Adapting to Climate Change

Climate Change Adaptation Guide for Private Sector

－Preparing for Climate Risk and Surviving－

March 2019

環境省
Ministry of the Environment

Contents

Introduction

In July 2018 torrential rain caused enormous damage in Japan, mainly in western regions, and Typhoon Jebi, which hit the Kinki region (the area around Kyoto and Osaka) in September of the same year, had a variety of impacts on private sector, including damage to buildings, power outages, water outages, and suspended operations. The impacts on private sector were not limited to the disaster-stricken areas, but spread throughout Japan due to the disruption of supply chains and distribution. In the future, climate change is expected to further increase the risks of such torrential rains and typhoons, as well as extreme heat.

The impact of climate change varies depending on the location and business activities of individual companies. Climate change impacts are expected to grow further in the future. In order to avoid and mitigate these impacts, it is important to implement independent measures that take into account the characteristics of each company's business activities. Strategic efforts to adapt to climate change are indispensable not only for enhancing business sustainability, but also for enhancing the competitiveness of private sector by, for instance, increasing the confidence customers and investors have in them, and creating new business opportunities.

Under Japan's Climate Change Adaptation Act enacted in June 2018, it is expected that "in order to carry out their own business activities smoothly, businesses shall endeavor to adapt to climate change in accordance with the content of their business activities and to cooperate with national and local governmental programs for climate change adaptation." To this end, Japan's Ministry of the Environment has formulated this Guide to support private sector's voluntary efforts.

The purpose of this Guide is to deepen understanding of the relationship between climate change and business activities and to promote independent efforts among those who are engaged in the management and operation of private sector seeking to tackle climate change adaptation. The main body of this Guide introduces the impact of climate change on business activities, the basic approach to adaptation, and the merits of private sector addressing adaptation. The accompanying supplementary material explains the items contained in the main body of this Guide, and also provides reference materials on climate change impacts and examples both in Japan and overseas.

We hope that this Guide will be used not only by private sector, but also by other organizations and NGOs as a reference document to promote independent adaptation and sustainable management in line with their respective activities. We hope that this Guide will also be used by local governments in cooperation with private sector and other organizations in their efforts to deal with the issues of local climate change adaptation.

1. What is Climate Change *Adaptation* for Private Sector?

In recent years, natural disasters, increased risk of heatstroke, and crop failures caused by climate change have begun to have a major impact on business activities.
There are concerns that the impacts of climate change will expand as global warming progresses, and the importance of *adaptation* efforts to avoid and mitigate the impacts of changing climate in the future is increasing.

As companies in Japan manage their daily business activities they have to deal with a variety of issues including a dwindling labor force, changes in consumer preferences, changes in the political and economic situation in Japan and abroad, and the need for stable procurement of raw materials.

At the same time, they are also required to act appropriately by giving consideration to the natural environment and to social issues such as the human rights of workers and coordination with local communities. Climate change, in particular, raises concerns that, in addition to bringing about major changes in social and economic activities as we strive to achieve decarbonized societies, it could also generate various impacts that will threaten the sustainable development of corporations, such as climate disasters, drought, increased risk of heatstroke, and changes in market and customer needs.

Adaptation to climate change refers to efforts to improve business continuity and resilience by avoiding and mitigating risks in preparation for climate change impacts that are currently occurring or are of concern in the future.

1) Climate Change Impacts are Growing

In recent years, extreme weather phenomena (i.e., abnormal weather) such as heat waves, torrential rains, and droughts have occurred frequently in many parts of the world. In Japan, too, heavy rainfall exceeding 100 mm per hour and extreme heat exceeding 40℃ have been observed in various areas of the country, and have had a major impact on corporate activities and the lives of citizens.

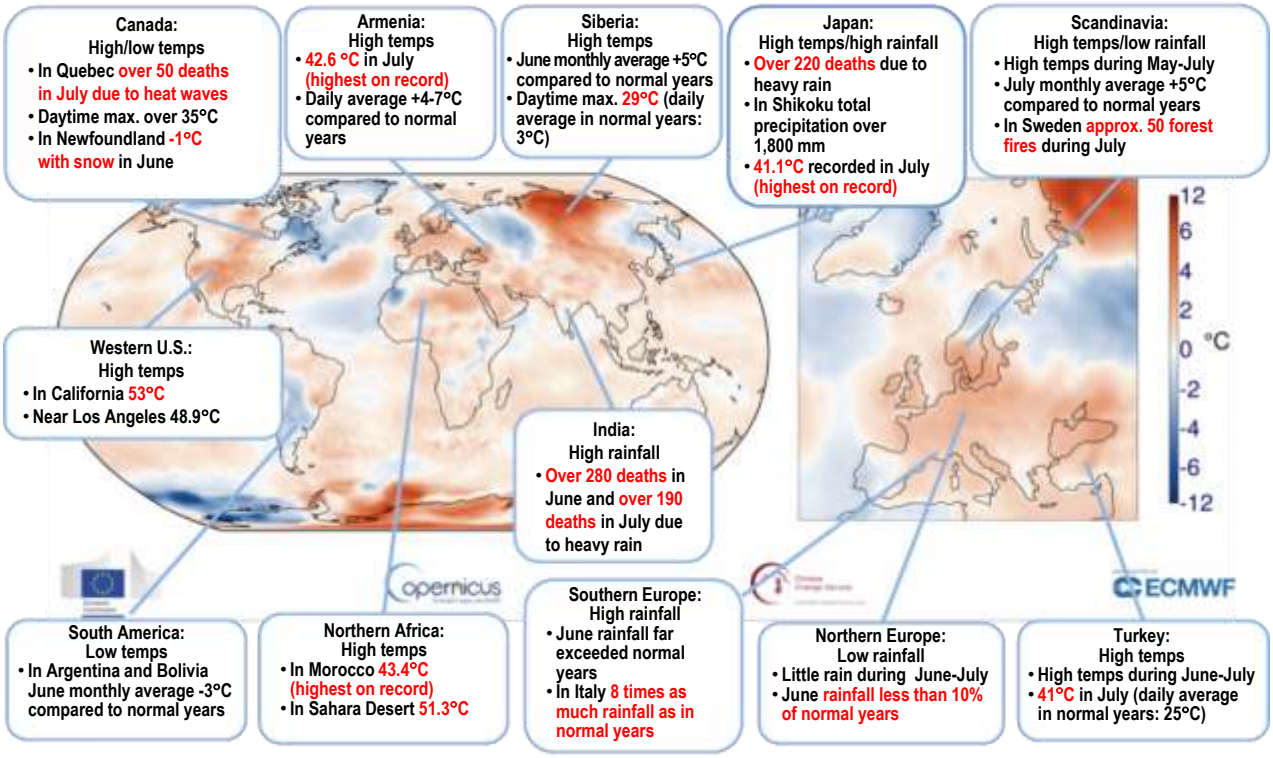


Figure 1.1 Abnormal weather worldwide
(Difference in average June & July temperatures compared to the average for 1981–2010)
Source: WMO (excerpted from WMO articles and the Japan Meteorological Agency's website)

One of the causes of these abnormal weather conditions is thought to be global warming resulting from greenhouse gases such as carbon dioxide emitted by human activities. Global average annual temperature is currently about 1°C higher than the pre-industrial level due to greenhouse gas emissions and is likely to exceed 1.5°C higher than the pre-industrial level between 2030 and 2052[1]. If adequate measures are not implemented in future, the average temperature is expected to rise by about 4°C by 2100. At present, various impacts on business activities and people's lives have already been generated, and there are concerns that the impacts will grow further as global warming progresses in the future.

1 IPCC (Intergovernmental Panel on Climate Change) 1.5°C Special Report (October 2018)
In English and Japanese: https://www.env.go.jp/press/files/jp/110087.pdf

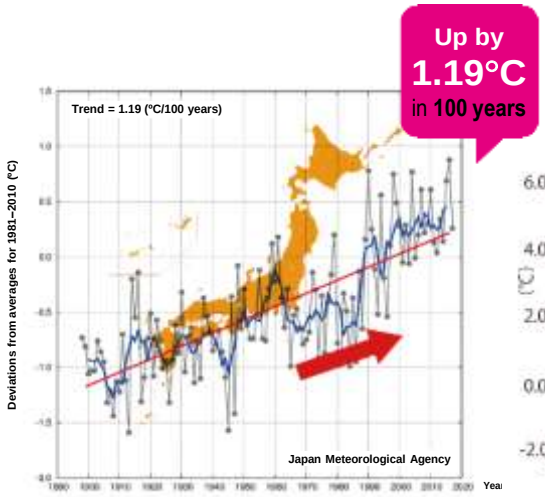


Figure 1.2 Annual average temperature deviations in Japan (1898–2017)
Source: Prepared based on annual average temperature data on the Japan Meteorological Agency website

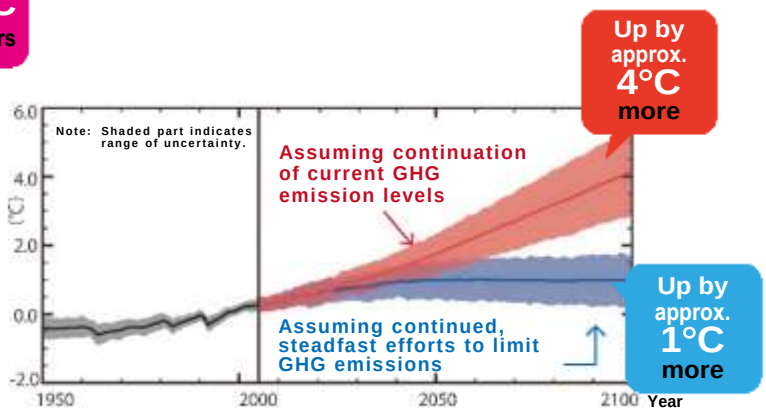


Figure 1.3 Projections of global average surface temperature Changes as compared to average temperature levels for 1986–2005
Source: IPCC, 2013: Prepared based on graphs in the Working Group I contribution to the IPCC *Fifth Assessment Report*

The effects of climate change may comprise not only sudden impacts, such as abnormal weather, which are relatively infrequent but can cause significant losses once they occur; they may also comprise long-term impacts that gradually progress, such as an increase in heatstroke risk due to rising average temperature, an impact on water resources due to changes in precipitation patterns, or an increase in storm surge risk due to rising sea levels.

