoretical aspects of the business processes concept, its classification in the activities of enterprises. *Economy and Competitiveness Enterprises*. <https://inneco.org/index.php/innecoua/article/view/974> Last Accessed on 21st April, 2024.
- Decree of the Cabinet of Ministers of Ukraine on the Approval of the Strategy for Environmental Safety and Adaptation to Climate Change for the Period Until 2030, 1363 (2021). <https://zakon.rada.gov.ua/laws/show/1363-2021-p#Text> Last Accessed on 1st May, 2024.
- Dvigun, A.O., Datsii, O.I., Levchenko, N.M., Shyshkanova, G.A. and Dmytrenko, R.M. 2022. Rational use of fresh water as a guarantee of agribusiness development in the context of the exacerbated climate crisis. *Science and Innovation*, **18**(2): 85-99. <https://doi.org/10.15407/scine18.02.085> Last Accessed on 1st May, 2024.
- Dvigun, A., Datsii, O., Levchenko, N., Shyshkanova, G., Platonov, O. and Zalizniuk, V. 2022. Increasing ambition to reduce the carbon trace of multimodal transportation in the conditions of Ukraine's economy transformation towards climate neutrality. *Science and Innovation*, **18**(1): 96-111. <https://doi.org/10.15407/scine18.01.096> Last Accessed on 1st May, 2024.
- Dziamulych, M. and Reikin, Yu. 2024. Dual digital and green transition in the context of forming a sustainable economic system. *Economy and Society*, **61**: 1-6. <https://doi.org/10.32782/2524-0072/2024-61-62> Last Accessed on 21st May, 2024.
- Evans, S. 2021. Analysis: Which countries are historically responsible for climate change?. Carbon Brief. <https://www.carbonbrief.org/analysis-which-countries-are-historically-responsible-for-climate-change/> Last Accessed on 1st May, 2024.
- Gonchar, O. 2023. *Prerequisites and peculiarities of development paradigms of the new economy under the conditions of global challenges*. Problems and prospects of business development in Ukraine. III International science and practice conf. of young scientists and students. Lviv, Ukraine. <https://www.lute.lviv.ua> Last Accessed on 21st May, 2024.
- Grosul, V., Kruglova, O. and Rachkovan, O. 2017. Justification of directions of adaptive development of the enterprise. *Financial and Credit Activity: Problems of Theory and Practice*, **22**: 151-157. <https://doi.org/10.18371/fcaptive.v1i22.109942>.
- Holych, N. 2021. *Adaptive development strategies of small businesses in the food industry in a decentralized environment*. (Dissertation of Ph.D in Economics). Ternopil Ivan Puluj National Technical University of the Ministry of Education and Science of Ukraine. <http://elartu.tntu.edu.ua/handle/lib/35047>.
- Hrinchenko, H., Trishch, R., Mykolaiko, V. and Kovtun, O. 2023. *Qualimetric approaches to assessing sustainable development indicators*. E3S Web of Conferences, 408. <https://doi.org/10.1051/e3sconf/202340801013> Last Accessed on 19th May, 2024.
- Hrustek, L. 2020. Sustainability Driven by Agriculture through Digital Transformation. *Sustainability*, **12**(20): 85-96. <https://doi.org/10.3390/su12208596> Last Accessed on 17th May, 2024.
- Ivanyuta, S., Kolomiets, O., Malinovska, O. and Yakushenko L. 2020. *Climate change: consequences and adaptation measures: analytic report*. Kyiv: NISD https://niss.gov.ua/sites/default/files/2020-10/dop-climate-final-5_sait.pdf Last Accessed on 17th May, 2024.
- Izaguirre, C., Losada, I., Camus, P., Vigh, J. and Stenek, V. 2021. Climate change risk to global port operations. *Nature Climate Change*, **11**: 14-20. <https://doi.org/10.1038/s41558-020-00937-z> Last Accessed on 17th May, 2024.
- Klarin, T. 2018. The Concept of Sustainable Development: From its Beginning to the Contemporary Issues. *Zagreb International Review of Economics & Business*, **21**(1): 67-94. <https://doi.org/10.2478/zireb-2018-0005> Last Accessed on 17th June, 2024.
- Kostetska, N. 2020. Strategic planning of enterprises activities: theoretical aspects innovative economy. *Scientific and Industrial Magazine*, **7-8**: 65-71. <https://inneco.org/index.php/innecoua/article/view/676> Last Accessed on 17th June, 2024.
