

CLIMATE RISK OF ECONOMIC SECTORS



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Climate Risk of Economic Sectors

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Abstract

The risks associated with climate change are addressed in the paper, since they are already affecting business performance and operations and will have an even greater impact in the future. The paper aims to demonstrate how climate risk affects business operations across a variety of industries, and to outline the reasons why firms must manage climate risk. Different industries are impacted by climate change in various ways and to different extents, and there are variations in sectoral impacts by region as well. The study presents the results of the European Central Bank's 2022 climate risk stress test, followed by an analysis of the effects of domestic sectors based on greenhouse gas emissions.

Regulation change will have the greatest impact on high-emitting industries, making them the most vulnerable to the risk of carbon leakage. In Hungary, the sector most exposed to the risk of carbon leakage is manufacturing, followed by electricity, gas, steam and air conditioning, but also transport and storage, agriculture, construction, trade and motor vehicle repair. Physical risks mostly impact industries like agriculture, construction, food production and tourism, whose operations are directly impacted by the weather. A Holmen company example used in the study made clear the necessity for firms to consider long-term processes in business planning and to strive to switch to renewable energy sources. The financial effects of climate risks must be calculated to each industry, and industry players must actively monitor changes in the regulatory environment. Screening and monitoring of supplier partners is necessary, and it is important to engage with a wide range of stakeholders inside and outside the organization.

Keywords: climate risk, sectoral exposure, energy efficiency, risk management, greenhouse gas

JEL codes: K32, L52, O13, Q54

Introduction

The climate risk of industries is an important and relevant issue today because the climate crisis and in response to it the changing legal environment are posing new challenges for companies of the European Union and Hungary. Although the extent of climate risk may vary from sector to sector, this study provides guidelines for all companies that consider sustainable operations important.

Assessing the climate risk for a given company and responding to the climate crisis can make a major contribution to the long-term continuous and competitive operation of companies and show the direction for developments to be worthwhile and necessary.

In the first chapter, we present a general overview of climate risks and their main types, namely physical and transition risks.

This will be followed by a discussion of the sectors that are significantly exposed to climate risk. We will present those sectors where adaptation risks are particularly significant. For companies in these sectors measuring their greenhouse gas (GHG) emissions and finding ways to reduce the emissions comes with a high priority.

We will show which sectors of the Hungarian economy are most exposed to climate risks. In terms of physical climate risk, the increasingly regular periods of drought and flooding in our country are putting many domestic companies in difficult situations, and unfortunately with increasing frequency. Especially the carbon-intensive sectors face significant regulatory risks.

The study advises what companies can do to manage the negative impacts of climate change and even gain a competitive advantage within their industry. We highlight the example of the Swedish forestry company, named Holmen as a good practice. Holmen is an example of how to successfully maintain long-term competitiveness through broad consultation, industry collaboration, thoughtful innovative product development and investment in renewable energy.

The study puts a strong emphasis on the active involvement of stakeholders, both internal and external. Successful sectoral risk management requires the involvement of employees as much as investors, suppliers and consumers, or even the financing institution. Understanding the stakeholders' perspectives can provide valuable information for the long-term sustainable operation of the company and its risk-management.

Finally, the study looks at the regulatory environment and compliance. It stands in the companies' interest to develop the necessary data collection, management systems and workflows to understand and optimize their operations, and to report this transparently to relevant authorities and other stakeholders.

The following introductory chapter describes climate risks in a more detailed manner and defines basic concepts such as climate risk, physical risk and transition risk.

1.Climate risk from a business perspective

Climate risk is defined as the risks that affect the financial performance of a business as a result of climate change. Climate change involves both physical and transition risks, the impact of which can be direct, for example through a reduction in business profitability, devaluation of financial assets, or indirect, through macro-economic changes. Risks affect the resilience of the business model of companies, both in the medium and long term, that rely on sectors and markets that are particularly vulnerable to climate and environmental risks.

1.1.Physical risks

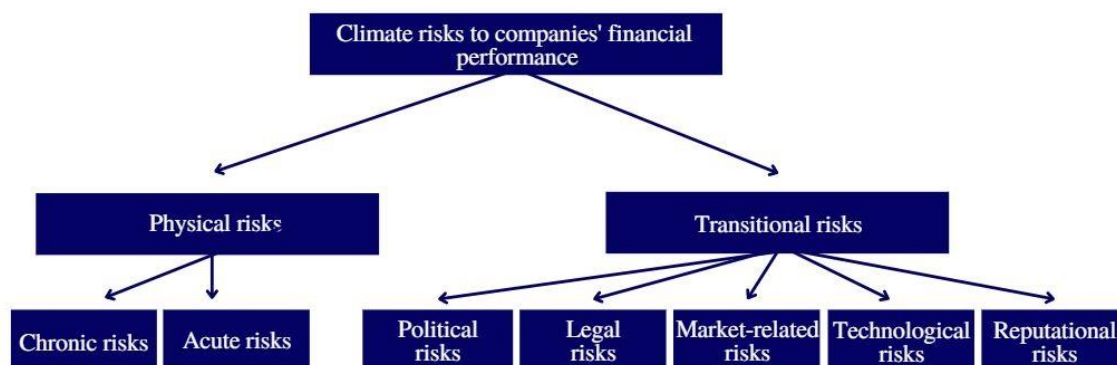
Physical risks are those that arise from the physical impact of climate change. They can be divided into two categories: the first is chronic risk - longer-term changes in climate, such as temperature change, diminishing water supplies, and changes in the fertility of land and soil. The second type of physical risks are acute risks - particularly weather-related events, such as storms, floods, heat waves, which can damage production facilities or lead to disruptions in value chains.

