



## **The impact of climate change on Finnish business**

### **Summary of scenario study**

Study by Deloitte for the Confederation of Finnish Industries (EK)

January 2020

# The impact of climate change on Finnish business

## Summary

### Study background

- Climate change poses significant physical and societal risks to companies. Finnish companies will face large-scale impacts due to changes in other countries and continents.
- On behalf of the Confederation of Finnish Industries (EK), Deloitte has examined the effects of climate change on different continents and the cross-border impacts of those effects on Finland.
- The purpose of this study is to support awareness-raising among EK member federations and companies about the global impacts of climate change, and to help businesses anticipate and adapt to the changes that will occur in the coming decades. These changes can also be transformed into opportunities.

### Study methodology

- The study examines the effects of climate change through a scenario analysis with 2050 as its target year.
- The scenarios are based on two key variables for Finnish business:
  - What future path will global warming follow? The 4°C and 1.5°C pathways mark the high and low boundaries of the study.
  - How will the global trade policy develop? We examine trade policy futures based on protectionism and free trade.

### Conclusions

- The impacts of climate change on business by 2050 will depend on each **value chain** in question.
- **Physical changes** have a significant impact on global value chains, particularly in terms of access to raw materials, logistics routes and the location of production.
- **Societal changes** particularly affect legislation, technology, migration, access to skilled labor, and investment within different countries.
- The scenario analysis highlighted phenomena for which Finnish companies should prepare:



**Changes in supply chains.** More frequent extreme weather phenomena will affect where companies outsource, what kinds of logistics routes they use, and transportation costs – or whether familiar raw materials, intermediate goods or services remain available at all.



**Circular economy.** The price of raw materials may have risen due to either reduced availability and continued overconsumption or the desire to limit their use in order to reduce emissions and to protect the environment. Both options will increase the need for circular economy solutions.



**Climate risks for finance and investment.** Both the 4°C and 1.5°C global warming pathways imply physical changes in the environment, which are addressed by shifting investments towards low-risk countries. Low carbon investment targets are the clear winners on the 1.5°C pathway in particular.



**Competence development.** The impacts of climate change will require new competencies within companies and industries. A situation where raw materials are scarcer and industries are restructuring will call for continuous investment in competences and product development.

- Adapting to climate change and preparing for the resulting changes in the business environment will help companies to anticipate changes in production and cost structures; fluctuations in customer expectations and demand; to assess the profitability of their investments; to get ahead of and differentiate themselves from competitors; and to seize new business opportunities.

### See the broader background report for impact analyses specific to the EK member federations, including:

- Finnish Food and Drink Industries' Federation
- Finnish Energy
- Finance Finland
- Finnish Commerce Federation
- The Chemical Industry Federation of Finland
- PALTA (Service Sector Employers Palta)
- The Confederation of Finnish Construction Industries RT
- Finnish Textile and Fashion
- Technology Industries of Finland

### Recommendations for companies:

#### 1) Map your own value chain in terms of climate risks

Which are the continents and countries, where changes would have a relevant impact on our operations?

#### 2) Build a knowledge base

What kinds of physical impacts and societal changes can climate change be expected to cause in these areas? Which variables have an effect on the expected changes, and what kinds of future scenarios can be created on the basis of these variables?

#### 3) Conduct a scenario analysis







How would different future scenarios affect our own business? Which common elements exist between different scenarios that we can expect to happen with relative certainty?

#### 4) Define follow-up measures

How should we prepare for the identified impacts? What strategic and operational decisions should we make, and on what timeframe? What are the costs and benefits of the measures?

# The impact of climate change on Finnish business

## Contents

	Background and methodology	4
	Impacts of climate change on different continents	8
	Interface of trade policy and climate change	17
	Scenarios for 2050	19
	Conclusions	24
	Recommendations for companies	29





# Background and methodology

# Background and methodology



The Confederation of Finnish Industries wanted to investigate the effects of climate change on the business environment of Finnish companies

## Background to the study

- In June 2019, a new government program, "Osallistava ja Osaava Suomi" (Inclusive and Competent Finland), was published. This includes an entry stating Finland's aim to become carbon neutral by 2035. All sections of society are expected to participate in achieving this goal.
- The EU is aiming for carbon neutrality by 2050.
- EK is committed to limiting global warming to 1.5 °C. To meet this target, EK's member federations are currently preparing road maps towards carbon neutrality.
- Finnish companies are generally aware of the impacts of climate change for business, but due to changes in the business sector's level of ambition and operating environment, a new, deeper level of understanding of the possible impacts is needed.

## Goals of the study

- EK wanted **support to improve its own and its members' understanding of** climate change impacts on Finnish businesses.
- Due to the physical changes caused by different warming pathways, and the uncertainty and non-linear nature of different societal and political reactions, the decision was made to study the issue through **scenario work**.
- In addition to physical and societal changes occurring in Finland, EK wanted to explore **global, continent-specific changes** as they will have a significant impact for its member companies to be aware of in order to examine the future such as the future operational requirements of their own production and supply chains, and those of their customers and competitors.
- To deepen the understanding of industry-specific changes, EK member federations were involved in assessing the impacts of climate change on the companies of their industry, for example **in terms of profitability, demand, competition, suppliers and the availability of competences**.
- As part of the results, EK also wanted to **provide general recommendations on preparing for and adapting to the impacts of climate change**.

