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Climate Change as a Risk Factor for Organisational Security and Supply Chain Stability

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Abstract:

Purpose: *This article aims to examine the impact of climate change on organisational security and the stability and resilience of supply chains in the context of growing environmental and economic threats. The analysis focuses on identifying key risk factors and evaluating adaptation strategies that can increase the resilience of logistics and operational systems.*
Design/Methodology/Approach: *The study is based on a critical analysis of scientific literature in the fields of management, logistics and security, as well as a review of the latest industry and international reports (IPCC, WMO, OECD, WEF, Allianz, BCI, Resilinc). An interdisciplinary approach was used, combining the perspectives of strategic management, risk management and crisis management. The research problem was formulated as follows: How does climate change affect the security of organisations and the stability of supply chains, and what management strategies can minimise the risks associated with this phenomenon? The research hypothesis assumes that climate change is a strategic risk factor that significantly destabilises the functioning of organisations and their supply chains, and effective security management requires the integration of adaptive strategies – such as diversification of sources, regionalisation of processes, digitisation of monitoring and development of organisational culture – to increase resilience and continuity of operations.*
Findings: *The results of the analysis indicate that climate change is systemic in nature and affects all levels of an organisation's operations – from employee productivity and infrastructure security to the stability of global supply chains. The greatest threat is the focus of organisations on cost efficiency at the expense of resilience. At the same time, it has been*

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shown that supplier diversification, regionalisation of production, development of climate monitoring systems and the creation of an organisational culture based on risk awareness significantly increase adaptability and operational stability.

Practical Implications: *The article offers practical guidance for managers and decision-makers on the importance of incorporating climate risks into security and strategic management policies. It emphasises the importance of cooperation across entire supply chains, the creation of contingency plans, and the integration of ESG standards and climate reporting. The conclusions presented can serve as a basis for designing more resilient business models and making investment decisions in infrastructure, technology and human capital.*

Originality/Value: *The value of the article lies in its interdisciplinary approach to the issue, combining perspectives on climate change with the theory and practice of organisational and security management. The study makes an original contribution by compiling findings from scientific literature and industry reports to build a comprehensive picture of climate risk. It also emphasises the importance of transforming the supply chain management paradigm from a focus solely on cost efficiency to a model that integrates efficiency with resilience. The article is therefore an important reference point for research on the adaptation of organisations to new economic realities and for management practice.*

Keywords: *Climate change, organisational security, supply chain stability.*

JEL codes: *Q5, M21.*

Paper type: *Research article.*

1. Introduction

Rapidly advancing climate change is one of the most serious challenges of the 21st century, affecting not only the natural environment but also the functioning of organisations and the stability of global supply chains. Extreme weather events, such as floods, hurricanes, droughts, and fires, are increasingly disrupting logistics processes, causing interruptions in the supply of raw materials, components, and end products.

This phenomenon results in severe economic losses and a reduction in organisational security, which manifests itself in difficulties with operational planning, increased costs, a decline in business partner trust, and the risk of losing competitiveness.

Contemporary organisations operating in the global economy are particularly vulnerable to the effects of climate change due to their high dependence on complex and dispersed supply chains. The disruption of a single link, especially in regions susceptible to climate change, can trigger a domino effect, impacting the activities of entire sectors of the economy. For this reason, the security of an organisation cannot

be considered solely in internal terms today, but requires a holistic view of the resilience and flexibility of supply chains.

The literature on the subject places increasing emphasis on integrating climate risk management with an organisation's security policy. This includes both forecasting and identifying threats, as well as developing adaptation strategies to minimise the effects of crises caused by climate change.

In this context, it is necessary to create models of operation that will ensure not only operational continuity, but also long-term stability and sustainable development of the organisation.

2. Climate Change as a Global Challenge

Climate change is one of the most serious challenges of our time, and its effects extend far beyond the natural environment, encompassing the economy, social security and the stability of organisations. The IPCC AR6 report indicates that further delays in adaptation measures will lead to an increase in sudden and cascading risks in socio-economic systems (IPCC, 2023, pp. 12-14).