1.2.Transition risks

Climate change transition risks refer to the risks arising from the transition, adaptation to a low-carbon economy that is resilient to the impacts of climate change. In the European Central Bank (ECB) Guidance on climate and environmental risks (European Central Bank, 2022A), five types of risk categories are distinguished. The first is political risk, which includes for example energy efficiency requirements and carbon taxes. Legal risk is defined as compensation liabilities arising from litigation over failure to avoid or minimize adverse impacts on the climate. The third type of risk is technological. Where a more climate-damaging technology is replaced by a less harmful technology, the profitability of companies using the 'old' technology may be reduced. When business partners, investors and consumers shift away from polluting companies towards less damaging products and services, we are talking about market-related risks. Finally, the fifth sub-category of transition risk is reputational risk, which means that employees, corporate customers and investors are turned away from polluting companies.

1. Figure- Categorization of climate risks to companies' financial performance

Source: BDO edited, based on ECB (2022) data



2. Sectors exposed to climate risks

2.1. Climate risk measurement

In theory, climate risk measurement is no different from "traditional" risk measurement, because at the micro and macro level, standard scenario analyses and stress tests can be applied to assess climate-related impacts. However, practice shows that climate change risks are more unpredictable than traditional financial risks, as the impacts of climate change are uncertain both because of their complexity and their time horizon. In addition to these factors, the limited availability of historical data makes it difficult to provide guidance on future developments, making risk estimates less reliable. However, some of the traditional practices used by financial institutions and supervisors are prominently used to measure climate risks as well, these practices are presented below.

The first risk management exercise is climate risk scores (including heat maps) and ratings. Climate risk scores can be used to assess the climate risk exposure of companies, portfolios or even countries. Climate risk scoring methods provide more detailed data and can show location-specific predictions, making them easier to integrate into a company's supply chain information. A risk classification system is combined with a set of classification criteria with the aim of assigning climate and environmental exposures a quality score corresponding to their classification. These classification criteria used in practice may be based on qualitative or quantitative factors.

The second is scenario analysis, which presents long term risk outcomes and is used to assess the potential impact of climate risk factors on financial exposures. The 6th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), published on 9 August 2021, models socio-economic pathways with five emission scenarios. The best vision, and the only one, is if the World can meet the Paris Agreement's ultimate goal of average temperatures of around 1.5°C above pre-industrial levels. In the worst-case scenario, CO₂ emissions would double between 2050 and 2100 and global average temperatures would rise by 4.4°C.

The third exercise is stress testing, a specific type of scenario analysis. In this case, the short-term resilience of an entity to economic shocks is assessed. For financial institutions, specific stress tests are carried out. In the solvency test, a macroprudential stress test is distinguished, which measures the impact of financial shocks on the financial system and the systemic risk they may trigger. The microprudential stress test assesses the solvency of individual financial institutions, taking into account portfolio risks. In 2022, the European Central Bank conducted a climate risk stress test as its annual stress test (European Central Bank, 2022C) - for the first time in its operations - because climate change and the transition to net zero carbon emissions pose risks to both households and firms, therefore ultimately to the financial sector.

Finally, the fourth risk assessment option is sensitivity analysis, which, like stress testing, is a specific sub-category of scenario analysis and is used to assess the frequent impact of a given variable on economic outcomes. In these analyses, one or more parameters are varied to examine the impact of the resulting change(s) on economic outcomes (BIS, 2021).

To get a more accurate picture of the exposure of individual economies, it is useful to combine these methodologies and risk assessment practices in the analysis. Analyses at the industry and macroeconomic level also support legislative work, as it is possible to see which sectors need stricter rules or support for the transition process.

2.2 Sectors exposed to climate risk in the EU

In financing the European economy, the involvement of banks has been traditionally prominent. A typical bank investment loan lasts 7-10 years but can be much longer for infrastructure development. Under the Green Deal, the European Union has decided to use the financing system to achieve decarbonization targets. This means that in case of new investments, the regulator wants to include this aspect in the decision-making process as well (EU Taxonomy). From this point of view, the European legislation counts as unique, i.e., the financial intermediary system has a key role to play, in addressing climate risks. The ECB's first Climate Risk Stress Test 2022 was designed to assess this element.

The European Central Bank's Climate Risk Stress Test 2022 examined which sectors in the European Union are most affected by the transition risks. To identify the extent of climate risks, the ECB used the greenhouse gas emissions of each sector as an indicator, taking into account the whole value chain. The results of the ECB's stress test show that the sectors most exposed to the risk of carbon leakage, based on aggregate EU data, are the refined petroleum products sub-sector, mining, mineral production and the electricity and energy supply sectors.

The aim of the ECB's climate risk stress test is to optimize the climate risk assessment capacity of the financial sector and its supervisors and to increase the information available on climate risk stress testing. A total of 104 banks participated in the test, which consists of three modules. The first module is a qualitative assessment

of the climate risk stress testing framework, i.e., it provides information on the banks' own climate stress testing capabilities. The second module provides a situational assessment of the banks' earnings sustainability and funding, i.e., their exposure to carbon-emitting sectors, while the third provides information on their performance under different scenarios, examining several time horizons. The bottom-up stress test within the third module is limited to 41 directly supervised banks to ensure proportionality for smaller banks (European Central Bank, 2022B).

1. Table - Scenarios for the third module of the European Central Bank Climate Risk Stress Test

Source: ECB, 2022 climate risk stress test

	Exposures	Scenario	Forecast	Time horizon
Transition risk	Global	Short-term stress	Basis level	3 years (2022-24)
			Stress	
		Long-term trajectory	Orderly	30 years (2030, 2040, 2050)
			Delayed, disorderly	
"Hot-house world"				
Physical risk	EU countries	Drought and heat risk	Basis level	1 year (2022)
			Stress	
	Flood risk	Basis level	1 year (2022)	
		Stress		

Module 1: The first module includes a qualitative questionnaire that provides a single and standardised assessment of banks' climate risk stress testing capacity. This part of the ECB stress test revealed that banks lack good practices, which requires them to develop climate stress testing capabilities that include market risk, counterparty risk and liquidity risk. 60% of the surveyed institutions do not have a climate risk stress testing framework, only 20% take climate risks into account when granting loans, and a large proportion of banks do not use the results of climate risk stress tests in their business strategy.