## The phases of the study

- The study was completed during November 2019 – January 2020.
- The work was done in four steps:

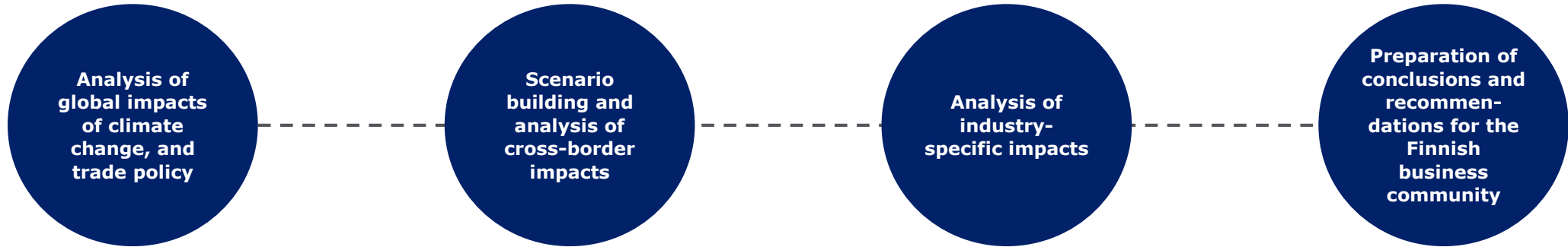


- The work included interviews with subject matter experts, as well as workshops held with EK member associations.

# Background and methodology



The scenario work is based on an analysis of the impacts of climate change and trade policy – future scenarios were used to assess the change in the business environment



## ***An analysis of the global impacts of climate change and a study of trade policy were used to build scenarios based on scientific knowledge and expert evaluations***

- The physical and societal changes of climate change were assessed for each continent. The following section presents more detailed perspectives on the analysis, and summarized results.
- The assessment had a particular focus on the interface of trade policy and climate change. More detailed perspectives on, and the results of, the analysis are presented in the section, "The interface of trade policy and climate change".
- A more detailed description of the analysis methodology is given on page 7. A more comprehensive description of analysis results is presented in the background report.

## ***Changes in the business environment were examined with the help of scenario analysis for the year 2050. The scenarios were based on an analysis performed during the previous phase of the work.***

- The scenarios in this study are based on the changes caused by different global warming pathways and two possible directions of trade policy: protectionism or free trade.
- See the section "Scenarios for 2050" for a more detailed description of the scenarios and some of their cross-border impacts on Finland – more details can be found in the background report.

## ***Future scenarios were examined from the perspective of Finnish industries in order to identify both industry-specific and wider impact chains***

- The industry-specific impacts were assessed in workshops with EK member associations. The industries examined the four scenarios from their own perspectives.
- Examination of the industry-specific impacts provided important tangible information on the challenges different sectors and industries are facing. The conclusions highlight the impacts of different future scenarios on both the industry and service sectors.
- See the section "Conclusions" for the industry analysis. Further information is presented in the background report.

## ***The presented climate change impacts on business and means of preparing for such impacts help companies to perform their own climate risk analyses***

- In the conclusions, we present phenomena which was discovered to be common to all of the examined futures, and for which Finnish business should prepare.
- As companies operate in different continents and countries, they should perform their own value chain-specific analysis of the impacts of climate change. "Recommendations for companies" provides guidance on performing such an analysis.
- The background report provides additional information on the benefits of assessing company-specific climate-change impacts, and on scenario analysis as an assessment tool.



# Background and methodology



The analysis of the global impacts of climate change, and of trade policy, was based on a literature review and expert interviews

## Impacts of climate change on different continents

- The work examined the physical and societal impacts climate change will have by 2050, from the perspective of all continents.
- Warming pathways of 1.5°C, 2°C and 4°C were examined.
  - According to the IPCC, these global warming pathways imply global warming of about 1.3–2°C by 2050.
  - NB! Subsequent scenario analysis omitted analysis of the 2°C scenario – only the extremes were described.
- The physical impact assessment is based on scientific research, mainly sourcing IPCC reports.
- In evaluating trends in the societal impact of climate change, assessments by the interviewed experts were used in addition to public sources.
  - There is more uncertainty related to the societal changes caused by climate change than about the physical changes.

### *Factors considered in the physical impact assessment*

Warming of the atmosphere  
Sea level rise  
Changes in precipitation  
Biodiversity  
Changes in vegetation  
Glacier change

### *Themes considered in the societal impact assessment*

Policy and legislation  
Society  
Economy  
Technology

## Impacts of global trade policy

- In addition to the impacts of climate change on each continent, the research examined the impacts of trade policy on industries in Finland, particularly the interface of trade policy and climate change.
- International trade and the related developments have a significant impact on the business environment of the Finnish export-driven economy.
- Analysis included examination of both the influence of protectionist measures on the society, and the context of free trade and related growing opportunities to promote international climate action through mechanisms such as carbon pricing.
- The review was based on interviews with international experts from the Ministry for Foreign Affairs and Deloitte. Recent news coverage on issues such as developments in emissions trading and carbon tariffs, and other public sources were also used.

### *Analysis of trade policy*

Protectionism versus free trade policy  
Terms for combating climate change as part of trade negotiations  
Emissions trading schemes and emissions taxes  
Carbon tariffs  
Fossil-fuel subsidy schemes



# Impacts of climate change on different continents



# Impacts of climate change on different continents



The warming climate will shape living conditions – the impacts will be unevenly distributed across the continents

2050

## North America

- Increasing frequency of droughts and heatwaves put pressure on agriculture and human settlements.
- Increasing frequency of extreme weather events and rising sea levels threaten settlements and industry on the east coast.
- The direction of climate policy is uncertain – states, provinces, cities and companies implement their own emission reduction plans.

## South America

- Global warming is most pronounced in the interior of the continent, leading to changes in agricultural areas.
- Andean glaciers continue to melt, affecting drainage basins along much of the west coast.
- Climate change creates pressure on infrastructure and populations in the already highly urbanized region.

## Europe

- Rising temperatures and changes in rainfall increase droughts in the Mediterranean.
- Infrastructure is under high pressure: rising sea levels threaten coastal settlements, waterways are becoming less secure and rail traffic may be disrupted by heat.
- The EU meets its carbon neutrality target for 2050 and economic structures are changing.