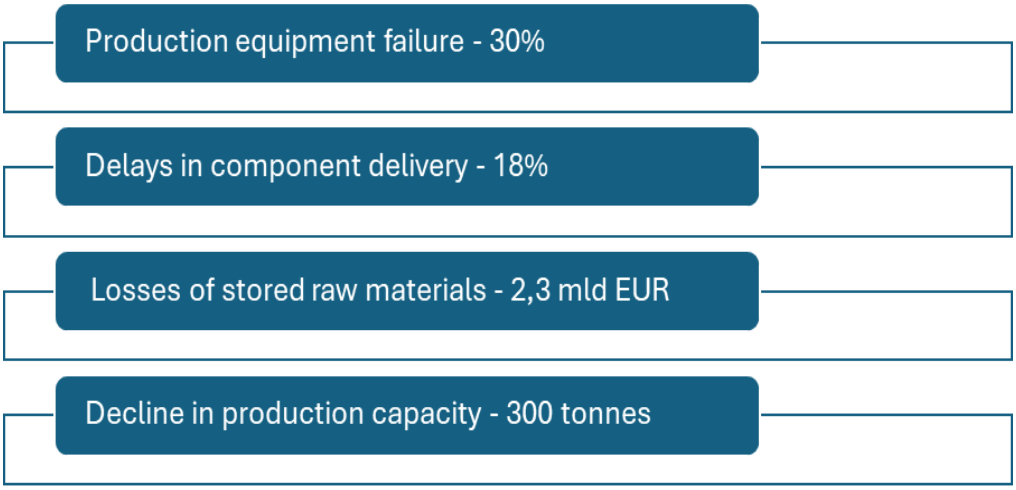
The World Meteorological Organization (WMO) reported that 2024 was the warmest year on record, with the global average temperature exceeding the pre-industrial level by 1.5°C, indicating that previously considered extreme scenarios are becoming a reality (WMO, 2025, pp. 3-5). It was the first year on record in which the global mean temperature exceeded 1.5 °C above pre-industrial levels (Copernicus, 2025, pp. 2-3).

Scientific literature complements these findings by pointing to specific economic and organisational mechanisms. Heat waves lead to severe financial losses, both direct (loss of employee productivity) and indirect (disruptions in supply chains), which in a high-emission scenario could reach as much as 4.6% of global GDP by 2060 (Sun *et al.,* 2024; Nature, pp. 797-803).

Climate change is prompting adjustments in global supply chains, as companies modify their selection of suppliers and production locations based on their exposure to climate-related risks (Pankratz *et al.,* 2022). Below is an example of the impact of rising temperatures on the supply chain (Figure 1).

Climate impacts include both acute hazards, such as floods, storms and fires, and chronic hazards, such as prolonged droughts, soil degradation and sea level rise. Rainfall intensity and the frequency of extreme temperatures will likely increase (IPCC, 2023, pp. 33-36). In this context, food supply chains are particularly vulnerable, especially to droughts and changes in precipitation, while transport and storage are more often affected by events such as floods and storms (Tchonkouang *et al.,* 2024, pp. 5-7).

Figure 1. *Impact of rising temperatures on the supply chain in 2024.*



Source: *International Energy Agency.*

Ports and maritime infrastructure are affected by both chronic (sea level rise) and sudden (tropical cyclones) impacts, which directly impact global logistics and trade (Becker *et al.,* 2018, pp. 28-33). Extreme weather events caused EUR 26 billion worth of damage to infrastructure in 2024. Examples are given below:

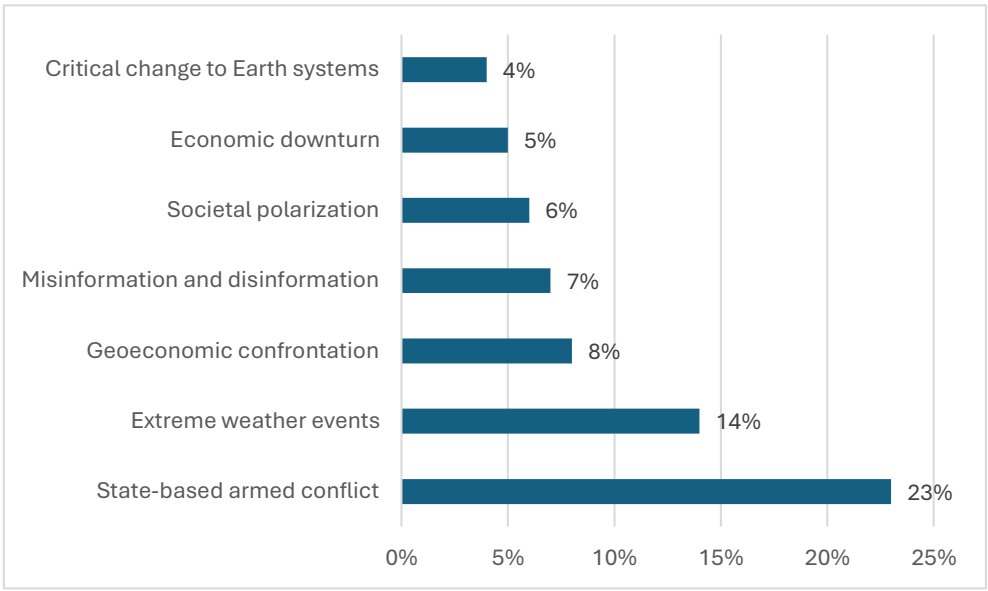
- 45-day delays in steel deliveries (flooding forced the steelworks to suspend deliveries to 120 factories);
- EUR 12 million in disruptions to electronics production (storms damaged 40% of production equipment);
- losses in maritime logistics of EUR 1.5 billion (storms in the Baltic Sea caused ships to run aground, disrupting deliveries for three weeks);
- rising warehouse insurance costs of EUR 4.7 million (flood risk caused warehouse insurance costs to rise from 0.8% to 1.2%) (PwC, 2025).

Extreme weather events have a macroeconomic dimension. The Allianz Risk Barometer 2025 report categorises climate change as one of the most significant global risks, alongside business interruptions and natural disasters (Allianz, 2025, pp. 6-7).

Similarly, the World Economic Forum's Global Risks Report 2025 ranks environmental risks as the top threat for the decade, highlighting their connection to geopolitical and social crises (WEF, 2025, pp. 15-17). The current risk landscape is presented below.

Scientific research confirms that climate risks have a measurable impact on companies' financial and operational decisions, leading to reduced cooperation with suppliers located in climate-sensitive areas (Pankratz *et al.,* 2022).

Figure 2. *Current Risk Landscape.*



Source: *World Economic Forum Global Risks. Perception Survey 2024-2025.*

Disruptions in supply chains are one of the most noticeable effects of climate change. The Resilinc report (2025) points to a 38% increase in global supply chain disruptions in 2024 (Resilinc, 2025, p. 2), and the Business Continuity Institute (2024) notes that companies are increasingly mapping their suppliers across multiple tiers (tier-mapping) to minimise risk (BCI, 2024, pp. 12-14).

Tchonkouang *et al.* (2024) emphasise that food transport and storage are insufficiently studied in terms of vulnerability to climate risks, which means that organisations may be particularly exposed to disruptions at these stages (Tchonkouang *et al.,* 2024, pp. 20-22).