See the next chapter (2. Impacts of Climate Change on Business Activities) for details.

Table 1.1 Examples of Potential Future Climate Change Impacts and Major Adaptation Measures

Category	Potential Future Climate Change Impacts	Examples of Major Adaptation Measures
Agriculture	Degradation of rice and of fruit trees due to high temperatures	Development and popularization of high-temperature resistant varieties
Natural disasters	Frequent flood damage exceeding the capacity of flood control facilities	Steady development of levees, flood control facilities, and sewerage systems
Water resources and water environment	More frequent, prolonged, and severe droughts	Promotion of rainwater and recycled water use
Natural ecosystems	Coral bleaching	Conservation and restoration of coral reefs
Health	Increased risk of mosquito-borne infections such as dengue fever	Promotion of measures to control vector mosquitoes

Source: Prepared from the Climate Change Adaptation Plan (approved by the Japanese Cabinet on November 27, 2018)

2) Climate Change Affects the Sustainability of Firms

To fundamentally solve the problem of global warming, it is essential to take measures to *mitigate*; that is, to reduce greenhouse gas emissions. The international Paris Agreement[2] sets goals such as keeping the increase in global average temperatures well below 2°C compared to pre-industrial levels (2°C target). In order to meet these goals, the Paris Agreement requires that emissions of anthropogenic greenhouse gases be reduced to net-zero[3] (i.e., decarbonization is achieved) in the second half of this century. To bring about decarbonized societies, governments certainly must accelerate their efforts, but high expectations are being placed on the contribution of industry as well.

The Paris Agreement also calls for the promotion of *adaptation* as another measure against climate change. This reflects concerns that—even if the efforts of governments and industry to reduce greenhouse gas emissions are maximally effective and the 2°C target is achieved—a temperature rise of 2°C compared to pre-industrial levels (about 1°C compared to today) could cause abnormal weather conditions such as torrential rains and heat waves to occur even more frequently than at present. In order for enterprises to manage their businesses sustainably, therefore, it is very important to work on *mitigation* targeting transition to a decarbonized society, as well as *adaptation* to avoid or alleviate the inevitable impacts of climate change.

In recent years, the attitudes of institutional investors who invest in companies have been changing, and the trend toward seeking disclosure of information on climate change risks, opportunities, and responses to them has accelerated. In June 2017, the Financial Stability Board (FSB)'s Task Force on Climate-related Financial Disclosures (TCFD) released its recommendations, and an increasing number of companies are using their annual reports and sustainability reports to disclose information on risks and opportunities associated with the transition to a decarbonized society (transition risks and opportunities), as well as climate change impacts (physical risks and opportunities), such as the increased number of abnormal weather events. The TCFD requires companies to identify transition risks and physical risks in their business activities from a medium- to long-term perspective through scenario analysis, and evaluate the risks' financial impacts and impacts on corporate strategies. Corporate climate change adaptation is an effort to analyze physical risk scenarios and respond to them, to collect information on future temperature rises and associated changes, and to evaluate the impact on business activities. (For a glossary on transition risks, physical risks, opportunities, and scenario analysis, see the supplementary material that accompanies this Guide.)

Climate change impacts vary depending on the business activities and location of companies. Correctly recognizing the relationship between climate change-induced changes in the business environment and the company's business activities, and implementing measures in accordance with

[2] Legal framework adopted at the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21) held in Paris in November to December 2015. It came into force in November 2016, and now 184 countries and regions have ratified it (as of January 16, 2019).

[3] This entails balancing the amount of anthropogenic greenhouse gas emission with the amount of anthropogenic greenhouse gas absorption through methods such as afforestation and CCS (engineering methods for capturing carbon dioxide emitted and storing it underground, etc.).

those business activities, will lead to building a business foundation that remains sustainable and resilient into the future. Strategic actions to adapt to climate change can also gain the trust of investors, customers, and other stakeholders, thereby leading to increased competitiveness.

2. Impacts of Climate Change on Business Activities

Climate change has had a variety of impacts on corporate business activities in the form of changes in the working environment of employees, decreased yields and quality of raw materials, increased costs for maintenance and management of equipment, and changes in market needs.

Climate change has various impacts on management resources that are indispensable for business activities by private sector (such as employees, raw materials, physical resources, products, facilities, funds, assets, technologies, and trust).

These impacts include not only sudden impacts such as damage to corporate facilities, or damage to employees' homes and disruption to commuting due to natural disasters. They also include long-term impacts such as decreased availability of water resources, agricultural products, fishery products, and natural ecosystems due to changes in climate patterns, and the scope of these impacts covers the entire supply chain.

These impacts of climate change affect enterprises' business activities in a variety of ways, including a decline in production capacity and an increase in operational costs.

Table 2.1 Examples of Climate Change Impacts on Business Activities

Management Resources and Business Activities	Examples of Climate Change Impacts
Buildings and facilities	・Increase in the frequency of damage to facilities due to abnormal weather and weather disasters, and in cost outlay for restoration ・Increase in the need for relocation due to sea level rise and storm surges
Employees, etc.	・Increased health risks due to heatstroke and infectious diseases, and increased costs associated with measures to prevent heatstroke ・Damage to employees' homes and disruption to commuting due to weather disasters
Manufacturing and business activities	・Damage to manufacturing facilities and interruption of business activities due to weather disasters ・Impacts of changes in climate conditions (precipitation, temperature, humidity, etc.) on product quality and water use
Supplies and logistics	・Interruption of business activities due to supply chain disruption, such as damage to suppliers' facilities ・Reduction in harvest yields and quality of raw materials and increase in their cost
Markets and customers	・Changes in customer needs and consumer trends (e.g., demand for high-temperature resistance) ・Changes in transaction and loan terms (e.g., stable supply is required despite increased weather disasters)

Table 2.2 Recognition of the Impact of Climate Change on Business Activities[4]

Impact of climate change on business activities	Japan	Worldwide
Decrease/collapse of production capacity Inability to maintain production levels	40%	43%
Increase in operating costs Increase in the daily cost of implementing projects	38%	46%
Decline in demand for products/services Decrease in consumer demand for products/services offered	17%	10%
Inability to execute business Rise of market entry barriers (e.g.) Insurance contracts cannot be offered due to very high uncertainties.	11%	14%
Increase in cost of capital Increase in capital investment required to maintain competitiveness. More frequent facility renewals and relocation costs	10%	9%

Source: Compiled from responses to the CDP Climate Change Questionnaire (2017)

[4] The impact of physical changes caused by climate change on their business activities as recognized by companies that responded to the CDP questionnaire for 2017 (limited to publicly available responses). CDP is an NGO established by institutional investors and others to encourage companies to disclose their efforts to tackle climate change, etc. Of the Japanese companies that responded, 40% recognized that they would not be able to maintain production levels, and 38% recognized an increase in operating costs, as effects of climate change.

1) Impact on Business Activities Due to Meteorological Disasters, etc. (Sudden Impact)

Climate change can bring about unprecedented weather disasters and heat waves.

In July 2018, torrential rain in western Japan brought a record amount of rainfall in various regions, causing serious impacts on private sector such as shutdown of operations, power outages, and interruption to supplies of water for industrial use due to inundation. Some small and medium-sized enterprises have been forced into bankruptcy due to these impacts. Although it is not easy to clarify the relationship between individual meteorological phenomena and climate change, there are concerns that climate change will increase the frequency and severity of climate disasters in the future.

Figure 2.1 Damage caused by July 2018 torrential rain disaster[5]

Case Study 2.1 Examples of Damage to Private Sector Caused by July 2018 Torrential Rain Disaster

Manufacturing: As the supply of water for industrial use ceased due to the effects of heavy rain, companies had to reduce their production activities by employing temporary measures such as intermittent operation and shutdown of production facilities. In addition, some of the in-house power generation facilities seriously malfunctioned and significant losses were incurred due to the costs of restoring these facilities to their original state and procuring additional external power.

Retail: A number of restaurant chain outlets were unable to operate due to prolonged water outages, which negatively impacted performance.

Leisure: Visitor numbers declined significantly due to the earthquake in northern Osaka Prefecture, the torrential rain in western Japan, and the extreme heat. As a result, business performance worsened and some companies had to apply for insolvency protection under the Civil Rehabilitation Act.

Source: Compiled by the Ministry of the Environment using public documents

Heatstroke has also become more serious in recent years. In 2018, extreme heat exceeding 40℃ occurred in many parts of Japan, and the number of ambulance trips due to heatstroke increased to 1.5 times the previous year's number. Particular attention is warranted in the construction industry

[5] Source: Disaster Research Activity: July 2018 Torrential Rain, Kokusai Kogyo Co., Ltd. website
In Japanese: http://www.kkc.co.jp/service/bousai/csr/disaster/201807_west/index.html

and other workplaces with many outdoor workers. According to a survey by the Ministry of Health, Labour and Welfare, the number of people killed or injured by heatstroke in the workplace has been in the order of 400–500 every year in recent years.