## Africa

- The average temperature is increasing throughout Africa in all seasons and adds pressure on food production.
- Population growth continues and the urban population triples by 2050.
- Intra-African market develops through the African Continental Free Trade Area.

## Arctic regions

- The climate in the Arctic warms so rapidly that society cannot keep pace with the adaptation measures.
- Access to resources in the Arctic is a major topic in power politics debates – indigenous peoples play a crucial role in adaptation
- Shipping traffic grows on both northern routes as sea ice recedes.

## Asia

- Storms and floods disrupt life on the coasts, drought is doing so inland.
- Farming and fishing opportunities are under threat.
- China has increased its influence on other continents through infrastructure investments.

## Australasia

- Combined with rising sea temperatures, acidification endangers the functioning of marine ecosystems.
- Intensifying dry and hot periods affect water availability and increase the frequency of wildfires.
- Internal and external migration increases as a result of climate change.

# Impacts of climate change on different continents – Europe



European development is guided by the EU's 2050 carbon neutrality goal, but even the 1.5°C warming pathway will have major physical effects on the continent by 2050

## 2050 in Europe

### Rising temperatures and changes in rainfall increase droughts in the Mediterranean



If the world follows a warming pathway of more than 2°C, the climate will warm up by at least 1.5°C by 2050. The number of hot days would then increase by 20–30 a year in Southern Europe, and the number of frost days reduce by 20–40 in Northern Europe.

Southern Europe is severely affected by heat and drought. Limiting warming to 1.5°C could reduce, but not eliminate, droughts of greater frequency and intensity.

Europe needs more electricity for cooling its current building stock as temperatures rise. At the same time, the electrification of society has advanced.

### Infrastructure is under pressure: rising sea levels threaten coastal settlements, waterways are becoming less secure and rail traffic may be disrupted by heat



Combined with heavy rainfall, the rise in global sea levels is very likely to cause storm floods in coastal areas, particularly along the Atlantic coast in Northern and Southern Europe.

Rails buckle in the heat and may thus stop rail traffic altogether – droughts also make it difficult to use inland waterways in Europe as logistics routes.

### The EU meets its carbon neutrality target for 2050 and economic structures are changing



Europe's energy self-sufficiency increases and its dependence on energy imports reduce to 20% of consumption.

More than 80% of energy comes from renewable sources and electricity covers half of energy needs.

Country-specific emission reduction targets leads to new solutions for the agriculture, transport, heating and waste management industries, changing old operating models.

The building stock's energy performance has significantly improved through energy renovations, and houses built between the 2020s and 2050s are zero-energy.

# Impacts of climate change on different continents – the Arctic



The Arctic is changing so fast that society and infrastructure cannot adapt – emerging economic opportunities create political tension

## 2050 in the Arctic

**The Arctic's climate warms so rapidly that the society cannot keep pace with the adaptation measures**



Lack of knowledge, finance, expertise and organizational capabilities limit adaptation to climate change in many sectors of society.

The melting of permafrost and the fluctuations in freezing processes intensify and cause damage to e.g., structures in bridges, pipelines, industry and other infrastructure, and logistically important winter and ice routes become less available.

**Access to resources in the Arctic is a major topic in power politics debates – indigenous peoples play a crucial role in adaptation**



Arctic oil reserves become accessible, which creates a conflict with striving towards fossil-free energy policies – countries with ambitious climate policies seek to prevent oil drilling in the Arctic.

The representation of indigenous peoples in decision-making is a key element in ensuring sufficient adaptation to climate change.

**Shipping traffic grows on both northern routes as sea ice recedes**



On the 2°C pathway, there is a 50% probability that sea ice will melt during the summer. A completely ice-free summer occurs at least once every 10 years – according to the most advanced forecasts, in some years a 4°C pathway would see the Northeast Passage open for up to 125 days by 2050.

Transport times between continents will be significantly reduced between countries able to take advantage of the routes.

# Impacts of climate change on different continents – Asia



Coastal regions in Asia suffer severe flood damage, while many inland areas suffer from water supply problems and drought

## 2050 in Asia

**Storms and floods disrupt life on the coasts, drought is doing so inland**



Temperatures rise approximately 2°C everywhere. Warming is approx. 2–3 times faster in the northern regions, depending on the warming pathway.

The number and intensity of tropical storms is increasing – the destructive effects of storms intensify, especially in geographically low-lying areas such as Indonesia and Vietnam.

Accelerated glacial melting in the Himalayas increase inland water volumes in the drainage basins, increasing flood risks. Access to water is a key challenge for societies in large arid regions of Asia, particularly Western Asia.

**Farming and fishing opportunities are under threat**



The ability of key rice-producing regions to provide livelihoods and food reduces significantly, at least in India, Pakistan, Thailand, Indonesia, the Philippines, and many regions in China.

In drought-sensitive areas, rainfall is projected to decrease by up to 50% by 2050.

Fish stocks deteriorate as seawater warms and fish seek cooler waters.

**China has increased its influence on other continents through infrastructure investments**



China's environmental and climate goals are driving technological development and the transformation of the energy system.

China's reserves of rare metals foster the energy technology transition in the region.

Developing countries in Asia continue to rely on local fossil fuels for a long time to come, due to low cost and security of supply.

Through its Belt and Road strategy, China has successfully promoted major infrastructure projects in Asia, the Middle East, Africa, Europe and the Americas, increasing its global influence.

# Impacts of climate change on different continents – Australasia



Water security is a major issue in Australasia, as societies adapt to and try to overcome intensifying climate risks

## 2050 in Australasia

**Combined with rising sea temperatures, acidification endangers the functioning of marine ecosystems**



Coral reefs and other ecosystems in the area will be significantly affected or even destroyed by warming seawater.