Module 2: In this part of the stress test, which includes an assessment of the sustainability of banks' income and funding, banks were asked to allocate their corporate volumes and income across 22 industries. This revealed that almost two thirds of banks' revenue from non-financial corporate customers comes from carbon-intensive industries and in many cases banks' 'financed emissions' come from a small number of large partners, increasing the transition risks. In addition, despite banks' frequent reliance on proxy data as a step to solve data gaps, institutions lack actual data on greenhouse gas emissions therefore they need to improve the quality of data from their customers to gain more accurate insights into their customers' transition plans.

Module 3: The third module includes a bottom-up stress test, in which banks made projections for a number of different scenarios and risk areas. These stress tests covered both physical and transition risks.

For physical risks, banks were required to submit a credit risk forecast under a drought and heat risk scenario and a flood risk scenario. The transition risks covered two time horizons. The first was a long-term 30-year horizon, for which three different climate policy scenarios were depicted: 1) orderly transition; 2) delayed, disorderly transition; 3) no-policy-change, "hot-house world". The second time horizon was for a short three-year time period.

2. Table - Long-term, 30-year scenarios for the European Central Bank's climate risk stress test

Source: ECB, 2022 climate risk stress test

Scenario	Climate policy actions	Carbon dioxide price
Orderly	Early implementation of climate policy, based on zero carbon emissions by 2050	Relatively high by 2030, further increase by 2050
Delayed, disorderly	Delayed policy implementation	Delayed price increases
"Hot-house world"	No new climate policy	No price increase

The result of this module shows that physical risks have a heterogeneous impact on European banks, because the vulnerability of institutions in drought and heat stress scenarios depends on sectoral activity and geographical location. The impact of these risks is reflected in reduced productivity, for example in agriculture and construction, and increased credit losses in the affected areas. The value of real estate collateral and related mortgages, as well as corporate loans, is expected to decline in the most exposed locations.

The third module of the stress test also shows that, for the short-term unrated and the two physical risk scenario's total lending and market losses amount to around €70 billion for the 41 banks affected. However this may be less than the actual climate-related risk for four reasons: 1) the available data are incomplete; 2) the modelling underlying the banks' projections only rudimentarily captures climate factors; 3) economic recession and secondary effects are excluded from the scenarios; 4) the exposures under consideration represent only about one third of the total exposures of the 41 banks.

Looking at the long-term projections, the analysis shows that an orderly transition leads to lower losses than a disorderly or no policy action, i.e., a "hot houses" scenario. However, banks make little distinction between the different long-term scenarios because there are no firm strategies or policies yet, except for reducing exposures from the most polluting sectors and promoting lower carbon businesses.

The results of the ECB's 2022 climate stress test show banks need to develop and step up their efforts to improve their climate risk stress testing capabilities to comply with supervisors and regulators. The topic will remain high on the ECB's agenda next year, as the European Banking Authority has already published guidelines and documents on stress testing for 2023. The stress test has also shown that portfolio concentration is significant in sectors exposed to transition risks and that the lack of data makes it very difficult to measure risks accurately.

2.3.Sectors exposed to climate risks in Hungary

2.3.1 Exposure of domestic sectors to adaptation risks

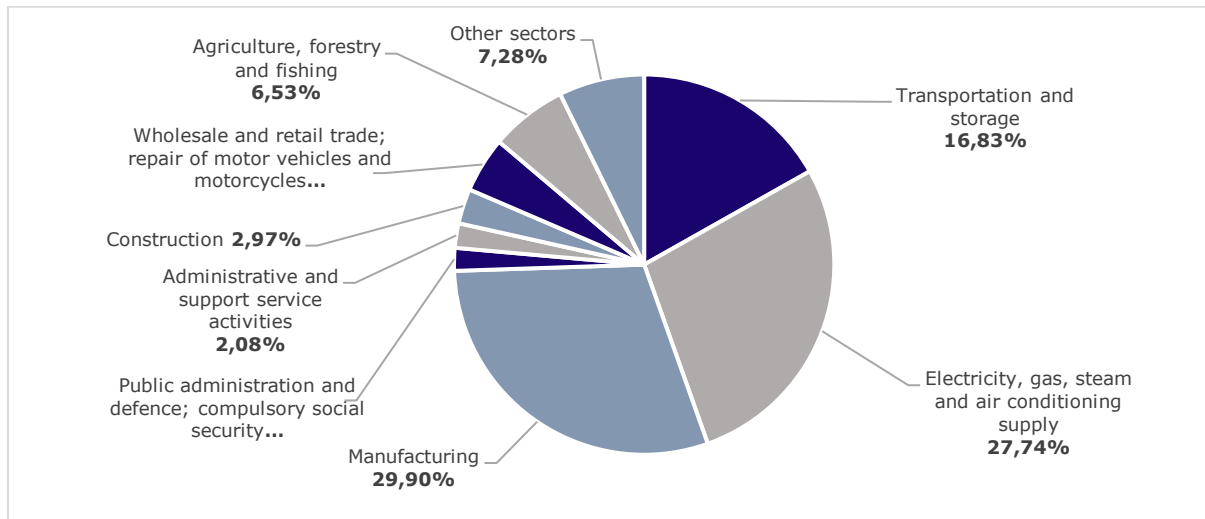
Every European economy has a different structure, therefore different sectors are affected by transition climate risks in Hungary as well. We have analyzed the greenhouse gas emissions of domestic industries based on Eurostat data, analyzing domestic national economic sectors. According to Eurostat's methodology, greenhouse gas is composed of three elements, carbon dioxide, methane and nitrous oxide, and is expressed in tonnes. The GHG emissions of a given sector in a given year is therefore obtained by adding the quantities of the respective elements. We have analyzed the year 2019 because it was the full year before the COVID shutdowns, which can give an indication of where we stand today.