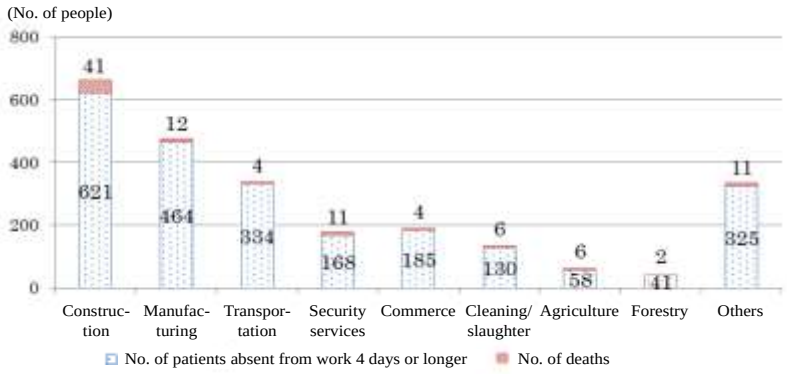


Figure 2.2 Deaths and injuries due to heatstroke by industry (totals for 2013–2017)

Source: *Death/Injury Accidents Caused by Heatstroke in the Workplace* (2017)
In Japanese: https://www.mhlw.go.jp/stf/houdou/0000208979.html

2) Long-term Impacts of Climate Change

The impact of climate change on business activities is not limited to sudden events such as storms and heat waves, but may also comprise the long-term impact of gradual climate change. Progress is gradual for such impacts as increased summer air-conditioning costs, crop failure due to higher average temperatures, effects on water resources due to changes in precipitation patterns, and risk of storm surge due to rising sea levels. For example, in the tourism industry, which depends on the natural environment, long-term impacts such as shortages of snow at ski resorts and coral bleaching in the Okinawa region have already emerged, and adaptation measures such as artificial snow machines and coral reef conservation are required.

For many companies it is very important to secure good-quality, abundant water resources for stable operations. Decreases in snowfall and changes in precipitation associated with climate change may affect river flow, water quality, and dam water storage. In addition, companies that handle food and beverages cannot overlook the impacts of climate change on the agricultural crops they use as raw materials. In order to continue to procure sufficient quantities of high-quality raw materials, it is necessary to implement measures over the medium to long term, such as improving the plant varieties used in order to produce crops that can withstand high temperatures, and moving production to different areas. At business facilities located in coastal areas, in addition to the increased risk of storm surges and high waves due to rising sea levels, poor drainage may also be expected.

These long-term impacts are not noticeable until they progress to some extent. However, when they materialize, countermeasures may not be taken in time, and there is a possibility that they will have a significant impact on business activities.

Box 2.1 Awareness of Water Risks among Global and Japanese Companies (Aggregated CDP Water Questionnaire[6] Data)

There are concerns that climate change may increase the risk of dry weather and drought as well as flooding. The aggregated results of the CDP Water Questionnaire show that global companies tend to be aware of water shortages and Japanese companies tend to be aware of floods. We can see that many companies already recognize water risks related to climate change even today.

Table 2.3 Awareness of water risks among companies responding to CDP Water Questionnaire

Awareness of water risks	Global		Japan	
	No. of companies	%	No. of companies	%
Worsening water shortages	363	62%	23	18%
Increasing water stress	298	51%	17	14%
Droughts	255	43%	14	11%
Floods	249	42%	30	24%
Climate change	237	40%	20	16%
Deteriorating water quality	226	38%	16	13%

Source: Aggregated from responses to the CDP Water Questionnaire (2017)

3) Indirect Impacts through Supply Chains

Supply chains encompassing suppliers of raw materials and parts, customers, and distribution networks play important roles in corporate business activities. Climate change impacts that occur outside a company's boundaries can therefore exert significant, although indirect, impacts throughout the supply chain.

A typical example of a weather disaster that caused significant damage through a supply chain was a major flood in Thailand that occurred in 2011. The prolonged inundation of seven industrial parks, many of which were occupied by Japanese companies, had a major impact on Thailand's domestic and international supply chains in the automotive and electronics industries, reducing global industrial production by an estimated 2.5%[7].

[6] A CDP questionnaire aimed at ensuring that companies are aware of water risk, engage in comprehensive risk mitigation strategies, and promote disclosure of the results. In 2017, CDP sent questionnaires to 4,653 companies worldwide and received responses from 2,025 companies. Of these, responses from 588 companies worldwide and 126 companies in Japan are available for public disclosure. Table 2.3 shows the results of an analysis of the publicly available responses from companies.

[7] White Paper on International Economy and Trade, 2012, Chapter 2, Section 1, "Thai Floods Significantly Impacted the Trade Environment for Japan and Other Nearby Countries and Regions," the Ministry of Economy, Trade and Industry

In Japanese: http://www.meti.go.jp/report/tsuhaku2012/2012honbun_p/2012_02-3.pdf

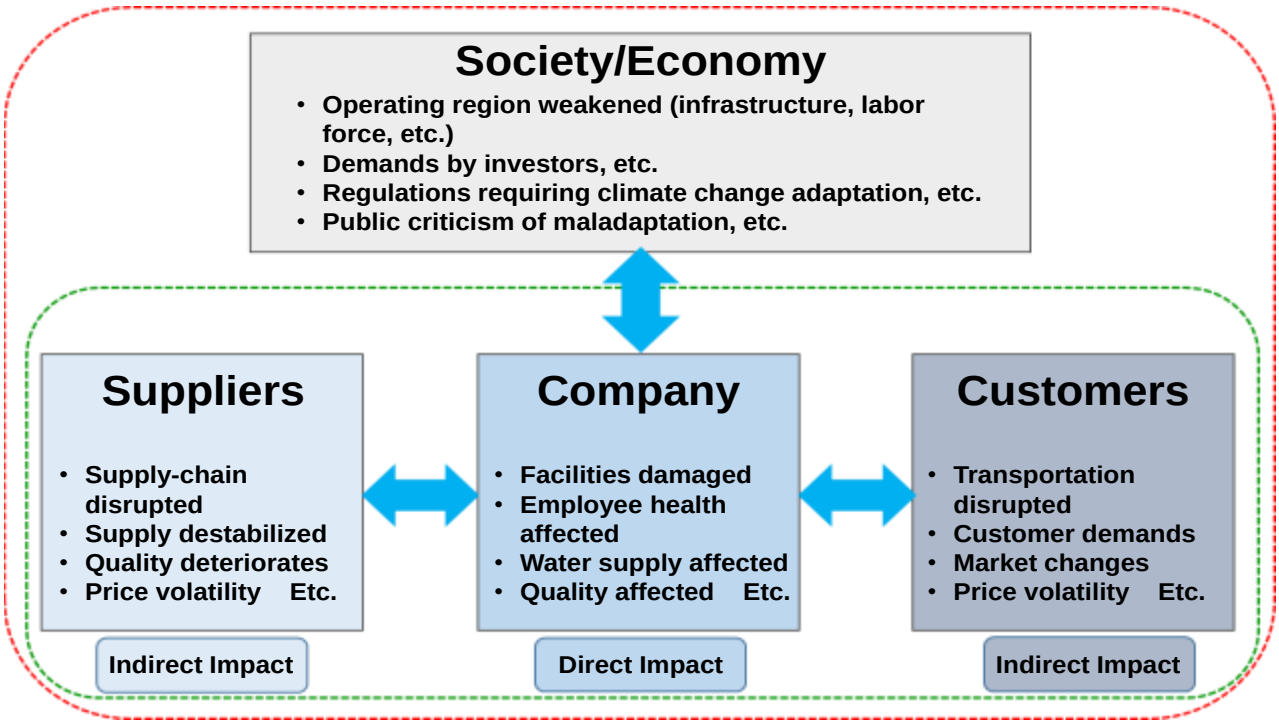


Figure 2.3 Indirect impacts of climate change through the value chain[8]

If climate change increases concerns about the procurement of raw materials and stable supply of products, it is anticipated that an increasing number of companies will change their procurement from only one supplier to many, will geographically diversify their suppliers, or will require them to prepare for climate change. Suppliers who are unable to respond to these concerns may lose their customers. Climate change could also change product specifications and market needs, and could affect the sale of existing products and services.

As a result of the shift to overseas production and the global expansion of supply chains, there is an increasing risk that impacts such as weather disasters and droughts, which occur particularly in areas vulnerable to climate change, will have a significant impact on the business activities of Japanese companies.

[8] The Environmental Reporting Guidelines 2018 of the Japanese Ministry of the Environment define a value chain as "The entire chain of economic agents or economic activities involved in the entity's business processes from the creation of added-value to consumption. Includes activities such as raw material mining, procurement, production, sales, transport, use, disposal, etc."

Box 2.2 Example of Checklist for Gauging Recognition of Climate-Change Risks in Supply Chains

The UK Environment Agency publication *Assessing and managing climate change risks in supply chains* (2013)[9] proposes that, if any of the checklist questions below apply, companies should recognize the potential for climate change risk in their supply chain and conduct a more detailed assessment:

Table 2.4 Checklist for Climate Change Risk in Supply Chains

Your supplier:	You:	Your customers:
Are they located or do they stockpile in vulnerable areas (along rivers, floodplains, coastal areas)? Are they clustered in (vulnerable) geographic areas? Are raw materials that are sensitive to climate conditions (agricultural resources, high water consumption in production) supplied? Are long-distance shipments made at sea or in mountainous areas? Is it a JIT supplier or does it keep stockpiles in vulnerable areas?	Are the effects of past weather phenomena on personnel and operations recognized? Are they located or do they stockpile in vulnerable areas (coastal areas, floodplains, and along rivers)? Is the number of alternative suppliers limited to one or a few? Is it heavily dependent on energy and water? Is the process dependent on cooling? Are long-distance shipments made at sea or in mountainous areas? Are you using long-lived assets?	Is climate change recognized as a risk? Are product and business sustainability promoted? Is there a limited number of products sold and are they susceptible to climate conditions? Are you located in a single or vulnerable location? Is there a risk of not being able to recover quickly in the event of a disaster? Are you dependent on other suppliers located or stockpiled in vulnerable areas (along rivers, floodplains, coastal areas)? Are you dependent on other suppliers clustered in (vulnerable) areas?