Rising seawater and air temperatures are affecting the area's nature tourism and other local livelihoods such as fishing.

**Intensifying dry and hot periods affect water availability and increase the frequency of wildfires**



The northern parts of the continent become rapidly drier and warmer, forcing societies to make radical changes in adapting to the new conditions.

More frequent wildfires and rising maximum temperatures increase direct health risks posed to humans and animals – in Melbourne, by 2070 the number of days above 35°C is expected to increase by 90–170% on the 4°C pathway and 30–90% on the 2°C pathway.

**Internal and external migration increases as a result of climate change**



Despite major problems in the region due to warming, people are moving to Australia from neighboring islands and South Asia.

The exploitation and export of Australia's fossil fuel reserves may become controversial as the country moves towards a renewable energy system.

# Impacts of climate change on different continents – North America



In North America, the impacts of climate change are particularly evident on the east coast and in the south

## 2050 in North America

**Increasing frequency of droughts and heatwaves put pressure on agriculture and human settlements**



On the 4°C warming pathway, by 2050 winter coastal temperatures rise by 1.5–3°C and, in the north and inland, by up to 3–6°C .

The devastating effects of wildfires on nature and societies increases, particularly in the southern and western United States. Agricultural productivity declines due to worsening droughts and an insecure water supply.

The great plains in Central America are also affected by drought, which impacts the region's food production and local livelihoods.

**Increasing frequency of extreme weather and rising sea levels threaten settlements and industry on the east coast**



Hurricanes may proliferate in the eastern regions of the continent and cause widespread storm damage in the built environment, cut off major traffic lanes, and cause disruptions and security of supply problems for industry.

Disruptions and damages of transportation routes increase as the effects of climate change intensify.

Coastal societies have to invest in flood control and prevention, while southern and central parts of the country will have to invest in water security.

**The direction of climate policy is uncertain – states, provinces, cities and companies implement their own emission reduction plans**



Different regions have diverged in the implementation of climate policy which also affects the pace of energy system reform.

There is strong development of CCS technology due to the use of the region's own fossil fuel reserves especially in North America; CSS may become economically viable by 2050.



# Impacts of climate change on different continents – South America

## South America's large agricultural sector will transform as the climate warms



### 2050 in South America

**Global warming is most pronounced in the interior of the continent, leading to changes in agricultural areas**



On the 4°C warming pathway, regional warming is already close to 3°C by 2050 in Central America and the interior of South America. Rainfall decreases on the west coast and increases in the southeast.

Yields of main crops decrease, particularly in Central America, Northeast Brazil and the Andes – however, primary production is expected to increase in both Central and South America due to the growing demand for food and biofuel.

The fauna and flora of the Amazon and Guyana regions are particularly affected by climate change.

**Andean glaciers continue to melt, affecting drainage basins along much of the west coast**



Particularly in large urban areas, the availability of clean water is a growing concern, and increasing demand for water is increasing the price of agricultural water supplies. This complicates the position of farmers.

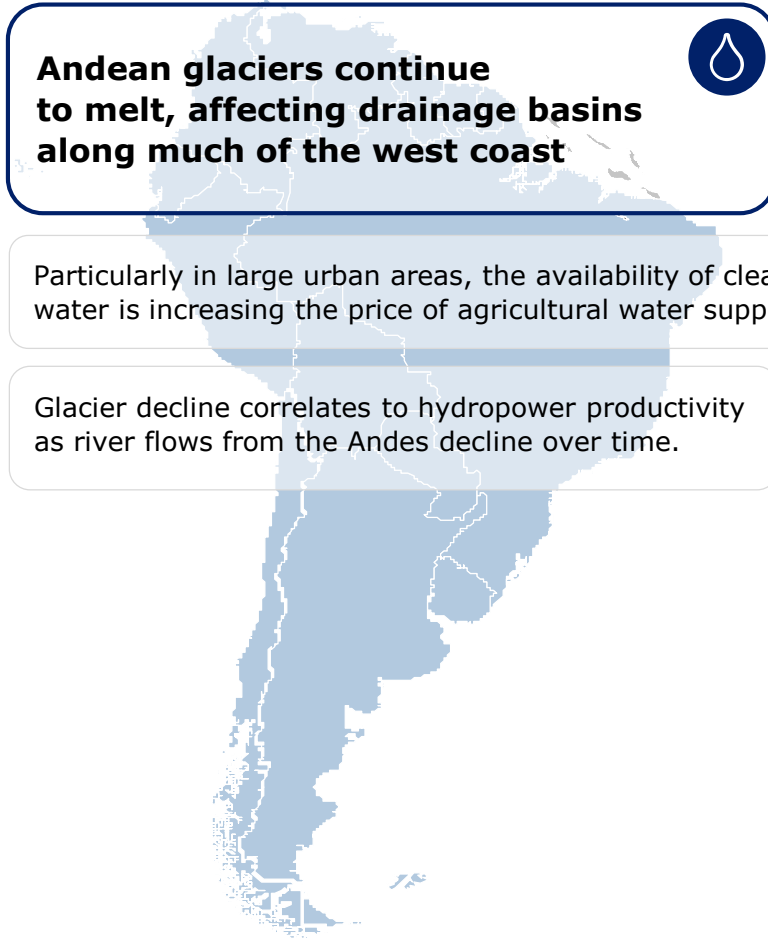
Glacier decline correlates to hydropower productivity as river flows from the Andes decline over time.

**Climate change creates pressure on infrastructure and populations in the already highly urbanized region**



The major urban areas on the continent grow even further as uncertainty caused by extreme weather events increases migration to cities.

As the standard of living on the continent rises, the number of passenger cars is expected to triple by 2050, compared to 2000. Rising temperatures and increasing air pollution increase health problems among city dwellers.