- Kryvokhyzha, Y., Komandrovskaya, V., Horiunova, K., Grytsyshen, D., Sergiienko, L. and Krap, A. 2023. The

- relationship between environmental issues and economic development: Transition to sustainable development of economic systems. *Review of Economics and Finance*, **21**: 1497–1505. <https://doi.org/10.55365/1923.x2023.21.165> Last Accessed on 17th May, 2024.
- Kyrylenko, O., Basok, B., Bazeyev, Ye and Blinov, I. 2020. Power industry of Ukraine and realities of the global warming. *Technical Electrodynamics*, **3**: 52-61. <https://doi.org/10.15407/techned2020.03.052> Last Accessed on 17th May, 2024.
- Maksimova, I. and Kurylyak, V. 2022. Digitalization of the global industry in the context of climate neutrality. *J European Economics*, **21**(3): 353-370. <https://jeej.wunu.edu.ua/index.php/ukjee/article/view/1609> Last Accessed on 17th June, 2024.
- Maksymova, I. 2023. Digitalization-based integration of climate policies of Ukraine and the EU. *J. European Economy*, **22**(1): 94-110.
- Maksymova, I., Mietule, I. and Kulishov, V. 2023. *Digital Solutions for a Climate Neutral Economy: Int Framework of Eco-Digital Projects*. Environment. Technologies. Resources. Proceedings of the International Scientific and Practical Conference, **1**: 123-127.
- Mahpour, A. 2021. Incorporating Climate Change in Pavement Maintenance Policies: Application to Temperature Rise in the Isfahan County, Iran. *Sustainable Cities and Society*, **71**. <https://doi.org/10.1016/j.scs.2021.102960> Last Accessed on 17th May, 2024.
- Maris, G. and Flouros, F. 2021. The Green Deal, national energy and climate plans in Europe: Member states' compliance and strategies. *Administrative Sciences*, **11**(3): 1-17. <http://dx.doi.org/10.3390/admsci11030075> Last Accessed on 17th May, 2024.
- Maryuk, O., Zhavzharova, T., Tsygryk, M., Kolishevskiy, E., Skidanyuk, M. and Fursik, O. 2021. Climate change and climate adaptation All-Ukrainian sociological survey and recommended measures for adaptation to climate change. International Foundation "Renaissance" with the financial support of Sweden. https://ua.boell.org/sites/default/files/2021-12/Zmina-klimaty-ta-klimatuchna-adaptacia_oputyvannia-UCN.pdf Last Accessed on 19th May, 2024.
- Masyk, M., Buryk, Z., Radchenko, O., Saienko, V. and Dziurakh, Y. 2023. Criteria for Governance Institutional Effectiveness and Quality in the Context of Sustainable Development Tasks. *Int. J. Quality Res.*, **17**(2): 501-514. <https://doi.org/10.24874/IJQR17.02-13> Last Accessed on 21st May, 2024.
- Mironova, N., Koptieva, H., Liganenko, I., Sakun, A. and Chernyak, D. 2022. Modelling the selection of innovative strategy for development of industrial enterprises. *WSEAS Transactions on Business and Economics*, **19**: 278-291. <https://doi.org/10.37394/23207.2022.19.26> Last Accessed on 17th May, 2024.
- Nechiporenko, O. 2020. Management of the risks of global climate change in the agro-industrial complex of Ukraine. *Economy of Agro-Industrial Complex*, **4**: 6-16. <https://doi.org/10.32317/2221-1055.2020040066> Last Accessed on 15th May, 2024.
- Nikolaenko, I., Khmara, M. and Manyk, I. 2022. *Strategic approach to climate risks in transport*. Collection of scientific works of the Dnipro National University of Railway Transport named after academician V. Lazaryan "Transport systems and transportation technologies", **23**: 29-37. <https://doi.org/10.15802/tstt2022/261648> Last Accessed on 17th May, 2024.
- Prots, N. 2018. Climate security: the essence and necessity of financial support. *Economic Journal of Lesya Ukrainka East European National University*, **1**: 142-148. <https://doi.org/10.29038/2411-4014-2018-01-142-148> Last Accessed on 17th May, 2024.
- Romanko, S. 2019. Environmental and legal policy of Ukraine in the field of climate change. *Entrepreneurship, Economy and Law*, **9**: 88-94. <https://doi.org/10.32849/2663-5313/2019.9.15> Last Accessed on 19th May, 2024.