[9] *Assessing and managing climate change risks in supply chains*, UK Environment Agency
In Japanese: http://www.adaptation-platform.nies.go.jp/lets/pdf/ref/RefOS01rev2.pdf 2013

4) Current Progress in Adapting to Climate Change

Climate change can affect corporate activities in a variety of ways. It is expected that the impacts will increase as climate change progresses in the future. However, while many Japanese companies are actively working to reduce greenhouse gas emissions, including through energy conservation, only a small number are actually working on *adaptation* to avoid or mitigate the impacts of climate change. For example, in Japan, 81.4% of large enterprises and 46.5% of mid-sized enterprises have formulated BCPs (business continuity plans)[10] based on their experience of disasters such as the major earthquake and tsunami that occurred in the Tohoku region in March 2011. However, only 43.2% of large enterprises and 30.0% of mid-sized enterprises include floods (excluding tsunamis) in the risks assumed by BCPs.[11] In addition, even if some companies have formulated BCPs including floods and weather disasters, still fewer companies seem to assume long-term climate change.

Factors contributing to the lack of progress in adaptation to climate change in private sector are thought to include: insufficient penetration of the concept of adaptation to climate change; insufficient understanding of the need for adaptation because of the lack of experience of actual harm as a result of climate change impacts; and the fact that priority is judged to be relatively low in the context of a balance with other risks and challenges related to business activities.

However, as mentioned above, some degree of climate change cannot be avoided in the future. It is important to analyze the impact of climate change on the company and strategically address adaptation so that the company can fulfill its social responsibility and gain an opportunity to enhance sustainability.

[10] Plans that enable continuation or early restoration of core businesses in the event of disasters and other emergencies while minimizing damage to business assets

[11] Fiscal 2017 Survey of Enterprises' Business Continuity and Disaster Prevention Efforts, Cabinet Office, March 2018
In Japanese: http://www.bousai.go.jp/kyoiku/kigyou/pdf/h30_bcp_report.pdf

3. Turning Climate Change Adaptation Initiatives into Opportunities

Strategic initiatives to adapt to climate change have the following benefits:

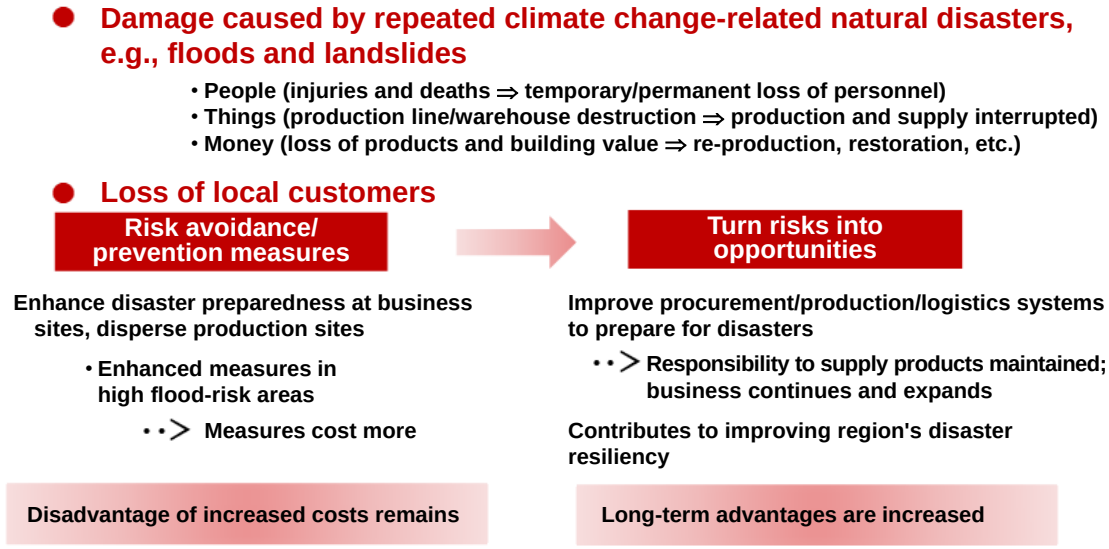
- Enhancing business continuity
- Building a flexible and resilient management base to resist climate change impacts
- Building stakeholder trust to enhance competitiveness
- Developing existing products and services as an adaptation business

Japanese companies have responded to various changes in the external environment, such as developments in domestic and foreign markets and the evolution of technologies, and have turned these changes into opportunities for growth. Climate change is a major change in the external environment and a risk to companies. At the same time, however, climate change can be regarded as a new opportunity for sustainable development, and strategic efforts to adapt to climate change can provide a variety of benefits.

The impact of climate change on business activities depends on the circumstances of individual companies. Therefore, in order to turn this change into an opportunity, it is important that companies *correctly recognize how changes in the business environment caused by climate change relate to their own business, and adapt to climate change in accordance with their business activities*.

Case Study 3.1: Turning Climate Change Adaptation Initiatives into Opportunities (Chemicals)

Sekisui Chemical Co., Ltd. manages risk by integrating risk management for preventing materialization of risks with crisis management for dealing with serious risks after they materialize. It considers the risk of climate change to be a significant risk for the entire company over the long term. The company evaluates this risk by classifying it into natural disaster risk, raw material procurement risk, and regulatory and legal liability risk, and considers measures to avoid or prevent it. Sekisui Chemical believes that responding to risks at an early stage will not only consolidate its business foundation, but will also enable such risks to be turned into new opportunities.



Source: Climate Change Adaptation Information Platform (A-PLAT)
In Japanese: http://www.adaptation-platform.nies.go.jp/lets/climaterisk/sekisui.html

1)Enhancing Business Continuity

a) Preparing for meteorological disasters

In preparing for meteorological disasters in the course of business activities, companies are expected to formulate BCPs (business continuity plans) anticipating the risks of weather-related disasters such as floods. Until now, BCPs have been based primarily on past experiences of disasters and similar events. However, from the perspective of *adaptation* in preparation for future climate change impacts, it is now advisable to anticipate hitherto unprecedented disasters. The impact of meteorological disasters varies depending on the business activities of each company. Even within the same industry, impact varies greatly depending on where a company operates, how it operates, the structure of the supply chain, business models, cost structures, and risk management capabilities. By carefully examining the impacts of climate change based on the particular characteristics of a company's business activities, it becomes possible to develop a more robust and effective BCP.

Table 3.1 Typical Examples of Meteorological Disasters by Industry

Industry	Typical Impacts of Meteorological Disasters
Food production	Loss of crops due to droughts and forest fires
Buildings and real estate	Damage to buildings due to extreme torrential rains, damage due to flooding, and loss of land value
Manufacturing	Disruption of parts and products logistics due to weather-related disasters
All industries	Damage to buildings and equipment due to storm surges and storms caused by typhoons

Case Study 3.2 Efficacy of BCPs in Dealing with Meteorological Disasters

Early recovery from torrential rain disaster (machinery)

The torrential rain disaster in July 2018 affected DISCO Corporation's Kure Plant as the result of a water outage and logistical turmoil. However, as business continuity management (BCM) measures worked effectively, delivery could be returned to the normal schedule promptly. The delivery delay was only one day at most, and the impact on customers was minimized.

Source：DISCO Corporate Report 2018
In English: http://www.disco.co.jp/eg/ir/library/pdf/dar/dcr2018eg.pdf

Formulating BCP is recognized as opportunity (non-ferrous metal)

Sumitomo Electric Industries, Ltd. is promoting preparations based on its Business Continuity Plan (BCP) to minimize damage and recover quickly even if major suppliers' plants are damaged by floods caused by typhoons or heavy rains. The ability to recover faster than their competitors gives them the opportunity to generate more sales amount.

Source: Response to CDP Climate Change Questionnaire 2017

b) Preparing for medium- to long-term business continuity challenges

For companies that use natural resources as raw materials or depend on water resources, difficulty in ensuring stable procurement of raw materials or adequate water intake can be critical. These companies are often already working to respond to risks by, for example, securing multiple suppliers. However, in addition to their existing activities, it is possible to enhance the sustainability of their business by taking into account medium- to long-term changes in temperature, precipitation, sea level, etc. caused by climate change.

When building facilities that will be used for a long time, even if no impacts of climate change are apparent during construction, the cost of renovation and loss of opportunity when impacts do

become apparent can be reduced by taking predicted future impact into account at the design stage. For existing facilities, meanwhile, it is possible to implement economical adaptation measures by considering climate change adaptation when renovating.

Companies that have not experienced actual damage from meteorological disasters and the like may find it difficult to understand the need to prepare for future climate change. However, changes in suppliers, development of alternative materials, and changes in business models may be too late once the impacts of climate change have materialized. Early recognition of the potential impacts of climate change and consideration of adaptation measures will lead to economical and sustainable business activities.

Case Study 3.3 Medium- to Long-Term Climate Change Preparedness

Sustainable and stable procurement in preparation for climate change (food)

The typhoon that hit Japan in August 2016 caused great damage to Hokkaido's agricultural products, and as a result, snack manufacturer Calbee, Inc. was unable to secure sufficient stores of potatoes, forcing sales of several products to be suspended. Global climate change is expected to increase the number of natural disasters in the future. However, the company has established closer partnerships with producers for procurement of the potatoes that can be regarded as its lifeline, and is taking measures in the medium to long term.