# Impacts of climate change on different continents – Africa



In Africa, the average temperatures are rising faster than the global average; a combination of heat and drought contribute to desertification, particularly in the north and south of the region

## 2050 in Africa

**The average temperature is increasing throughout Africa in all seasons, putting pressure on food production**



By 2050, throughout Africa temperatures rise by about 1–1.5°C on the 1.5°C warming pathway – the intensity and frequency of dry periods increase, particularly in the northern and southern parts of the continent.

A warming climate poses major risks to Africa's food security – working conditions are also deteriorating.

For example, tea, coffee and cocoa plantations and productivity are affected, and the area suitable for maize cultivation in West Africa contracts by 40%.

**Population growth continues and the urban population triples by 2050**



The share of the population with poor access to clean water falls to less than 20% by 2050.

Young people account for a significant proportion of the population. If living conditions and environmental conditions deteriorate as the climate warms, population movements increase within and out of the continent.

**The African internal market develops through the African Continental Free Trade Area**



African countries engage in closer economic cooperation and the internal market of Africa develops. The negotiation power of Africa in relation to other economies grows.

Africa's energy system electrifies and the societies adopt new technologies. However, some countries remain reliant on fossil fuel reserves for a long time to come.



# Interface of trade policy and climate change

# Interface of trade policy and climate change

Role of climate change mitigation in trade policy – climate-related controls will be introduced to level the playing field between economies



## Trade policy instruments in the fight against climate change

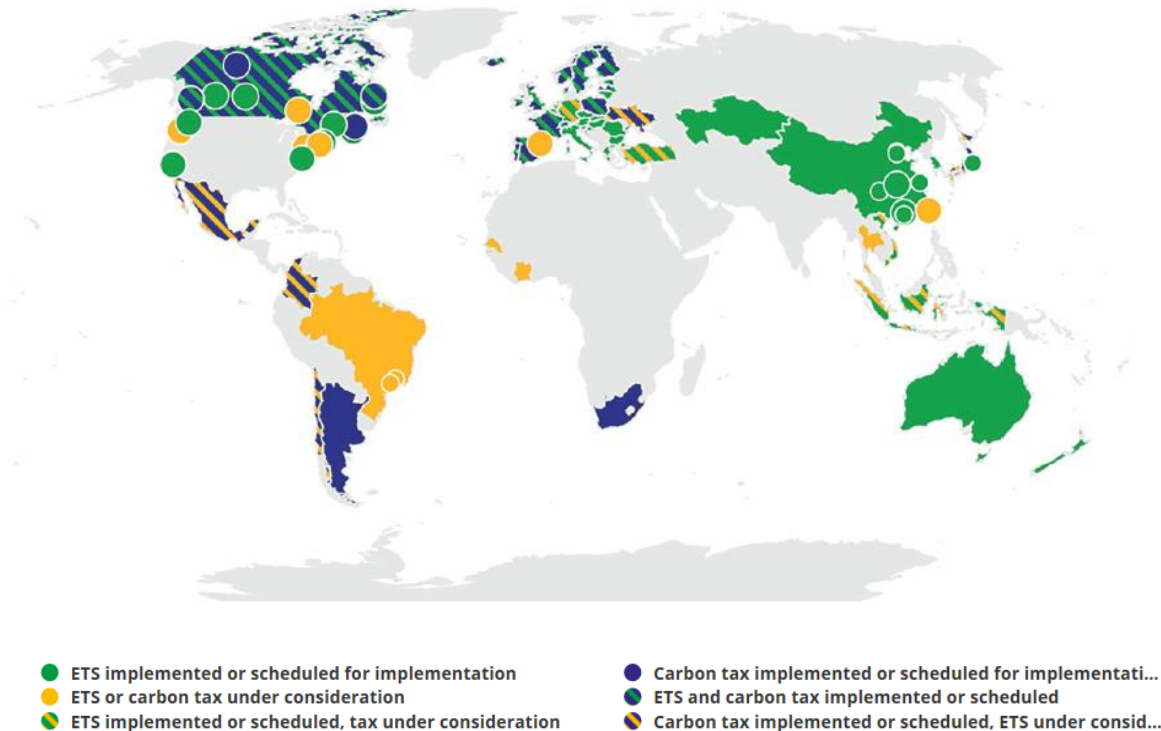
### Climate clauses in trade agreements

Measures to combat climate change can be included in bilateral trade negotiations. The EU requires that free trade agreements comply with the Paris Agreement.

### Emissions trading schemes and emissions taxes

Transnational emissions trading systems and emissions taxes will set a price for emissions and level the playing field for companies in different countries. If all countries are not covered by the same emission pricing systems, carbon leakage may occur, such as the off-shoring of industrial production to countries where emission pricing does not occur.

Global carbon pricing initiatives (1/2020)



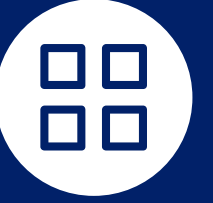
Source: World Bank Carbon Pricing Dashboard 2020

### Reform of fossil fuel subsidy schemes

Use of fossil fuels is still subsidized in many countries. The reform of these subsidies will have important trade policy implications as fuel prices change and energy self-sufficiency increases.

### Carbon tariffs

In practice, carbon tariffs are a marginal tax paid by companies on other continents in order to sell their products on the market of the state or economic territory imposing the carbon tariff. The aim of carbon tariffs is to price climate impacts into products or raw materials produced, using high-polluting technologies, outside the economic territory in question.