The link between GHG emissions and the risk of carbon leakage is clearly linked to the EU Green Deal, including the objectives of the Fit for 55. Within the EU, regulation can be used to kick-start the decarbonization process. On the legislative side, we already see a number of examples, which will be discussed later.

Looking at domestic industries, 2019 data show that manufacturing had the highest GHG emissions of all sectors of the economy (29.9%), followed by electricity, gas, steam and air conditioning (27,74%), although the emissions of the transport and storage sector (16.83%), agriculture (6.53%), construction (2.97%) and trade and repair of motor vehicles (4.72%) can be considered significant.

2. Figure: Hungary's greenhouse gas emission in 2019

Source: BDO edited, based on EUROSTAT data



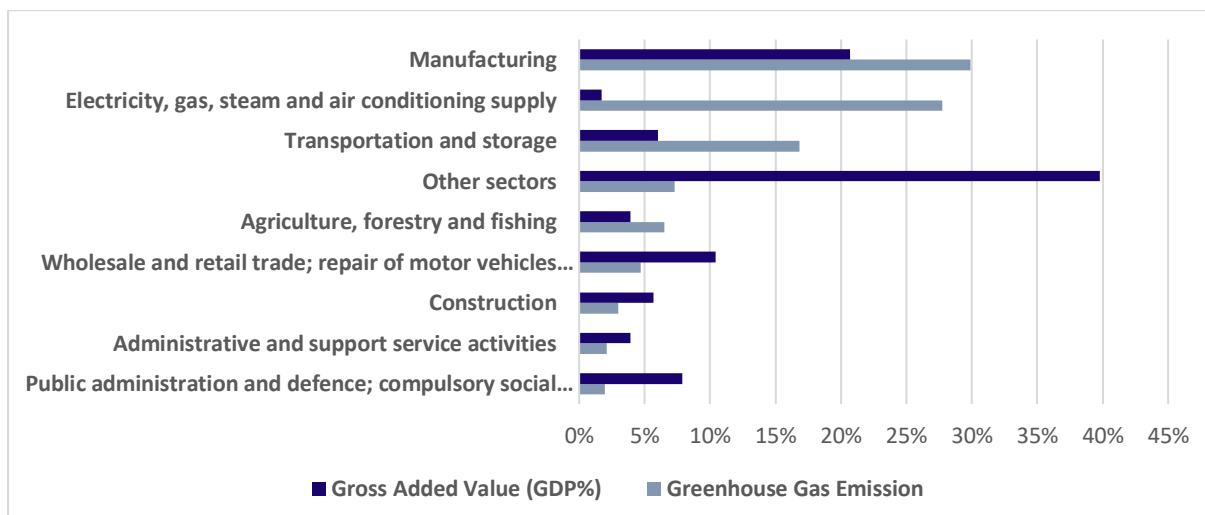
Overall, the eight sectors responsible for 92.7% of corporate GHG emissions in Hungary account for 60.2% of GDP in 2019. Therefore, the transition risk exposure is significant in the Hungarian economy.

Each company within a given sector has a different emissions rate, but it is important for any company operating in any sector of the economy, to be aware of the how much is the exposure of the sector to carbon leakage risk is in which it operates, . The measure of exposure is the GHG emissions, the extent of which can be determined by how high the GHG emissions are in terms of to the total domestic GHG emissions.

In our country, the manufacturing sector has the highest GHG emissions. Based on 2019 data, four segments are responsible for 72% of GHG emissions in the manufacturing sector: chemicals and chemical products (22.59%), other non-metallic mineral products (21.81%), coke and refined petroleum products (14.31%), and basic metals (13.33%). Food is responsible for 7.82%, and transport for 2,8% of the manufacturing sector GHG emissions in Hungary.

3. Figure - GHG emissions from domestic sectors and their weight in the economy (2019)

Source: BDO edited, based on EUROSTAT and KSH data



2.3.2 Examples of sectors affected

Food companies need to switch from plastic packaging to recyclable alternatives in the context of the circular economy. Single-use plastic products are no longer allowed on the EU market from 1 July 2021. In the Hungarian Official Gazette No 100 of 2021, a stricter regulation than the EU regulation was published, banning the sale of non-biodegradable plastic carrier bags with a thickness of between 15 and 50 microns in shops and stores. From 1 January 2023 all plastic and plastic-coated beverage cups are banned as well.

The automotive industry is considered one of the most polluting industries within the manufacturing sector globally (Palea - Santhià, 2022). The regulation of vehicles' carbon dioxide emissions is pushing automotive companies to reduce vehicle emissions as much as possible and is leading to a shift in production and innovation towards electric drive systems.

Sustainable energy management in a country is determined by the energy mix and the share of renewable energy sources in the energy supply. Compared to the EU and Visegrád/V4 countries (the Czech Republic, Hungary, Poland and Slovakia) averages, Hungary has a lower share. According to the MNB's 2021 Sustainability Report, the current target for domestic energy policy is to increase the share of renewables to 21% by 2030, which means a relatively low level of ambition according to the Sustainability Report (MNB, 2021). For companies in the energy sector, the transition risk appears as complying with climate-friendly energy sector regulations to significantly reduce the dependence on natural gas.

Companies operating in the water supply, wastewater collection and treatment, waste management, and decontamination sectors are also significantly exposed to transition risks. This high exposure is explained by the need to comply with the circular economy and waste management legislation. There are a number of ways to reduce the amount of waste and increase the proportion of recycled waste. According to the MNB's 2021 Sustainability Report, by 2029, the recycling rate for plastic waste should be 90%, and by 2030, the material composition of plastics should contain at least 30% recycled material. The target for waste management also includes the mandatory recycling of beverage packaging (MNB, 2021).

In the case of agriculture, the source of climate change risk is the various regulations. These include regulations limiting the use of pesticides, production standards and animal welfare measures.

Transition risks in the transportation and storage sectors are considered to be significant, as more and more partners are favoring lower carbon transport modes, and is therefore a factor of competitiveness in the logistics sector. Companies operating in this sector also have a key role to play in reducing GHG emissions and complying with supply chain regulations.