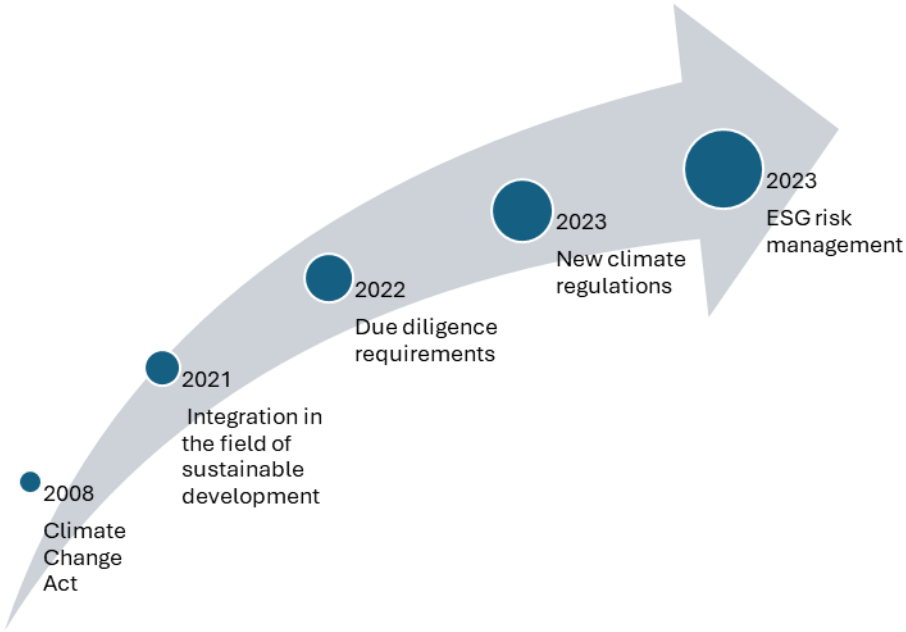
Economic sectors vary in their level of exposure to climate impacts. Agriculture, energy and transport are particularly vulnerable (OECD, 2025, pp. 8-10).

Globalisation remains strong despite growing threats. Global trade remains at record levels, although regionalisation and diversification of supply chains are increasingly observed (DHL, 2024, pp. 3-6). Climate change is not ending globalisation, but is leading to its restructuring, forcing the adaptation of sourcing strategies (Pankratz *et al.,* 2022, pp. 20-22).

At the same time, transition risks associated with climate regulations, such as CBAM and disclosure standards, are increasing. UNEP FI (2024) emphasises the importance of integrating climate risks into financial management (UNEP FI, 2024, pp. 5-7). Climate factors will affect the costs and availability of resources (S&P,

2024, pp. 4-6). In the perception of management boards, climate change is now one of the main risk factors (Allianz, 2025; WEF, 2025). The years of implementation of the most important regulations are presented below (Figure 3).

Figure 3. *Year of implementation of the most important regulations.*



Source: *European Commission.*

At the same time, the IPCC (2023) warns of a widening adaptation gap, particularly in resource-constrained regions (IPCC, 2023, pp. 58-60). The logistics and food sectors lack sufficient adaptation strategies in place (Tchonkouang *et al.,* 2024, pp. 22-24). As a result, organisations must redefine the concept of security – it now encompasses not only protection against internal and geopolitical threats, but also the ability to respond to climate crises.

Industry reports and scientific literature clearly indicate that climate change is systemic in nature and threatens the continuity of organisations and the stability of global supply chains. Organisational security increasingly depends on adaptability, resilience to physical and regulatory risks, and the ability to integrate climate management into long-term strategies.

3. The Impact of Climate Change on Organisational Security

In the classical approach to organisational management (Drucker, 1999; Mintzberg, 2009; Koźmiński, 2011), security was mainly perceived through the prism of the stability of internal processes and the ability to achieve strategic goals. Meanwhile,

the contemporary environment is characterised by growing uncertainty, which is referred to in the literature as the VUCA environment (Volatility, Uncertainty, Complexity, Ambiguity) (Bennett and Lemoine, 2014).

Climate change is one of the main factors contributing to this uncertainty – it affects resources, infrastructure, the labour market and regulations, and consequently the security of organisations in a broad sense. Organisational security today encompasses both the protection of tangible and intangible resources and the ability to adapt to external factors (Crandall, Parnell, and Spillan, 2010).