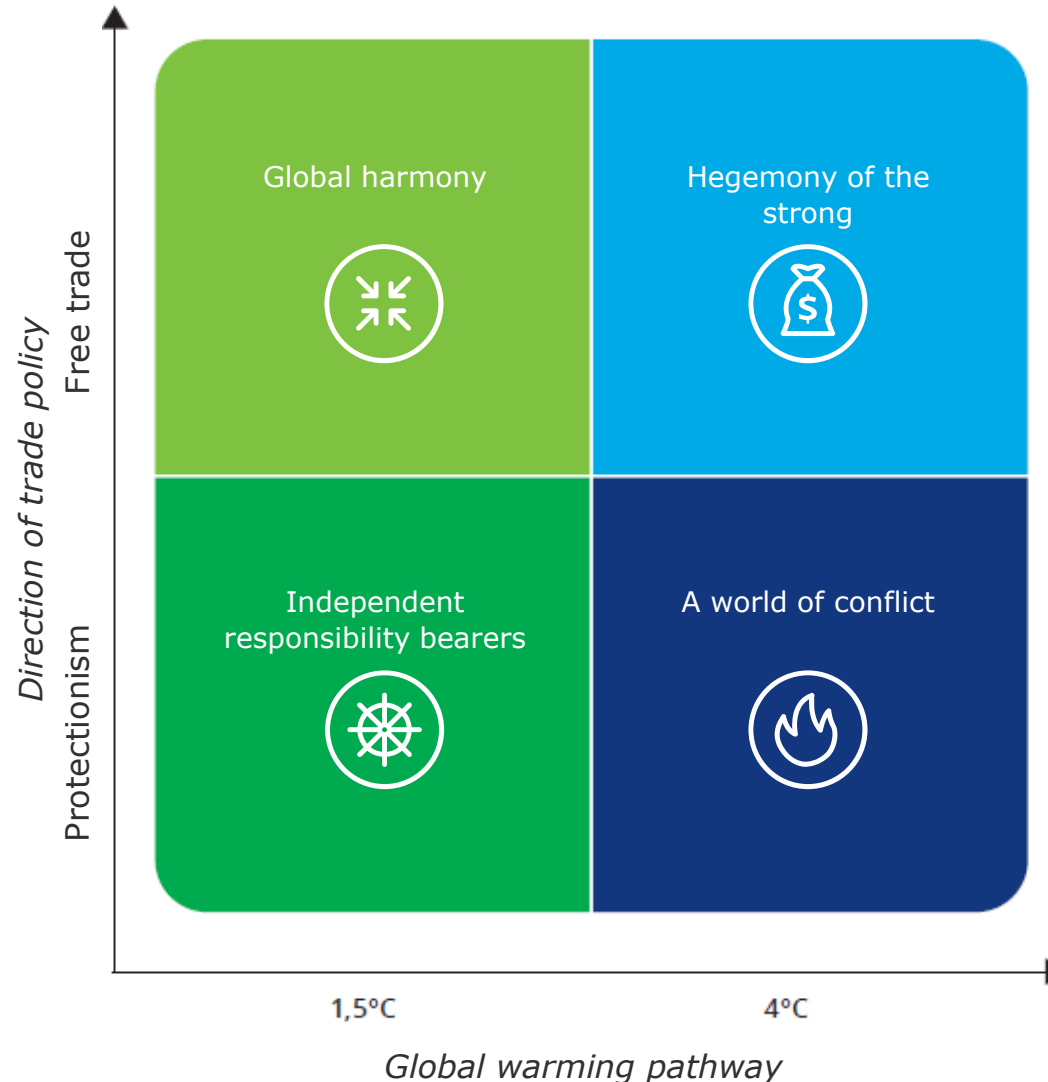
# Scenarios for 2050

# Scenarios for 2050



Four future scenarios were created by examining alternative global warming pathways and trade policy directions - companies can use these scenarios to anticipate future changes in the business environment

- Scenario analysis is a tool used in strategy work, to prepare for a range of futures. The scenarios are not forecasts or predictions, but imaginary future narratives based on the knowledge and observed phenomena of today. Their purpose is to help strategic thinking.
- The year 2050 was chosen as the scenario target year because it is a key target year in climate policy and by then, the effects of different warming pathways will be evident. The year is also relevant in terms of companies' investment horizons.
- These scenarios are based on an examination of the predicted physical changes caused by the 1.5°C and 4°C warming pathways and the resulting societal impacts. The variable illustrates the extremes of the predicted trends: the 1.5°C warming pathway assumes that societies make a very rapid low carbon transition, while the 4°C warming pathway assumes dramatic physical changes.
- The other variable chosen for the study was the direction of trade policy. The scenario analysis examined the potential effects of both free trade and protectionism.



The worldviews presented by the scenarios were supplemented by some certainties, that is, trends occurring in all four scenarios, irrespective of the warming pathway and direction of trade policy.

**Certainties**

- The EU retains and achieves its carbon neutrality goal for 2050
- There is free trade in emission-reducing technologies
- Development of digitization and automation continues
- Urbanization continues
- Global population growth continues, but in developed countries the population declines