Source: Calbee, Inc. website
In Japanese: https://www.calbee.co.jp/csr/social/trader.php

Discovery of optimal varieties in cooperation with research institutes (food products)

Coffee production sites have been affected by increases in temperature and humidity associated with climate change, and changes in volumes and timing of rainfall,. Consequently, a warning has been sounding that the land suitable for cultivating coffee (of the arabica variety) will be reduced to 50% of what it is today by 2050. Key Coffee Inc. is working on the International Multi-Location Variety Trial (IMLVT) with World Coffee Research, a global coffee research organization. IMLVT is a project to cultivate high-quality coffee varieties selected from around the globe and test them in production areas in various countries to identify optimal coffee varieties that are resistant to climatic changes and pests, while also offering rich flavor. Key Coffee offers part of its directly managed plantations at Toraja on Sulawesi Island in Indonesia as a research site and carries out joint test activities. By identifying optimal varieties based on the test results and sharing information and technology with the local community, the company can expect better coffee yields and quality, as well as improved profitability for the producers. Meanwhile, coffee drinkers can enjoy a stable supply of delicious, premium coffee.

Source: Climate Change Adaptation Information Platform (A-PLAT)

2) Building a Flexible and Resilient Management Base to Resist Climate Change Impacts

Climate change has various impacts on daily operations and management activities. It is important to incorporate the concept of climate change adaptation into such daily operations and management activities (called "mainstreaming of adaptation"). Reviewing these operations and activities from the perspective of adaptation to the impacts of climate change may lead to reductions in the costs of responding to the impacts, as well as in manufacturing costs.

In order to avoid and mitigate the impacts of climate change, it is likely that far-reaching measures such as business reviews and business model changes will become necessary. By anticipating and preparing for the impacts of climate change when making decisions in day-to-day operations, it is possible to respond sensitively to such changes and to build a foundation for flexible and resilient management to resist the impacts of climate change.

Table 3.2 Examples of Incorporating Climate Change Adaptation into Daily Operations and Management Activities

Operations and Activities	Examples of Incorporating Climate Change Adaptation
Product development	Anticipating changes in consumer preferences and changes in raw material prices due to rising temperatures when developing products and formulating sales strategy
Facility management	Reducing damage, repair costs, and opportunity losses by considering the possibility of floods and heat waves when designing facilities
Quality management	Establishing a management system to prevent deterioration of quality due to high temperature, high humidity, etc.
Environmental management	Establishing a management system that takes into account the need to prevent effects of high temperatures such as offensive odors and deterioration of water quality Implementing measures to prevent the outflow of contaminated soil and waste during flooding
Safety and health management	Introducing measures for the prevention of heatstroke in outdoor workers Managing hygiene of drainage channels, etc. to prevent risk of infectious diseases
Supply chain management	Ensuring a raw material procurement system in the event of a disaster or other emergency Sharing information on climate change impacts with suppliers and customers
Energy conservation measures	Introducing renewable energy and improving the work environment to avoid high temperatures and increased electricity use in summer (i.e., combating the heat by improving ventilation and changing work hours)

Case Study 3.4 Cost Reduction Effects of Climate Change Adaptation

Adapting to increased operation costs due to rising temperatures (information & communications)

Risks associated with rising temperatures include increased operating costs due to greater power consumption by communications equipment and air conditioning equipment used in data centers. For this reason, the NTT Group is continually promoting measures to reduce power consumption, such as the introduction of an optimal air-conditioning control system. In addition, energy conservation is promoted through elimination of heat spots that cause high temperatures, thereby optimizing the temperature setting of air conditioners.

Source: NTT Group Sustainability Report 2018
In English: https://www.ntt.co.jp/csr_e/pdf/sustainability_report_2018e.pdf

Reducing CO2 emissions and costs by reducing water consumption (food products)

Climate change can cause extreme rainfall and drought. Reducing water consumption in response to droughts will reduce CO2 emissions and the cost of manufacturing products. Since the Kirin Group uses 87,861 thousand m3 of fresh water worldwide (as of 2016), water-saving activities will enable significant reductions in costs.

Source: Response to CDP Climate Change Questionnaire 2017

Reducing manufacturing and materials procurement costs through business improvement (retail)

Examples of operations within the supply chain of Abercrombie & Fitch Co (A&F)[12], which may be affected by changes in precipitation patterns, include the agricultural industry (e.g., water availability for cotton cultivation) and its apparel production networks (e.g., water use in dyeing). A&F believes that there is an opportunity to identify/implement best practices to involve material suppliers to improve water efficiency in these agricultural supply chains, and reduce the impact of climate change on water shortages. By proactively identifying and implementing these actions ahead of competitors, A&F can improve its operational efficiency and consequently reduce manufacturing and material procurement costs.

Source: Response to CDP Climate Change Questionnaire 2017

[12] A US-headquartered manufacturer of clothing for casual fashion brands

3) Building Stakeholder Trust to Enhance Competitiveness

Active efforts to adapt to climate change will enable companies to build good relationships with employees, business partners, and customers, leading to new business opportunities. Moreover, proactively disclosing information on climate change efforts will help gain the confidence of investors and enhance competitiveness. Cooperation with local governments and other bodies to tackle climate change not only fulfills a company's social responsibility, but also enhances the credibility and sustainability of the company in local communities.

a) Building good relationships with employees and suppliers

Active measures against meteorological disasters and heatstroke will improve the workplace environment and safety of employees, enabling improved work efficiency and loyalty. In addition to a company pursuing its own climate change adaptation, supporting the efforts of suppliers and other business partners (e.g., by providing guidance, advice, and emergency sites and facilities) will enable a stable and resilient supply chain to be built, which will in turn lead to enhanced sustainability of business activities. Through efforts to adapt to climate change, good relationships of trust can be built with employees and business partners, which are indispensable to a strong business foundation.

Case Study 3.5 Working with Business Partners to Adapt to Climate Change

Measures to combat heatstroke in coordination with partner companies (construction)

Daiwa House Industry Co., Ltd. and its partner companies are taking steps together to protect the health of their employees and workers from heatstroke, including setting up rest areas that provide shelter from sunlight, stocking water and other liquids at all times, and providing training on prevention of heatstroke.

Since 2016, moreover, the company has been developing environmental sensors jointly with manufacturers and installing them at more than 100 construction sites. These comprise three built-in sensors: temperature/humidity, wind speed, and motion. When a sensor detects temperature/humidity or wind speed exceeding the reference value, it alerts workers with indicator lights and sounds, and sends an email to the manager. This allows the company to implement early countermeasures and prevent incidents.

Source: Climate Change Adaptation Information Platform (A-PLAT)

Building a strong supply chain (food products)

British American Tobacco (BAT)[13] works closely with the supply chain to understand the climate change challenges that suppliers (particularly farmers) are facing today and in the future.

BAT provides the necessary support through agricultural support and awareness programs and has the necessary reporting and monitoring tools to better understand the resilience of farmers (supply chains) to climate change risks.

Protecting the BAT supply chain, i.e., protecting the amount and quality of leaves needed, means that it is an opportunity for BAT to maintain/improve market share.

Source: Response to CDP Climate Change Questionnaire 2017

[13] A tobacco manufacturing and sales company, headquartered in the UK

b) Enhancing the trust of customers

As awareness of the impacts of climate change increases, there is a tendency among companies to place emphasis on securing multiple suppliers that are geographically dispersed to ensure stable procurement. However, suppliers themselves can actively tackle climate change adaptation and use these efforts as PR to gain the trust of customers. For example, building a system that can provide stable supplies even in the event of a meteorological disaster could enhance the competitiveness of supplier companies and lead to new business opportunities.

Case Study 3.6 Building Trust to Enhance Competitiveness

We guarantee stable delivery to your door! (manufacture of resin products)

TOYOX Co., Ltd. has formulated a business continuity plan (BCP) that prioritizes flood control measures, having considered the geographical characteristics of its head office and vicinity, which are surrounded by rivers. The company is rated highly by its customers for its strict adherence to delivery dates. In addition to strengthening measures against flood risk at the head office factory itself, therefore, the company is building a system that will enable stable supply even in the event of a disaster. To that end, it is dispersing its bases domestically and internationally and developing a BCP for its supply chain. TOYOX actively disclose progress with these activities, which has led to greater trust from its customers.

Source: TOYOX Co., Ltd. website, etc.
In English: https://english.toyox-hose.com/company/bcp/
Climate Change Adaptation Information Platform (A-PLAT)
In English: https://adaptation-platform.nies.go.jp/en/lets/climaterisk/toyox_e.html

c) Strengthening the management foundation by gaining the trust of investors, etc.

By tackling climate change adaptation actively and disclosing information on such actions strategically, companies can gain the trust of investors and financial institutions and strengthen their management base.

In June 2017, the TCFD announced its recommendations on the disclosure of corporate climate change risks. These recommendations aimed to enable individual companies to understand the financial impacts of climate change *risks* and *opportunities* in their business activities and to disclose them through annual reports and sustainability reports.

It is widely recognized that climate change impacts, such as meteorological disasters and shortages of raw materials, as well as changes in regulations and markets to combat global warming, can threaten corporate value. Individual enterprises are required to grasp these changes in advance and attempt to transform their businesses.

These recommendations were agreed and signed by 585 institutions worldwide (as of the end of January 2019), of which 51 institutions are from Japan, including 43 companies; the National Bankers' Association; the Government Pension Investment Fund (GPIF); the Ministry of the Environment; the

Ministry of Economy, Trade and Industry; and others. It is believed that the recommendations will be one of the indicators for assessing the credibility of companies and the sustainability of business in Japan, as in other countries. For a summary of the TCFD recommendations, please refer to the supplementary material that accompanies this Guide.

d) Improving corporate value through coordination with local governments

Companies rely on local resources (raw materials, infrastructure, employees, communities, customers, etc.) for their business activities. On the other hand, companies also play an important role in supporting local infrastructure, employment, and economic activities. Consequently, climate change impacts in local communities have an impact on business activities of companies, and climate change impacts on companies have a significant impact on local communities. It is therefore very important for private sector to contribute to climate change adaptation in cooperation with local governments, not only to fulfill their social responsibility, but also from the perspective of their own adaptation.