In today's world, organisations face an increasing number and variety of threats (Ciekanowski *et al.,* 2024, p. 143). One of the most serious types of threats is climate change, which is increasingly affecting the way organisations define and implement their security and management strategies. A crisis can have various consequences, such as disruption of operations, financial losses, damage to reputation, and even the liquidation of the organisation (Ciekanowski, 2023, p. 350).

Increasing extreme weather events and long-term processes such as droughts and sea level rise will directly affect the functioning of organisations in various sectors (IPCC, 2023, pp. 12-14). Organisations operating in the global economy are particularly vulnerable, as their dependence on extensive supply chains means that even local climate events can have global consequences (Christopher, 2016).

Research indicates that heat waves negatively impact employee performance, particularly in sectors such as manufacturing, logistics, and services, leading to decreased productivity and increased healthcare costs (Sun *et al.,* 2024, pp. 800-802). The consequences include operational disruptions, employee absenteeism, and a decline in process quality. In terms of organisational safety management, these phenomena require not only an operational response, but also systemic changes in human resources policy and health and safety standards (Hollnagel *et al.,* 2006).

The infrastructural consequences are no less significant. Ports and production facilities in coastal areas are vulnerable to storms and sea level rise, which threatens physical safety and the continuity of logistics processes (Becker *et al.,* 2018, pp. 28-33). Investments in climate-resilient infrastructure are becoming a pillar of economic policy in highly developed countries (OECD, 2025, pp. 8-10). The literature on crisis management (Boin, Hart, Stern, and Sundelius, 2016) emphasises that an organisation's ability to respond to such threats depends on planning, scenario testing and redundancy.

The impact of climate change also affects the financial and reputational spheres. Companies often terminate their cooperation with suppliers located in regions of high climate risk, which involves the stability of their supply chains and strategic decisions (Pankratz *et al.,* 2022). The Allianz report (2025) indicates that nearly a quarter of European companies have already experienced operational losses related

to floods or heatwaves (Allianz, 2025, p. 7). As a result, climate risk management is becoming increasingly important in corporate governance and non-financial reporting (Bryson, 2018).

Regulatory and legal aspects are also changing the organisational security framework. UNEP FI (2024) emphasises the importance of reporting standards such as TCFD and ISSB, which are becoming tools for controlling and assessing climate risks (UNEP FI, 2024, pp. 5-7).

Companies that ignore these requirements risk losing funding and damaging their reputation. S&P Global (2024) adds that investors are increasingly requiring climate scenarios to be integrated into strategic plans (S&P, 2024, pp. 4-6).

The human factor is no less critical. Employees in the transport and food storage sectors are particularly vulnerable to the effects of flooding and disruptions in cold chain logistics, which directly affect the stability of organisations (Tchonkouang *et al.,* 2024, Science of the Total Environment, pp. 20-22).

General literature on human resource management (Armstrong, 2021) emphasises the growing importance of building an organisational culture that is resilient to crises, including those related to the natural environment.

In organisational practice, this means that business continuity plans that take climate risks into account must be implemented. Diversification of suppliers, development of local production chains and investment in climate monitoring technologies are key elements of new security strategies (OECD, 2025, p. 9).

The concepts of resilience (Hollnagel *et al.,* 2006) and sustainable management (Drucker, 1999; Mintzberg, 2009) are becoming central to the discussion about the future of organisations. Organisational resilience can be achieved through actions that minimise the risk of undesirable events and mitigate their adverse effects (Ciekanowski *et al.,* 2024, p. 142).

Climate change is increasingly determining the security of organisations. It affects employee productivity, infrastructure, supply chains, finances, reputation and regulatory compliance.

In light of the literature on management and security, it can be concluded that organisations that incorporate climate risks into their strategies and management structures will be more resilient and better equipped for long-term development.

Companies that disregard these processes will face rising costs, destabilisation and loss of competitive advantage. Organisational security in the era of climate crisis is therefore becoming inextricably linked to adaptability, flexibility and the ability to manage complex risks in a turbulent environment.