# Scenarios for 2050

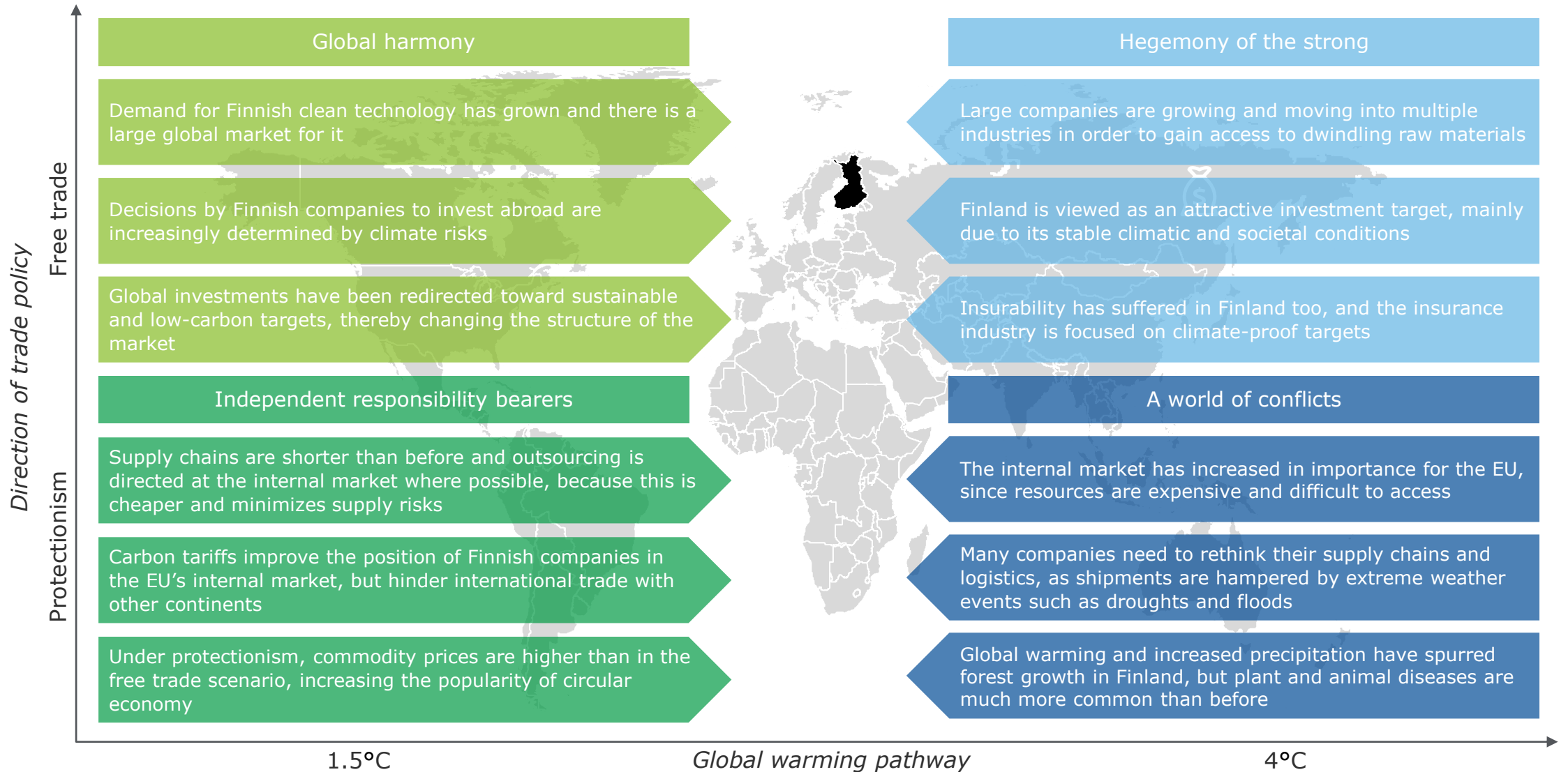


The scenarios depict the most extreme future narratives - the development path that will eventually prevail is likely to lie between those extremes



# Scenarios for 2050

## Examples of cross-border impacts on Finland























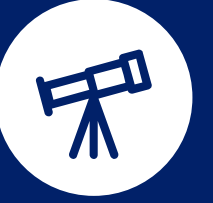


# Scenarios for 2050

## Similarities and differences between scenarios



Sub-area	Features of scenarios					
						
Policy and legislation	The EU's low-carbon climate policy 	No extensive global climate policy 	Tense international relations 	Unified environmental legislation and product standards 		
Economy	Circular economy –based operating models in use 	Over-consumption and scarcity of natural resources 	Ecologically sustainable global economic growth 		Expensive raw materials 	
Society	Significant changes in social structures 	Increased population movements 	Increasing inequality between countries 		Threat of major conflicts 	
Technology	The EU is a driver of low-carbon technology development 	No large-scale abandonment of fossil energy sources 	Rapid development of recycling technologies 		Energy production is largely emission-free 	



# Conclusions

# Conclusions



The physical impacts of climate change will increase towards the mid-century but remain moderate in Finland – thus Finnish companies are influenced primarily through the developments in their global value chains

## On a global scale...

- Global warming and the resulting physical impacts are distributed very unevenly throughout the world.
- On a large scale, the southern hemisphere and continents experience faster warming than the north, and inland areas warm faster than the coasts.
- Even on a 1.5°C warming pathway, disruption of freshwater supply occurs in many areas, e.g. southern Africa and the Mediterranean.
- Changing rainfall and a warming climate cause vegetation biome shifts and the migration of species to new areas, and extinctions of animal and plant species.
- Loss of biodiversity reduces societies' ability to adapt to climate change.
- Following a 4°C warming pathway means a rise of 2°C of the average global temperature by 2050.
- The physical impacts of climate change by the mid-century are more profound in the 4°C pathway in comparison to the 1.5°C pathway. On the 4°C pathway for example the extreme weather events and sea level rise are much more pronounced.
- Reaching a 1.5°C warming pathway requires comprehensive and rapid transformation in various sectors. Low-carbon solutions are the winners in the global economy aiming for that path.

## In Finland...

- **A warming climate does not significantly improve agricultural conditions in Finland, but accelerates forest growth and enables greater carbon sequestration.**
  - However, growing the carbon stock requires avoiding and preventing forest damage. Development in forest use also strongly affects actual carbon sequestration.
- **Industries dependent on foreign raw materials are vulnerable to the physical risks posed by climate change.**
  - Changes of climate conditions on different continents affect the reliability of raw material supply chains, due to factors such as infrastructural damage, leading to changes in supply chains or increasing costs.
- **By 2050, Finland relies mostly on clean energy technologies and the society is extensively electrified.**
  - Efforts to reduce industrial emissions have markedly increased demand for electricity generation.
- **The impacts of climate change for the service sector are mainly indirect and experienced through the shifts in economy.**
  - Demographic trends in Finland also play an important role for the service sector. In a world following the 4°C warming pathway, population movements driven by climate change are likely to increase significantly more than on the 1.5°C pathway. This may mean a major increase in immigration to Finland.
- **Finland's attractiveness as an investment environment may increase due to the relative stability of the country from the point of view of physical climate impacts.**

# Conclusions



Each scenario identified recurring phenomena for which all companies in Finland should prepare



**Changes in supply chains.** More frequent extreme weather phenomena will affect where companies outsource, what kinds of logistics routes they use, and transportation costs – or whether familiar raw materials, intermediate goods or services remain available at all.