Cooperation with local governments has the advantage of enabling information, technology, and resources to be shared with each other. By cooperating in climate change adaptation, which is a common issue, companies and local governments can also be expected to achieve results that cannot be achieved by themselves alone.

For cooperation between private sector and local governments, it is important to foster a relationship of mutual trust on a daily basis and to have a common understanding of issues faced by both sides. Building this relationship of trust and common understanding through coordination to address the specific theme of climate change adaptation can provide a basis for companies and local communities to work together on themes related to sustainability as well as to climate change. At the same time, for private sector, such a relationship can help with building a foundation for sustainable development and improving corporate value.

Case Study 3.7 Examples of Coordination between Private Sector and Local Governments

Coordination between private sector and local governments in times of disaster (retail)

The Aeon Group as a whole has concluded disaster preparedness agreements with more than 900 local governments, and does all it can to assist them with procurement of supplies in the event of a disaster. It is important that Aeon and the local governments that order the supplies share detailed information on the disaster-stricken areas (evacuation centers, etc.) where goods are to be delivered to ensure that goods are supplied without problems. When the torrential rains occurred in July 2018, Aeon supplied a total of 920,000 products in over 80 deliveries to disaster-stricken areas in the Chugoku-Shikoku area from July 6 to August 30.

Source: Responses to interviews with Aeon Co., Ltd.

Expectations for regional financial institutions (finance)

One of the major roles of regional financial institutions, which are the drivers of regional economies, is support for the management of small and medium-sized enterprises. Indeed, most regional financial institutions are thought to be providing programs for solving the business problems of such enterprises.

As a result of this experience, it is believed that these financial institutions understand what SME managers really want to achieve and the factors obstructing them when they tackle new challenges, and therefore, they can be expected to be good supporters of climate change adaptation efforts by the SMEs. For example, Seibu Shinkin Bank provides the following programs to help SMEs solve their problems.

(1) Implementation of "business support seminars" (dissemination of information that leads to solutions to business, social, and environmental issues)

(2) Support via the bank's core businesses (loans and deposits) that contributes to solving social and environmental issues

(3) Comprehensive support for NPOs and social businesses that endeavor to solve social and environmental issues

(4) Co-sponsorship of the Eco-Power Award for Corporate Executives (including activities to publicize the award)

Source: Responses to interviews with Seibu Shinkin Bank

e) Contributing to the achievement of the Sustainable Development Goals (SDGs)

Climate change adaptation is related to Target 13 of the SDGs: "Take urgent action to combat climate change and its impacts." In addition, climate change adaptation is associated with a variety of other areas, including SDG Targets 1, 2, 6, 11, and 15. Implementing adaptation measures that take into account sustainability-related issues not only in-house, but also in the communities where the companies operate, is expected to contribute to the SDGs on many levels.

Table 3.3 Major SDG Targets Related to Private Sector Adaptation

Target		
	1.5	By 2030, build resilience for the poor and those in vulnerable situations, and reduce their exposure and vulnerability to climate change-related extremes and other economic, social, environmental shocks and disasters.
	2.4	By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality.
	6.4	By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity, and substantially reduce the number of people suffering from water scarcity.
	11.b	By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels.
	13.1	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.
	13.3	Improve education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning.
	15.3	By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.

4) Developing Existing Products and Services as an Adaptation Business

While climate change has various impacts on citizens' lives and industries, it is also expected that new markets ("adaptation business") will expand to provide products and services that help citizens and businesses adapt to climate change.

The Climate Change Adaptation Information Platform (A-PLAT)[14] includes the Adaptation Business section, which provides examples of products and services that can help with adaptation to climate change. As of September 2018, 42 such examples had been featured. In terms of the fields of adaptation addressed, many products and services related to natural disasters and coastal areas; industrial and economic activity; or agriculture, forestry, and fisheries. By industry, the manufacturing industry accounted for almost half of the products or services, followed by the construction industry.

According to these examples, many companies utilize existing products and services for adaptation business. Companies may be able to increase their new business opportunities if, in addition to taking a risk-based approach to assessing the relationship between climate change and their businesses, they also utilize their existing products, services, and strengths to engage in adaptation business.

[14] In English: https://adaptation-platform.nies.go.jp/en/index.html

Box 3.1 Private Sector's Awareness of Opportunities Resulting from Climate Change (Aggregated Results of CDP Climate Change Questionnaire)

Analysis of the results of the CDP Climate Change Questionnaire shows that 39.4% of the 2003 companies worldwide that responded to the questions (limited to publicly available responses), recognized that increased demand for existing products/services is an opportunity. In addition, 24.8% in the financial sector recognized that new products/services represent opportunities, and 28.6% in the agricultural and forestry resources sector recognized the opportunities represented by lower operating costs. In this way, awareness of opportunities is characterized by industry (the items recognized as opportunities by more than 20% of enterprises are shown in yellow).

Table 3.4 Awareness of Opportunities with Regard to the Physical Impacts of Climate Change by Industry

Opportunities recognized	Industry sector							All sectors
	Financial	Energy and mineral resources	Transport and logistics	Agricultural and forestry resources	Other manufacturing	Construction and real estate	Other services	
Increased demand for existing products and services	**36.7%**	**28.0%**	**45.3%**	**25.0%**	**47.5%**	**52.2%**	**37.5%**	**39.4%**
Lower operating costs	13.0%	14.5%	15.1%	**28.6%**	10.7%	19.9%	14.1%	15.1%
New products/services	**24.8%**	9.0%	9.3%	10.4%	18.4%	13.4%	11.6%	14.9%
Increase in production facilities	1.9%	15.9%	3.5%	14.6%	2.0%	2.5%	1.2%	5.1%
Investment opportunity	12.2%	5.9%	0.0%	2.1%	1.3%	0.5%	1.2%	3.3%
Broader societal benefits	3.3%	6.2%	2.3%	4.7%	2.0%	2.5%	4.2%	3.5%
Premium price opportunity	2.6%	1.7%	1.2%	5.2%	1.3%	2.5%	1.7%	2.1%

Source: Aggregated from responses to the CDP Climate Change Questionnaire (2017)

Box 3.2 Adaptation Business Initiatives of Overseas Companies

The UN Framework Convention on Climate Change (UNFCCC) Secretariat operates a platform (the Private Sector Initiative [PSI]) that publicizes case studies of unique and innovative adaptation initiatives by private sector[15]. As of September 2018, this platform contained 102 case studies (including non-adaptation businesses), mainly of European and US companies. Looking at these case studies by industry, the most common industries in the adaptation business are consulting and environmental services, finance and insurance, and information technology and communications (service-based industries). A-PLAT case studies, on the other hand, are currently characterized by a large number of manufacturing and construction companies (product-based industries).

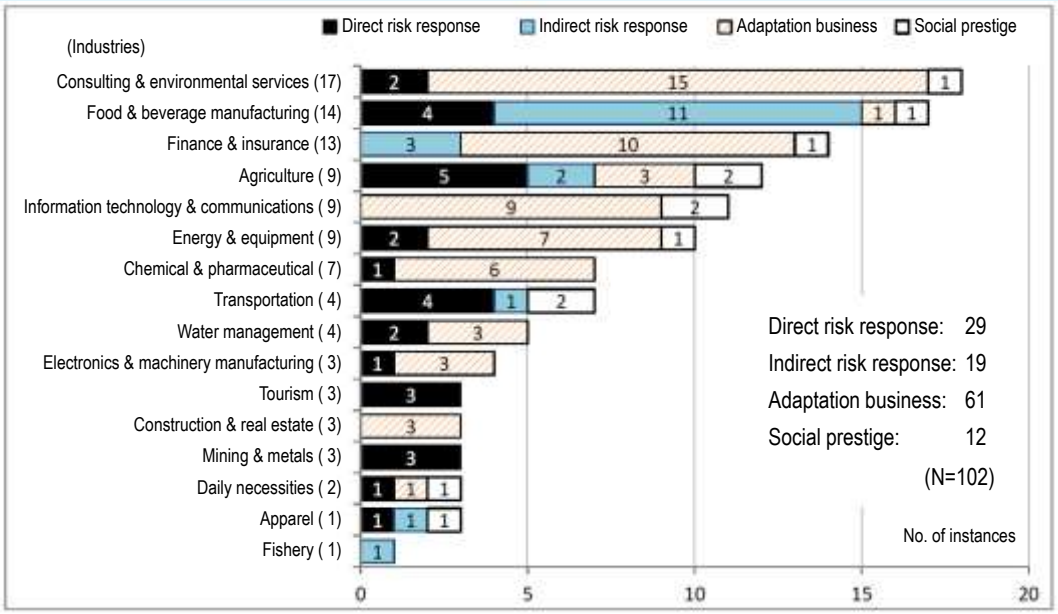


Figure 3.1 Distribution of adaptation businesses in the UNFCCC PSI Database (by industry)

Source: *Climate Change Adaptation Business (Part 1): Why is Japan's Adaptation Business Lagging?* Masahiko Kawamura (NLI Research Institute Report July 16, 2015)
In Japanese: http://www.nli-research.co.jp/files/topics/42597_ext_18_0.pdf

[15] In English: https://unfccc.int/topics/resilience/resources/adaptation-private-sector

4. How to Approach Climate Change Adaptation

Adaptation to climate change does not necessarily require extensive efforts. The approach differs depending on the objectives of climate change adaptation and the characteristics of the business. If companies thoroughly analyze the impacts of climate change on their business activities and pursue initiatives tailored to their respective characteristics, they will be able to adapt to climate change economically and effectively.