Financial and insurance activities should not be overlooked, as banks are subjects to significant regulations. Climate risks must be given special attention in their risk assessment and in determining their capital requirements. The extent of the risks is reflected in the amounts of physical risk the sector is already facing.

Swiss RE Institute estimates that global insured catastrophe losses could rise to approximately USD 112 billion in 2021, the fourth highest amount since 1970. Last year, Hurricane Ida caused insured losses of USD 30-32 billion in the US, and Winter Storm Uri caused losses of USD 15 billion. The correct measurement of physical risks, especially in the insurance sector, is becoming more and more valuable.

Domestic financial institutions have a higher exposure to climate risks compared to EU institutions. Approximately 61% of the domestic financial sector's credit exposure falls into the highly exposed category, exceeding the results of the European Banking Authority's survey (Ritter 2022). On the other hand, through their financing activities, financial institutions can also influence the activities of companies by financing green economy activities, therefore the role of the financial sector can be considered significant in the transition to a green economy compared to other sectors. The above-mentioned transition tasks generate a significant need for investment on the part of companies.

2.3.3. Exposure of domestic sectors to physical risks

Hungary also faced drought and heat waves in 2022, while floods and fires are ravaging many parts of the world. In addition, longer-term climate changes are also a risk, with diminishing water supplies, temperature changes and changes in soil fertility. According to the National Meteorological Service, a significant increase in the national average annual temperature is shown by the 1.2 degrees Celsius increase in the national average annual temperature between 1901 and 2020 and by the 1.7 degrees Celsius increase between 1981 and 2020.

Physical risks mainly affect sectors whose activities are directly exposed to the weather, such as agriculture, construction and food industry. In addition, tourism should also be considered as an industry exposed to climate change, since if conditions like water quality and ecosystem of an area change, tourism will also be affected.

The performance of human capital is also influenced by climate change, which may lead to reduced productivity. This will particularly affect manual workers, but also decreases the productivity of office workers, who cannot be expected to work effectively in peak daily temperatures of over 40 degrees Celsius. The performance of human capital is particularly sensitive to climate change in agriculture, construction and mining, increased attention needs to be paid to protecting the health of the workforce in these sectors.

In order to reduce the physical exposure of agriculture in Hungary, it would be necessary to increase the proportion of irrigated land, as crop production is significantly exposed to the risks of climate change. The national goal is to double the area under irrigation by 2024 and to increase it to at least 400,000 hectares by 2030 (MNB, 2021).

Drought and deterioration of soil quality can lead to a reduction in agricultural yields, which in turn can have a knock-on effect on the food industry in the form of shortages of inputs and increased input costs. According

to the September 2022 drought and water scarcity assessment of the National Chamber of Agriculture, the water-household situation is critical in approximately 70 percent of Hungary's territory. In domestic crop production, almost half (42.1%) of the compensation payments were paid for drought damage and about one third (28.2%) for spring frost damage between 2012 and 2017 (Fogarasi et al., 2021). Above all that, agriculture is also threatened by the increasing number of forest fires.

Extreme weather conditions do not benefit companies operating in the information and communication sector either, as damage to the established telecommunications and IT infrastructure can cause huge losses. Physical damage to various facilities can also cause significant financial loss to businesses in the financial and insurance sectors, which can be greatly mitigated by accurate and detailed risk management.

3. International and national good practice

This study presents a good practice of a company in the forestry industry, but it can also be used by companies in other sectors. Rakhi Kumar, Head of ESG Investments and Asset Management, highlighted that the forestry and agriculture sectors are major GHG emitters, responsible for about a quarter of global emissions, and thus risks have a high financial impact on these sectors. The involved companies need to publish the steps they are taking to mitigate climate risks and how they are adapting to the impacts of climate change. Climate adaptation is guiding business strategy in these sectors and is reflected in the targets set (Kumar, 2019).

3.1 Overview of Holmen's good practice

Good practice is presented through the example of the Swedish company Holmen. Holmen is a forestry company producing cardboard and paper products. In addition, it also uses renewable energy sources (Holmen 2022). Holmen aims to increase the value of the forests he owns, the cardboard, paper and wood products it produces can be recycled after their first life cycle. In order to reduce their fossil energy exposure, they rely on renewable energy through wind and solar power. The company's business units have their own processes to manage climate risks and identify opportunities for improvement. In addition, they have ISO certified management systems and the company's business units have a strong focus on energy consumption and GHG emissions. They also prepare a continuity plan for the risks associated with the company's locations (Holmen 2021).

Holmen's research and development plans show that climate change and climate adaptation are central to the company's business strategy, with three main areas of focus: promoting the growth of forest areas, developing new and existing products from forest resources, and increasing production efficiency (Holmen 2021).

The company is also looking at its supply chain in terms of climate risk and is conducting a sensitivity analysis to explore the financial impacts of having less access to wood and energy and how this would have an impact on sales (Holmen 2021).

3.1.1 Legal requirements

Holmen sells its products globally and is therefore exposed to a number of risks in its value chain, including political, natural, and climate related risks. In addition, they are exposed to risks from changes in legal and regulatory requirements, but Holmen actively participates in professional dialogue and advocacy both through industry associations and by promoting fossil-free operations, which it incorporates into its own operations. Although permitting wind farm constructions in Sweden is time and money consuming, the company is steadily expanding its wind power capacity and moving away from bio and fossil energy. Since 2005, it has already reduced its direct emissions under its direct control (Scope1 emissions) by 85%. Fossil-free sources are also preferred for grid supply. Due to the EU Green Deal, the European Commission is developing a strategy for forest management and the EU Taxonomy requires the company to be sustainable. However, compliance is a challenge, as Holmen's forests of different biodiversity require different management (Holmen 2021).

3.1.2 Transition and physical risks

Holmen sees an opportunity to maintain its positive reputation for sustainability, with a focus on quality and reliability. In addition, it provides and develops products that are sustainable and engages in activities that improve the state of climate. This is achieved by removing more carbon dioxide from the atmosphere through the planting of new trees than the company's operations emit (Holmen 2021).