- Shkurenko, O. and Chorna, N. 2023. Innovative strategy of enterprise development in conditions of adaptation to modern challenges. *Adaptive Management: Theory and Practice. Economics Series*, **16**(32). [https://doi.org/10.33296/2707-0654-16\(32\)-10](https://doi.org/10.33296/2707-0654-16(32)-10) Last Accessed on 19th May, 2024.
- Snizhko, S., Shevchenko, O. and Didovets, Yu. 2021. Analysis of the impact of climate changes on the water resources of Ukraine (full report based on the results project). Center for Environmental Initiatives "Ekodiya". <https://ecoaction.org.ua/wp-content/uploads/2021/06/analiz-vplyvu-vodni-resursy-full.pdf> Last Accessed on 23rd May, 2024.
- Sumets, A., Tyrkalo, Y., Popovych, N., Poliakova, J. and Krupin, V. 2022. Modelling of the environmental risk management system of agriholdings considering the sustainable development values. *Agricultural and Resource Economics*, **8**(4): 244-265. <https://doi.org/10.51599/are.2022.08.04.11>
- Sytnyk, H.P., Zubchik, O.A. and Orel, M.H. 2022. Conceptual understanding of the peculiarities of managing innovation-driven development of the state in the current conditions. *Science and Innovation*, **18**(2): 3-15.
- TIC Ukraine. 2022. *Energy efficiency program for the enterprise*. Official representative office of TÜV Austria in Ukraine. <https://tic-ua.com/uk/statti/programa-z-energoeffektyvnosti-tablyczya-zahodiv-2/> Last Accessed on 17th May, 2024.
- Tkachenko, T., Lytvyn, M., Reshetchenk, S. and Olenyk, V. 2022. *Influence of climate on the state of the forest cover of Ukraine. Climate changes and agriculture. Challenges for agricultural science and education*. Proceedings of the V International Scientific and Practical Conference. https://nmc-vfpo.com/wp-content/uploads/2022/12/tezymalynka-15-11-2022_compressed.pdf Last Accessed on 21st May, 2024.
- Trypolska, G. 2022. A summary of the international experience of developing national adaptation strategies for use in the processes of the NSS of Ukraine. The UN Development Program in Ukraine. <https://mepr.gov.ua>

- Tymoshenko, Y., Kyslenko, D., Kuzmichova-Kyslenko, E., Leonenko, I. and Servetsky, I. 2022. Features of the pre-trial investigation of air pollution. *Environment and Ecology Research*, **10**(2): 133-145.
- UNDP Ukraine, 2017. Strategy for Sustainable Development of Ukraine until 2030: Project-2017. *United Nations Development Program in Ukraine*, 112. https://www.undp.org/sites/g/files/zskgke326/files/migration/ua/UNDP_Strategy_v06-optimized.pdf Last Accessed on 17th May, 2024
- Verkhovna Rada of Ukraine, 2022. On Approval of the Concept for the Introduction and Development of the Green Bond Market in Ukraine: Order of the Cabinet of Ministers of Ukraine of February 23, 2022, № 175-p. *Legislation of Ukraine*. <https://zakon.rada.gov.ua/laws/show/175-2022-%D1%80#Text> Last Accessed on 21st May, 2024.
- Wang, T., Yang, Z., Clark, G., Nichol, T. and Ge, Y. 2020. Climate change research on transportation systems: Climate risks, adaptation and planning. *Transportation Research Part D Transport and Environment*, **88**. <https://doi.org/10.1016/j.trd.2020.102553> Last Accessed on 17th May, 2024.
- Yakovenko, Y. 2020. *Formation and implementation of the strategy of sustainable development of industrial enterprises*. (Dissertation of PhD in Economics). Kremenchuk Mykhailo Ostrohradskyi National University. https://www.kdu.edu.ua/Documents/diser_Yakovenko.pdf Last Accessed on 17th May, 2024.
- Zghurska, O., Korchynska, O., Rubel, K., Kubiv, S., Tarasiuk, A. and Holovchenko, O. 2022. Digitalization of the national agro-industrial complex: new challenges, realities and prospects. *Financial and Credit Activity: Problems of Theory and Practice*, **6**(47): 388-399.
- Zhukova, D. 2021. *Development of the System of Strategic Choice of a Company*. (Dissertation of the Doctor of Philosophy). University of Customs and Finance. <http://surl.li/tmovc> Last Accessed on 21st May, 2024.