The objectives of companies in adapting to climate change vary from company to company. There are also a variety of events that trigger these efforts. For example, they may be implemented as part of risk management activities, facility construction plans, product development plans, etc., or as overall climate change countermeasures combined with mitigation. It is expected that when companies actually tackle climate change adaptation, they will proceed with initiatives tailored to the characteristics of each business, while referring to the following basic approach.

1) First Steps

a) Objectives (policies) for climate change adaptation

Climate change affects all aspects of business activities, so a wide range of departments and personnel will be involved. For this reason, it is important for companies to first clarify the objectives (policies) of their efforts to adapt to climate change, taking into account the impacts of climate change experienced in the past and business activities that are expected to incur significant impacts in the future. Such objectives may include the following:

For example:

- Assessing climate-related risks and opportunities and financial impacts on overall operations
- Incorporating climate-related impacts into corporate risk management (ERM), business continuity management (BCM), and environmental management systems (ISO 14001, etc.)
- Enhancing sustainability of supply chains in the context of climate change impacts
- Minimizing the increase in operating costs and adverse effects on the working environment due to climate change
- Taking advantage of business opportunities by developing products that reflect changing market needs associated with climate change

b) Scope (boundary)

Companies should clarify the scope of their climate change adaptation efforts. As discussed in Chapter 2 of this Guide, "Impacts of Climate Change on Business Activities," climate change affects not only a company itself, but also its entire supply chain. Although it is not necessary to consider the entire supply chain, however, the scope should be set so as to avoid overlooking elements (e.g., manufacturing facilities, business sites, distribution, business partners, or customers) that may be significantly impacted, in light of the objectives. If resources are limited, focus may be put on elements that are the most important and may be impacted in the short term, subsequently expanding the results to other elements.

c) Time frame

The table below shows some potential time frames for which companies might consider climate change adaptation measures (i.e., how far into the future companies might look ahead). The period for formulating a medium-term business plan is often about three years. On the other hand, it is not uncommon for a business to have a lifetime of more than 10 years and for facilities to have a useful life of several decades.

Table 4.1 Potential Time Frames According to Objectives

Objectives of climate change adaptation	Potential time frames
Avoiding and mitigating risks to business activities in general	During medium-term business plan formulation
Ensuring stable supply of raw materials	Estimated lifetime of the related business
Managing effects on facilities	Durable years of facilities
Making investment decisions for the business	Time period during which reliable forecasts are available

d) Implementation structure

Companies should clarify the organizations that will play central and ancillary roles in their climate change adaptation in accordance with the objectives of their initiatives. For instance, initiatives aimed at enhancing the sustainability of the supply chain require an implementation structure including major suppliers. If it is possible to incorporate an initiative into existing activities (BCP, ISO, etc.), the initiative can be started more smoothly by utilizing the existing framework.

ISO 14001 (revised in 2015), for example, requires that internal and external issues of the organization be clarified and addressed, and these issues include environmental conditions capable of affecting the organization. ISO 14001 also refers to inclusion of climate change adaptation and other measures in companies' environmental policies. If initiatives such as acquiring ISO 14001 certification are already underway, it is also possible to analyze and respond to climate-related risks and opportunities within its framework.

Furthermore, involvement of as wide a range of organizations as possible can be expected to increase awareness of climate change impacts. If SMEs in particular lack the internal resources necessary to take action (human resources, information, etc.), they may seek the support of local financial institutions or SME support organizations, or seek the advice of their major customers.

Table 4.2 Examples of Incorporating Climate Change Adaptation into Existing Business Activities According to Objectives

Objectives of initiatives	Existing corporate activities
Assessing climate-related risks and opportunities throughout operations	Company-wide risk management (ISO 31000, etc.) Environmental management (ISO 14001, etc.)
Preventing damage and achieving early recovery in the event of weather disasters	Business continuity management (ISO 22301, etc.) Business continuity plans (BCP)
Developing products that reflect climate change-related market needs	Product development plans
Stabilizing raw material procurement in the context of climate change impacts	Supply chain management
Reducing the impact of climate change on operating costs, etc.	Facility management, production management, and quality control
Preventing effects on employees due to heatstroke, etc.	Safety and health management
Preventing effects on the surrounding environment due to rising temperatures, etc.	Environmental management

Box 4.1 Climate Change Adaptation Using the Framework of Business Continuity Management Systems (BCMS)

The British Standards Institution (BSI Group) has prepared and published instructions for adaptation using BCMS. This manual takes the standpoint that, when an organization is actually addressing climate change risks, it is most efficient to focus on one business function and its associated standards. Given multiple business functions in an organization, it is therefore advantageous to focus on BCMS in preparing for climate change adaptation. The BSI Group manual provides specific support for BCMS personnel during actual operation of BCMS. (An overview is given in the supplementary material that accompanies this Guide.)

e) Involvement of senior management

Since adaptation to climate change is a response to future issues characterized by uncertainty, companies should align their efforts with management plans, etc. In order to adapt to climate change, it may be necessary to take measures that involve management decisions, such as large-scale facility improvements, or changes to business plans and business models, so it is important to involve senior management from the early stages of these efforts.

In recent years, TCFD recommendations, ESG investment, and other developments have increased demand for companies to disclose their risks and initiatives related to climate change. These disclosures emphasize whether management properly understands the risks and opportunities of climate change, makes decisions based on them, and steers the business soundly. From this point of view, it is important for management to recognize climate change as an important management issue, and to inform others both inside and outside the company of the company's commitment to linking related initiatives to sustainable development of the company.

Case Study 4.1 Examples of Management Involvement in Related Activities

Management-led sustainability initiatives (land-based transportation)

Tokyu Corporation has set out a medium-term three-year management plan that includes three basic policies on sustainability (sustainable urban development, sustainable corporate development, and sustainable HR development) and six material sustainability themes (materialities), driven by senior management. Since its founding, the company has been working from a social perspective, but this is the first time it has defined its efforts in terms of materialities. Through repeated exchanges of opinions with senior management, the company is discussing sustainability in light of the overall business direction, and considering a number of social issues, including those raised in the SDGs, to identify social issues that need to be resolved by taking advantage of the company's business domains and strengths.

Source: Responses to interviews with Tokyu Corporation

Addressing management issues by integrating management and employees (printing)

In order to develop new possibilities, Ohkawa Printing Co., Ltd. holds annual workshops in which management and employees work together to take a backcasting approach to discussing how to achieve the future vision for the company. The company has adopted a bottom-up method of management plan formulation in which all employees participate and management issues are narrowed down based on the ideas that have emerged from these workshops. As a result, since 2017, it has been working on the SDGs Management Plan to implement the SDGs in our management planning. Not only does this help all employees to feel more involved in management, but also enables them to recognize the linkages between global issues and their own work, thereby nurturing employees' sense of mission, awareness of issues, and ability to take action. This has prompted activities that lead to the creation of new businesses.

Source: Responses to interviews with Ohkawa Printing Co., Ltd.

2) List the Impacts (Risks and Opportunities) of Climate Change

Companies should list as comprehensively as possible the impacts of climate change experienced to date (impacts due to weather disasters, abnormal weather, high temperatures, heavy rain, drought, storm surges, etc.), the impacts of climate change expected to affect future business activities (impacts due to changes in temperature and precipitation, etc.), and information about countermeasures that are currently being implemented.

a) Determine the impacts of climate change experienced so far

Collating information on climate change impacts experienced to date is the first step toward climate change adaptation. This information can be collected by checking records on disaster countermeasures implemented by the company or repair of facilities affected by wind and flood damage, as well as by conducting interviews with related parties. The widest possible range of past examples should be collected: even cases in which damage did not actually occur, or the causal relationship with climate change is not clear, or cases involving other companies in the same industry, may offer important information for future planning.

Examples of climate change impacts experienced so far:

- Impacts of torrential rains, typhoons, storm surges, high waves, and strong winds
- Impacts on employee health, such as heatstroke
- Impacts of high temperatures on facilities and equipment
- Impacts on the supply chain, such as failed raw material harvests, supplier damage, and disruption of transportation routes

b) Obtain information on future climate change and impacts in each field

Companies should collect information on future climate changes (temperature, precipitation, etc.) and climate change impacts (forecasts on meteorological disasters, impacts on agricultural products, fishery products, water resources, natural ecosystems, etc.) that will become factors (triggers) of impacts on business activities, as well as related information (adaptation plans of relevant municipalities, climate change risk management policies of customers and others, market trends related to climate, etc.).

Methods for obtaining information on climate change and its impacts consist of collecting existing projections and conducting forecasting simulations independently using climate models and impact assessment models. Existing projections can be collected from IPCC (Intergovernmental Panel on Climate Change) reports and from reports published by national research institutes[16]. For example, A-PLAT, managed by the National Institute for Environmental Studies, collects data on climate change to date, as well as a variety of information needed for adaptation efforts, such as projections of future climate change impacts. Its National and Prefectural Information (in Japanese) provides information on projected impacts of climate change at the national and prefectural levels. The Hazard Map Portal site[17] of the Ministry of Land, Infrastructure, Transport and Tourism contains information on floods and landslides.

Relevant information such as municipal adaptation plans can be obtained from A-PLAT's Local Government Initiatives pages (in Japanese), including public information such as local climate change adaptation plans by local governments. Effective means of learning about the latest trends in industry might include obtaining information provided by industry associations, conducting interviews with major business partners (e.g., suppliers or customers), and utilizing outside experts.