4. Stability and Resilience of Supply Chains in the Face of Climate Change

Supply chain security management is a key element of the operational strategies of modern organisations. In the face of increasing globalisation, rapidly changing market conditions, and emerging new threats, organisations must face numerous challenges that can impact the stability and continuity of their supply chains (Żurawski *et al.,* 2025, p. 50).

Supply chains, which form the backbone of the modern economy, are particularly vulnerable to the effects of climate change. Their global, dispersed nature means that even local weather events can have a domino effect, leading to international disruptions.

The literature on supply chain management emphasises that the traditional paradigm of efficiency (lean supply chains) must now be complemented by the paradigm of resilience (resilient supply chains) (Christopher, 2016; Sheffi, 2007). Climate change is one of the key factors accelerating this transformation. The various barriers to risk management in the supply chain are presented below.

Table 1. *Barriers and Principles of Risk Management in the Supply Chain.*

Barriers to risk management in the supply chain	Supply chain risk management principles
• globalisation of supply chains (the share of global markets in most companies in the areas of procurement, production and distribution), • actions focused strictly on cost reduction rather than efficiency, • mismanaged outsourcing processes, • focus of manufacturing companies on the production of a single product (narrow specialisation), • centralisation of distribution, • increased dependence of manufacturers on the efficiency of suppliers by expanding the supplier base, • seasonal, incidental changes in market demand (fluctuation), • shortening of the product life cycle, • lack of access to information, • errors in the information management system, • lack of control and evaluation procedures.	• awareness of risk occurrence, • motivating employees to identify their role in logistics processes and in minimising supply chain risk, • continuous monitoring of the relationship between changes in company strategies and the risk profile, • constant analysis of the supply chain environment, • The selection of the best risk management options should be made from the perspective of the entire supply chain and jointly by its participants, • creation of a system of contingency plans, • diversification of the range of products or services (diversification), • creation of an evaluation system, • the length of the production cycle should be minimised, • material flows throughout the supply chain should be synchronised, • processes should be designed with customer requirements in mind, • Decisions in the supply chain should be made in a coordinated manner, taking into

	account their impact on individual participants.

Source: *J. Myszak, M. Sowa, Risk management in the supply chain, PTiL, No. 4/2016 (36), 2016, p. 190.*

In 2024, the number of supply chain disruptions increased globally by 38% compared to the previous year, with more than a third directly related to extreme weather events (Resilinc, 2025, p. 2). The Business Continuity Institute (2024) notes that over 70% of the organisations surveyed experienced supply disruptions, with floods, fires, and heatwaves being the primary factors (BCI, 2024, pp. 12-14). These data clearly show that climate has become one of the main determinants of the stability of logistics and production processes.

Scientific research provides in-depth analyses of the mechanisms behind this phenomenon. Heat waves are systemic in nature – they cause not only direct losses in places affected by extremes, but also indirect disruptions that spread through supply networks and exacerbate global economic costs (Sun *et al.,* 2024, pp. 797-803). Food supply chains, in turn, are particularly vulnerable to climate disruptions, with cold chain logistics remaining a particularly sensitive link, exposed to power outages and flooding (Tchonkouang *et al.,* 2024, pp. 20-22).

Supply chain resilience is defined as the ability of a system to adapt and recover after a disruption (Hollnagel *et al.,* 2006). The literature on the subject distinguishes between various strategies for building resilience, including redundancy, diversification, flexibility, digitalisation, and information sharing (Sheffi, 2007; Christopher, 2016). For example, redundancy can be achieved by maintaining safety stocks, while diversification involves developing alternative sources of supply and transport routes.

One of the main trends in recent years has been the regionalisation of supply chains, which reduces the risks associated with intercontinental transport and vulnerability to climate events in remote regions (OECD, 2025). Globalisation is not receding – instead, we are seeing a ‘restructuring’ of networks, where regional and local configurations are developing alongside global relationships (DHL, 2024).

Practice shows that resilience is becoming an integral part of an organisation's security strategy. Pankratz *et al.* (2022) argue that companies are changing their suppliers as production locations become increasingly vulnerable to the effects of climate disasters (Pankratz *et al.,* 2022; Review of Financial Studies, pp. 18-20). This means that climate risk management is becoming one of the criteria in purchasing policy and managing relationships with business partners.