**Circular economy.** The price of raw materials may have risen due to either reduced availability and continued overconsumption or the desire to limit their use in order to reduce emissions and to protect the environment. Both options will increase the need for circular economy solutions.



**Climate risks for finance and investment.** Both the 4°C and 1.5°C global warming pathways imply physical changes in the environment, which are addressed by shifting investments towards low-risk countries. Low carbon investment targets are the clear winners on the 1.5°C pathway in particular.



**Competence development.** The impacts of advancing climate change will require new competencies within companies and industries. A situation where raw materials are scarcer and industries are restructuring will call for continuous investment in competences and product development.

# Conclusions



The scenarios were examined from the perspectives of different industries in collaboration with EK member federations – the impacts vary widely across sectors



## Industry will suffer more than services from the direct impacts of climate change

- Changes in supply chains, rising commodity prices and unpredictable production conditions on other continents will have a direct impact on the profitability of industrial companies.
- The impacts on service sector will occur indirectly, through general economic developments. Climate change will affect the service sector through factors such as reduced consumption and immigration.



## Increased energy use in other sectors will have an impact on the energy industry

- From the energy industry's perspective, investments in clean energy systems will have been made by 2050.
- The scale of investment needs to respond to e.g. the growing demand for electricity is depends on the scale of and fluctuations in electricity demand by other sectors and consumers.
- In an uncertain political environment, a 4°C warming pathway will be more likely than the 1.5°C scenario, and companies will be more likely to invest in projects with a short payback period.



## Immigration is likely to increase, affecting domestic demand as well as companies' recruitment opportunities

- Climate change may cause major population movements.
- The stronger global warming is, the more unpredictable will its effects on the scale and direction of population movements be.
- A major increase in the number of immigrants to Finland would have a substantial impact on the country's social structures in general.
- Various industries emphasized the importance of investing in education and social integration, regardless of the expected immigration levels.



## Protectionist trade policy is largely negative for Finland and will affect all sectors due to the slowdown of the world economy

- Finland is an export-driven economy and increasing protectionism is likely to reduce international demand.
- Protectionist measures between large states or economic areas are likely to have a negative impact on Finland: operating conditions are likely to become more difficult for industry as factors of production, such as raw materials, become more expensive.
- The service sector will largely follow the general economic trend, being affected by the reduction in people's purchasing power.



## In the free-trade scenarios, research and development in low-emission technology will be a major competitive factor

- A world with an ambitious climate policy will have huge markets for clean, sustainable solutions.
- There will be demand for solutions if the world follows the 4°C pathway: continents outside the EU will also need to take account of air pollution in large cities, which may increase demand for clean technology in this scenario too.
- To be winners in global competition, Finnish companies would be wise to increase their investments in emission-reducing technology.

# Conclusions

## Highlights of the cross-border impacts of climate change on Finnish business



Many crucial production materials will become more difficult to acquire as e.g. production areas relocate, crops suffer and mining is hampered by changing climatic conditions.

- **Demand for circular economy solutions and alternative raw materials will grow in heavy industry as well as the food and clothing industries.**

In some regions, business and housing insurance may become impossible due to high climate risks.

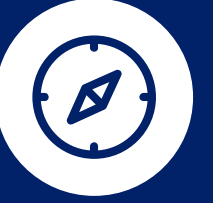
- **Even in Finland, flood risks may for example affect the insurability of buildings.**

A warmer climate will adversely affect the working conditions of outdoor workers and factories without air-conditioning, especially in the southern hemisphere – there may be stoppages due to heatwaves.

- **Working conditions will deteriorate and productivity fall in many factories.**

More frequent heatwaves will cause tracks to buckle and hamper the use of inland waterways as logistics routes.

- **Shipments suffer, new logistics routes must be found and are becoming more expensive, or suppliers are being sought from closer locations to ensure security of supply.**



# Recommendations for companies



# Recommendations for companies



Each company has a different value chain, and therefore the impacts of climate change should be studied from the perspective of individual companies and the third parties they operate with

**From the perspective of individual companies, the physical and societal changes caused by climate change are worth examining, in four steps:**

**1**

## **Map your own value chain in terms of climate risks**

- Which are the continents and countries, where changes would have a relevant impact on our operations?

**2**

## **Build a knowledge base**

- What kinds of physical impacts and societal changes can climate change be expected to cause in these areas
- Which variables have an effect on the expected changes, and what kinds of future scenarios can be created on the basis of these variables?

**3**

## **Conduct a scenario analysis**

- How would different future scenarios affect our own business?
- Which common elements exist between different scenarios that we can expect to happen with relative certainty?

**4**

## **Define follow-up measures**

- How should we prepare for the identified impacts?
- What strategic and operational decisions should we make, and on what timeframe?
- What are the costs and benefits of the measures?

Adapting to climate change and preparing for the resulting changes in the business environment will help companies to anticipate changes in production and cost structures; fluctuations in customer expectations and demand; to assess the profitability of their investments; to get ahead of and differentiate themselves from competitors; and to seize new business opportunities.

Taking the above steps in anticipation of climate change impacts is therefore worth including e.g. in business environment reviews done as part of strategy processes.



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