Holmen monitors the Swedish Meteorological and Hydrological Institute's forecasts to assess physical risks, and the forecasts indicate that Sweden will have more rainfall, higher soil moisture and higher average temperatures. This will lengthen the growing season of forests and change biodiversity, but also bring risks such as storm and snow damage, increased fungal decay and insect damage. Thus, soil damage can make harvesting more difficult. Rising water levels in the Baltic Sea and water shortages mean even more risks. Access to timber can be also under concern, 40% of the timber used by Holmen is coming from its own forest, the rest being sourced from other partners and the value chain may carry risks for procurement. According to climate risk analysis, they plant trees that are more resilient to climate change. The longer growing seasons and photosynthesis promoting increased atmospheric carbon dioxide, that will result from climate change, represent an opportunity for forest management. They can make use of this by promoting high quality regrowth by planting new trees in dense forests, as young trees sequester more carbon dioxide from the atmosphere. The company relies on the most up-to-date knowledge, which is why it also follows the recommendations of the Swedish University of Agricultural Sciences in its forest management activities. In their operations Risk manager reports directly to the financial manager (Holmen 2021).

3.1.3 Sustainable value chain

Holmen is a forest owner and active in developing sustainable forestry, and therefore focuses on forestry-related awareness-raising, research and development. 97% of the wood used by the company comes from Sweden and only 3% from imports, mainly from the Baltic States. The company also analyses its suppliers in terms of climate risk. There are many Swedish forest owners in its supply chain, as they own half of Sweden's forests. The supply chain is optimized between forest industry members by exchanging purchases after the deal is done, so that the wood is delivered to the nearest timber yard. This makes transport significantly shorter, more efficient, cheaper and more sustainable, to the benefit of all parties (Holmen 2021).

3.1.4. What can we learn from Holman's example?

The example of Holmen illustrates the need to consider long-term processes in business planning that will take place up to 10-20 years from now. Different industries need to consider a strategy of at least 5-10 years. In addition to a long-term perspective, it is important to identify steps and actions that can be taken today.

Companies should strive to become more independent from biofuels and fossil fuels and move towards renewable energy. This is also a market opportunity to promote business and environmental sustainability through R&D.

Industry actors can demonstrate the level of compliance of their activities through ISO certified management systems. The existence of business continuity plans is a prerequisite for risk reduction and secure long-term operations.

Industry members need to calculate the potential financial impact of climate risks specific to their sector. Based on the results of the GAP analysis, industry best practices will provide guidance on how to mitigate risks in the most effective way and in a timely manner.

Companies need to closely monitor changes in the regulatory environment, such as the EU Green Deal and new legislation emerging under the EU Taxonomy, to ensure legal compliance. To be effective, they should join best practice sharing platforms and aim at opportunities for cooperation, for example in advocacy meetings.

Natural and political risks, that threaten the value chain can be reduced by screening, monitoring and professional dialogue with suppliers.

Best practices should aim to maintain a positive reputation, high quality and reliability. Wherever possible, producing and manufacturing companies should also engage as much as possible in the circular economy, which leads to a more efficient value chain and reduced environmental damage.

It is necessary to keep abreast of scientific findings that affect the profitability of the sector and to manage emerging risks at a high organizational level.

When a company develops its own good practices, it is important to engage with a wide range of stakeholders inside and outside the organization. Dialogue should be ongoing, and it is necessary to understand their perspectives and preferences in order to build successful climate risk management and wider ESG strategy practices. Furthermore, compliance with legislation requires continuous awareness raising and building new structures (appointment of sustainability officers) and optimizing existing ones. These are proposed in the following chapter.

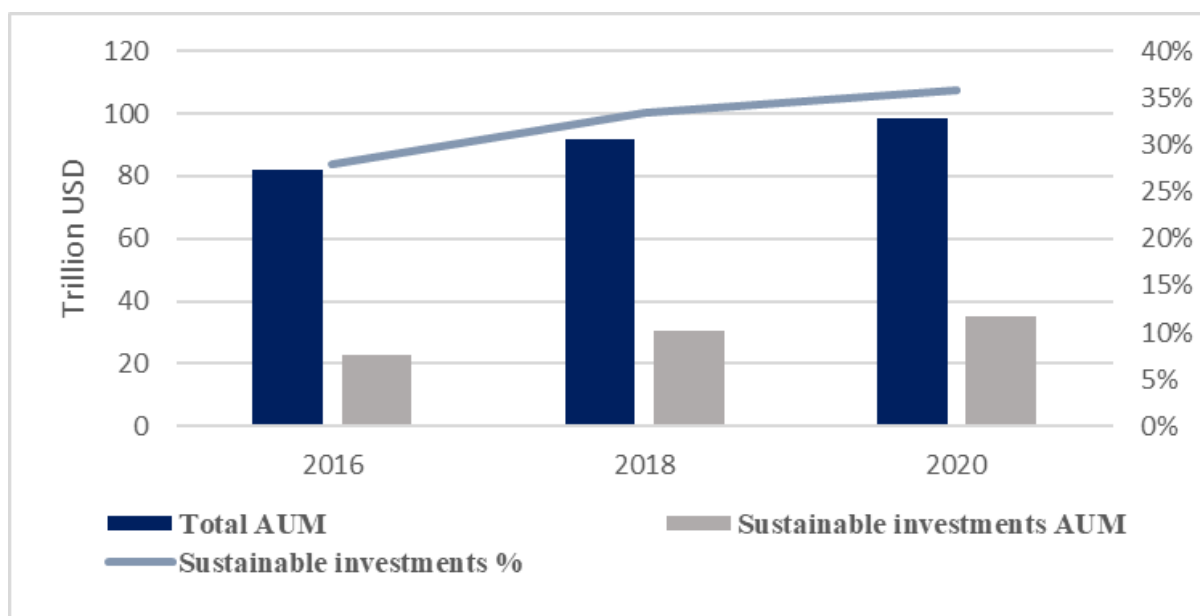
4. The importance of preparing for climate risks, opportunities

4.1 Preferences of investors, consumers, suppliers, employees and regulators

Stakeholders such as investors, consumers, suppliers and employees are concerned about the long-term sustainable operation of their associated companies. ESG and the long-term planning it advocates takes into account sectoral climate risks, the steps needed to manage physical and transition risks, and creates sustainable value and competitiveness for companies and their stakeholders.