The literature on safety management (Crandall, Parnell, and Spillan, 2010; Boin *et al.,* 2016) emphasises that resilience requires not only technical measures, but also the development of an organisational culture focused on adaptation and learning.

In the context of supply chains, this means greater visibility, openness to cooperation and investment in predictive technologies. The use of artificial intelligence and satellite data in monitoring climate risks can significantly reduce response times and improve the ability to predict threats (WEF, 2025). Below are the key areas of supply chain development to strengthen resilience to climate challenges.

Figure 4. *Key areas for supply chain development to strengthen resilience to climate challenges.*

Source: *B. Siekanski, From storms to blackouts: How S&OP responds to the five biggest climate threats, Strategy&, PwC, June 2025.*

The concept of resilience is also reflected in regulations. UNEP FI (2024) emphasises the importance of integrating climate scenarios into financial and ESG reports, which forces companies to incorporate climate into mainstream risk management (UNEP FI, 2024, pp. 5-7). Insurers are increasingly differentiating rates based on the level of adaptation and resilience of their customers (Allianz, 2025).

The stability of supply chains cannot be understood as immutability, but rather as the ability to maintain key functions despite disruptions. The literature suggests that the most resilient companies combine short-term response strategies (e.g., rerouting transportation) with long-term investments (e.g., flood-resistant infrastructure, digital risk management systems) (Sheffi, 2007; Hollnagel *et al.,* 2006).

Climate change is one of the most significant factors destabilising supply chains. However, thanks to the development of the concept of resilience, new technologies

and regulatory pressure, it is possible to create systems that are more resistant to climate shocks. This requires organisations to make a strategic shift in focus – from concentrating solely on cost efficiency to balancing efficiency and resilience. In an era of climate crisis, the stability of supply chains is becoming a key element of organisational security, and managing them requires the integration of knowledge in the fields of logistics, risk management, finance and climate policy.

5. Conclusions

Climate change is clearly shaping the conditions in which modern organisations operate, affecting their security, adaptability and supply chain stability. The results of analyses indicate that these phenomena are no longer distant forecasts, but are real and increasingly frequent disruptions that affect both the operational activities of companies and their long-term strategic position.

In the face of increasing weather extremes, growing regulatory requirements and pressure from investors and consumers, organisational security is becoming a concept closely linked to the ability to anticipate and manage climate risk.

This necessitates a redefinition of the approach to management. Organisations cannot limit themselves to traditional cost-effectiveness criteria, as an excessive focus on reducing expenditure weakens their ability to respond to disruptions and crises. It is becoming increasingly clear that competitive advantage is built by those entities that can combine efficiency with resilience, i.e., simultaneously reduce costs and invest in process flexibility, supplier diversification, the development of local and regional logistics networks, and the implementation of digital solutions to support risk monitoring.

The research also concludes that resilience and stability cannot be treated solely as a function of technology or infrastructure. They are systemic in nature and encompass an organisational culture in which employees are aware of their role in logistics processes and are involved in activities aimed at minimising risk. This means that effective security management requires simultaneous investment in people, knowledge and procedures that will enable the creation of contingency plans and the rapid restoration of system functionality after disruptions.

Another important conclusion is that climate risk management requires looking beyond the boundaries of a single organisation. The interdependence of entities in supply chains necessitates that risk management decisions be made in a coordinated manner, considering the impact on all participants in the network. Only cooperation and information exchange can ensure the real resilience of economic systems to the effects of climate change.

In summary, climate change poses a serious threat to the functioning of organisations. Still, at the same time, it is an impetus for innovation and the

implementation of new management models. Organisations that treat climate as a strategic risk factor and integrate it into their security and strategic management policies have a better chance of stable development and maintaining a competitive advantage. In the coming decades, the ability to build resilience and flexibility in uncertain conditions will become the key determinant of a company's success and sustainability on a global scale.

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