Investors have been shifting investment trends towards ESG over the past decade or more, marking a turning point for ESG at global level. CEOs are expected to understand investors' expectations of ESG and to communicate effectively about their ESG activities, thereby attracting more and better financing opportunities (Baum, Tower, 2022).

4. Figure - Total assets (AUM) of sustainable investments in developed markets (trillion USD)
(Europe, USA, Canada, Japan, Australia)
 Source: Global Sustainable Investment Review (2020)



ESG considerations are becoming increasingly prominent in the values of customers as well and this stakeholder group is of particular importance as they decide which company to buy products or services from. In addition, if a company is more in line with their values, they are more willing to buy at a higher price. For

its Global Sustainability Study 2022, global consultancy Simon Kucher & Partners surveyed more than 11,500 consumers across the world about their attitudes towards sustainability. The survey found that two-thirds of consumers cited sustainability as one of the top 5 drivers behind their purchasing decisions, up from 50% in 2021. On average, 32% of all consumers are willing to pay more for a sustainable product and service. Product development, the application of circular economy policies and the selection of new market areas should be aligned with this rising trend (Baum, Tower, 2022).

There is an increasing expectation that not only the company itself, but also the entire value chain, should operate in a sustainable, transparent and ethical way. Under the German Supply Chain Act, which came into force on 1 January 2023, a number of German large wholesalers will have ESG due diligence obligations for the entire value chain. This example of legislation shows that companies in the value chain will increasingly have to comply with codes of ethics and due diligence, both at the behest of the company that commissioned the work and at the behest of certification bodies.

The fight against climate change is also becoming an increasingly important part of employee preferences. We are already seeing more and more of the younger generation preferring to work in jobs where ESG objectives are part of the corporate strategy, and this trend is likely to increase in the future. According to CONE Communications' 2016 survey of millennial workers, 64% of the millennial generation take a company's social and environmental commitment into account when deciding where to work. Companies with an ESG focus may experience greater employee loyalty and lower fluctuation.

Regulators are adopting laws and regulations that impose structured and rigorous requirements for ESG report publishers. Some rules and recommendations apply to publicly traded companies, but legislation is already affecting the ESG activities of large companies. The Corporate Sustainability Reporting Directive (CSRD) is one such expected regulation in the European Union, requiring companies above a threshold to publish non-financial reporting with an ESG perspective. In the United States, the Securities and Exchange Commission (SEC) is also setting up a new set of rules on climate change reporting requirements.

4.2. Legal compliance

In recent years, the European Union has adopted a series of directives and regulations requiring a growing number of companies to address ESG and their sectoral risks. The EU has pledged to reduce its emissions by at least 55% by 2030 and to achieve climate neutrality by 2050. The EU Green Deal is a plan of action to support the achievement of the 2050 targets, to ensure that there are no losers in the transition and to achieve decoupling of economic growth from resource use. The relevant regulations and directives in force at the time of the study in November 2022 are shown in Table 3, while Table 4 shows the legislation expected in the near future.

In general, compliance is based on the establishment of a data collection and management system with sufficient detail. The different sectors have their own specificities that need to be included in the data set, as these form the basis for the reporting and disclosure required for compliance.

Transparency, responsible corporate behavior and comparability between reports will also be supported by the new set of rules. Compliance also requires companies to develop appropriate internal data management and workflows and to measure their environmental, social and governance impacts. This will require companies to have a good understanding of their sectoral climate risks, whether they are physical, legal or market specific, in addition to their sectoral specificities. Companies covered by the above Regulation and Directives should develop a strategy and roadmap and involve the widest possible range of business stakeholders in its implementation. This will require management and employees to motivate and sufficiently involved in the process. It is recommended to launch pilot projects in cases where expected, but not yet final legislation will impose new compliance tasks on the sector and the company.

3. Table - Current legislative environment

Source: Directive 2014/95/EU, Regulation (EU) 2019/2088, Regulation (EU) 2020/853

Legislation currently in force	
NFRD Directive 2014/95/EU	Requires large companies and organisations to disclose and report non-financial, such as social and environmental information.
SFRD Regulation (EU) 2019/2088	The SFRD aims to standardise sustainability disclosures to help institutional asset managers and retail clients understand, compare and monitor the sustainability characteristics of investment funds, and an important objective is to encourage the financial sector to promote sustainable activities and to encourage capital divestment from environmentally and socially harmful activities.
EU Taxonomy Regulation (EU) 2020/853	The EU Taxonomy has identified economic activities that are environmentally sustainable, which is a major benefit for companies and decision-makers. The taxonomy is binding and there will be strong sanctions for non-compliance.

4. Table - Legislation coming into force in the future

Source: (COD) 2021/0104, (COD) 2022/0051

Legislation coming in force in the near future	
CSRD Reporting requirement	While the EU provides voluntary reporting guidelines for NFRD reporting, the CSRD introduces more detailed reporting requirements and mandatory EU sustainability reporting requirements. CSRD reporting is aligned with the existing Regulation on disclosure of sustainable finance and the EU taxonomy.
CSDD EU Corporate Sustainability Due Diligence Directive	The EU's Corporate Sustainability Due Diligence Directive (CSDD) is a wide-ranging reform that imposes a corporate due diligence obligation on companies to identify, prevent, eliminate or mitigate the negative impacts of their operations on people and the environment.

Conclusion

Climate risk issues have become a key concern at company level, as the negative impacts of climate change can be increasingly detected. We are experiencing heat waves, floods and increasingly extreme weather conditions. In addition to the physical risks, companies are also faced with transition risks, as many regulations will come into force in the coming years, and preparation is not a matter of waiting for the moment, as ESG-based business operations will not be implemented overnight but will require thorough preparation and anticipation.

Companies in different industries will be affected by climate change to different degrees, so it is necessary to examine climate risks by sector and industry. Financial institutions are also under increasing pressure from regulators to manage climate risks. In its 2022 stress test, the European Central Bank examined which sectors are most exposed to climate risks, and the MNB has highlighted the climate risks affecting individual sectors in its Sustainability Report.

The presented good practice, using Holmen as an example, showed that cooperation between market actors is necessary, can bring mutual benefits, can be cost-effective steps for companies to reduce their ecological footprint and can increase their competitiveness within the sector. The challenges of climate risk can be translated into business benefits.

It should be recognized that climate change is not only a risk for companies, but also an opportunity. Strategic planning should start by identifying the risks facing the company, mapping the relevant regulatory environment and building a system for measuring non-financial data. If companies start preparing for sustainable operations in time, they can gain a competitive advantage over those that do not. In the current environment, where companies face a number of constraints, this step may be easier to achieve.

Bibliography

Studies

- Fogarasi, J., Kemény, G., Keményné Horváth, Z., Kóti, A., Lőrincz, K., Miskó, K., ... & Zubor-Nemes, A. (2021). Természeti kockázatok kezelésének tapasztalatai a hazai növénytermesztésben, 2012–2017= Experiences of natural risk management in Hungarian crop production, 2012-2017. Accessed: 25. November 2022.
- Kumar, R. (2019). Effective Climate-Risk Disclosure in the Agricultural and Forestry Sectors through the Lens of the Task Force on Climate-related Financial Disclosures. Accessed: 6. November 2022.
- Palea, V., & Santhià, C. (2022). The financial impact of carbon risk and mitigation strategies: Insights from the automotive industry. *Journal of Cleaner Production*, 344, 131001.
- Ritter, R. (2022). Banki klímakitettségek: A magyarországi vállalati hitelállományban felépült átállási kockázatok helyzetképe. *HITELINTÉZETI SZEMLE/FINANCIAL AND ECONOMIC REVIEW*, 21 (1), 32-55.
- Tower, C., Baum, K. (2022). The Stakeholder Value mandate; Available at: <https://www.bdo.com/insights/assurance/corporate-governance/the-stakeholder-value-mandate> Accessed: 8. November 2022.

Documents

- BIS - Bank for International Settlement (2021). Climate-related financial risks – measurement methodologies; Climate-related financial risks - measurement methodologies (bis.org), ISBN 978-92-9259-471-8 (online) Accessed: 16. November 2022.
- Directive (EU) 2018/844 of the European Parliament and of the; <https://eur-lex.europa.eu/legal-content/HU/TXT/HTML/?uri=CELEX:32018L0844&-from=hu#d1e636-75-1>
- European Central Bank (2022C). 2022 Climate risk stress test (Source) Accessed: 2. November 2022.
- European Central Bank (2022B). Guide on climate-related and environmental risks – Supervisory expectations relating to risk management and disclosure (Source) Accessed: 4. November 2022.
- Global Sustainable Investment Review (2020); GSIR-20201.pdf (gsi-alliance.org) Accessed: 26. November 2022.
- Hungarian National Bank: Sustainability Report (2021); <https://www.mnb.hu/letoltes/fenntarthatosagi-jelentes-2021-hun-0518.pdf>. Accessed: 18. November 2022.
- Magyar Közlöny Nr. 100 of 2021; Magyar Közlöny (magyarkozlony.hu) Accessed: 18. November 2022.
- Magyar Közlöny Nr. 101 of 2021; Magyar Közlöny (magyarkozlony.hu) Accessed: 25. November 2022.

Websites

- Chamber of Agriculture's situation review of September: Operatív aszály- és vízhiány szeptemberi értékelése az Országos Vízügyi Főigazgatóság mérőállomásainak adatai alapján Accessed: 25. November 2022.
- Cone Communications Millennial Employee Engagement Study 2016 Cone Communications Millennial Employee Engagement Study – Cone Accessed: 26. November 2022.
- European Central Bank (2022A). Banks must sharpen their focus on climate risk, ECB supervisory stress test shows (Source) Accessed: 6. November 2022.

EU Green Deal | European Commission (europa.eu) Accessed: 25. November 2022.

Holmen, Climate risks and opportunities; Available: <https://www.holmen.com/en/sustainability/our-sustainability-work/reporting/sustainability-report/environmental-sustainability/climate-risks-and-opportunities/> Accessed: 6. November 2022.

Holmen; <https://www.holmen.com/> Accessed: 11. November 2022.

Országos Meteorológiai Szolgálat, országos középhőmérséklet alakulása: Éves és évszakos középhőmérsékletek változása - Hőmérséklet- és csapadéktrendek - met.hu Accessed: 25. November 2022.

Simon Kucher & Partners Sustainability Study 2022: Sustainability Study 2022 (simon-kucher.com) Accessed: 26. November 2022.

Swiss RE Institute A globális biztosított katasztrófaveszteségek 2021-ben 112 milliárd USD-ra emelkednek, ami a negyedik legmagasabb a nyilván-tartásban, a Swiss Re Institute becslése szerint | Svájci Re Accessed: 25. November 2022.

Sources of laws

CSDD: EUR-Lex - 52022PC0071 - EN - EUR-Lex (europa.eu) Accessed: 28. November 2022.

CSRD: EUR-Lex - 52021PC0189 - EN - EUR-Lex (europa.eu) Accessed: 28. November 2022.

EU Taxonomy: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CEL-EX:32020R0852> Accessed: 11. November 2022.

NFRD: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX-%3A32014L0095> Accessed: 11. November 2022.

SFDR: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex-%3A32019R2088> Accessed: 11. November 2022.