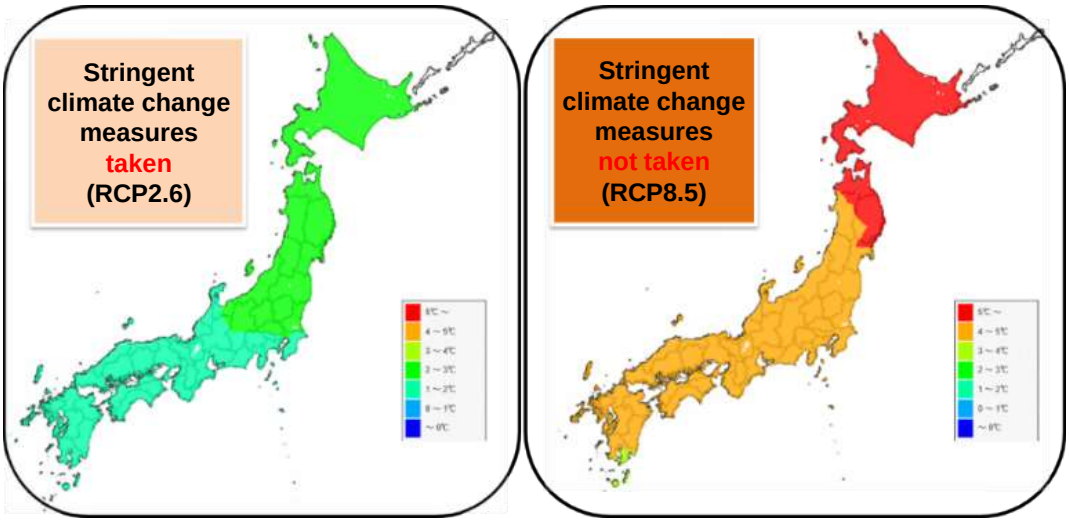


Figure 4.1 Examples of climate change projections (future projections of annual average temperature)

Annual average temperature change (°C) at the end of the 21st century relative to average temperature between 1981 and 2000

Source: Projection of Annual Average Temperatures, Climate Change Adaptation Information Platform (A-PLAT)

[16] The supplementary material that accompanies this Guide introduces relevant reports and publications in "2. Information on Climate Change Impacts."

17 In Japanese: https://disaportal.gsi.go.jp/

c) List the specific impacts expected in future

Based on the information they have collected, companies should list as comprehensively as possible the concrete impacts of climate change on future business activities (impacts on operations due to flooding, increases in heatstroke due to rising temperature, changes in customer needs, etc.). Future impacts may include the spread of impacts already experienced, as well as entirely new impacts. In order to avoid overlooking potential impacts on business activities, it is important to anticipate future impacts from as broad a perspective as possible. To this end, not only the departments directly related to the objectives of adaptation efforts, but also other departments including corporate planning and general affairs need to discuss the matter together. It is possible that a wide range of ideas could be obtained by exchanging opinions workshop-style with the participation of related departments. The exchange of opinions with relevant departments can also be expected to make the relevant parties feel more involved in climate change adaptation. However, in order to avoid bias, it is recommended that experts with knowledge of private sector climate change adaptation be present and act as facilitators. In addition, companies can extend their awareness of impacts they may not have noticed on their own by collaborating with research institutes and consultants that have an interest in climate change impacts and business risks, and holding discussions involving experts.

Examples of climate change impacts on future business activities:

- Increase in maintenance and management costs at individual sites due to rising temperatures and increasing storms
- Future impacts on agricultural crops and plants/animals used as raw materials
- Requests for implementation and disclosure of climate change adaptation from key customers
- Changes in consumer behavior associated with changes in climate (e.g., long-term increases/decreases in temperature)

Case Study 4.2 Obtaining Information on Climate Change Impacts

Understanding of risk perceptions through questionnaire surveys (pharmaceuticals)

The Basic Environmental Policy of the Daiichi Sankyo Group states that it will deal with the impacts of climate change and water risks on its business activities, and it therefore identifies climate change and water risks, and pursues countermeasures. As part of these efforts, the Group believed it would be effective to evaluate the risks caused by climate change, etc. based not only on information already available to head office, but also from the onsite perspective by, for instance, reassessing onsite perceptions of the current situation, as well as the actual situation itself. Accordingly, the Group conducted a questionnaire survey of its domestic branches to ask about risk perceptions. Using questions provided by the CDP as a reference, the survey asked about climate change and water risks. It found that many

employees were concerned about the potential impact of changes in maximum and minimum temperatures on production due to cost increases and equipment failures, and the impact of changes in tropical storms on production and raw material procurement.

Source: Climate Change Adaptation Information Platform (A-PLAT)
In English: https://adaptation-platform.nies.go.jp/en/lets/climaterisk/daiichisankyo_e.html

d) Determine the actual extent of countermeasure implementation

Determine the extent to which a response is currently being implemented (or will be implemented in future) for each specific impact listed.

Table 4.3. Examples of Future Impacts of Climate Change

Reference number	Business sites, etc.	Department in charge	Cause of impact	Impact expected	Status of response
(1)	Plant A	General affairs	Typhoon	Employees unable to attend work	None
(2)	Plant A	Manufacturing	Heavy precipitation	Power supply facility flooded and plant function stopped	Preparation of sandbags
(3)	Branch B	Sales	Heavy precipitation	Main road flooded and logistics stopped	None
(4)	Plant C	General affairs	Flooding	Flood response costs increase every year	Alert level changed
(5)	Sales office D	Administration	Summer heat	High temperature lowers work efficiency	None
(6)	Head Office	Sales	Temperature	Decrease in sales of seasonal products	Use of long-term weather forecasts
(7)	Head Office	Product development	Market change	Changes in consumer behavior due to changes in temperature	None

Box 4.2 Scenario Analysis

The TCFD recommends,[18] with regard to an organization's strategy, that it should "disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material."

It also states that "organizations should describe how resilient their strategies are to climate-related risks and opportunities, taking into consideration a transition to a lower-carbon economy consistent with a 2°C or lower scenario and, where relevant to the organization, scenarios consistent with increased physical climate-related risks." It thus recommends taking into account different climate-related scenarios, including scenarios below 2°C.

In order to develop "scenarios consistent with increased physical climate-related risks," it is necessary to take into account changes in the business environment surrounding the company (such as its business plans, policies on climate risk measures of relevant governments and major customers, and the market environment) as well as events (such as weather disasters and impacts on water resources) that will result from future climate changes. Much of this information can be obtained through the steps detailed in Chapter 4-2) of this Guide, "List the Impacts [Risks and Opportunities] of Climate Change."

Events that will result from future climate changes may be based on the IPCC's Representative Concentration Pathways (RCPs). However, when developing adaptive plans in a medium- to long-term timeframe, for example, RCP4.5 (the medium stabilization scenario) and RCP6.0 (the high stabilization scenario) could be assumed in addition to RCP2.6 (the low stabilization scenario). Changes in the business environment surrounding companies vary from one enterprise to another, but if uncertainties about future changes are considerable (e.g., when indirect impacts of climate change are significant risks, and when uncertainties about the socio-economic impacts of climate change are substantial), multiple scenarios corresponding to these uncertainties could be assumed.

[18] Recommendations of the Task Force on Climate-related Financial Disclosures
In English: https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-2017-TCFD-Report-11052018.pdf

3) Identify Priority Issues

Of the climate change impacts listed, identify issues that need to be addressed as priorities (i.e., assessed in detail, with measures to be considered and implemented as necessary). One of the methods of identifying priority issues among many impacts is a risk-based approach (i.e., selecting issues highly likely to materialize that will also have significant impacts). In addition, there are other methods to identify priorities, such as taking into account aspects other than climate change impacts, as follows.

For example:

- Issues for which specific impacts have already materialized or are highly likely to have materialized
- Issues that may be difficult to tackle if the timing of the response is missed (planning, design, etc. of large-scale facilities)
- Issues that could solve problems other than climate change impacts, and issues that lead to co-benefits (such as upgrading and replacing aged equipment, improving energy efficiency, and contributing to regional adaptation)
- Issues that require long-term review and data collection for implementation (e.g., changes in raw materials and business models)
- Issues for which acting promptly will increase value (e.g., early acquisition of market for adaptation business), etc.

Case Study 4.3 Example of Evaluation Using a Risk Map (electrical utility)

UK Power Networks[19] selected 14 potential impacts on its electricity distribution network over a time frame up to 2080 and analyzed the relative likelihood and magnitude of these impacts.

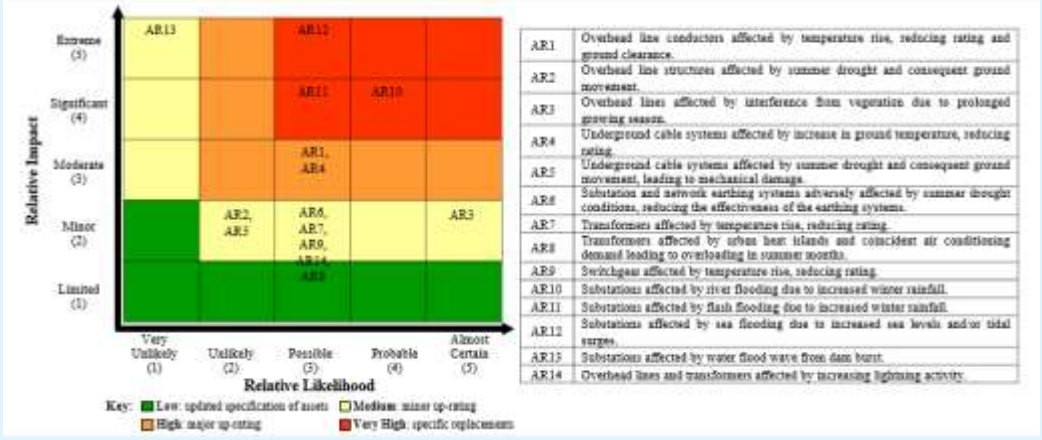


Figure 4.2 Example of evaluation using a risk map

Source: *UK Power Networks Business Plan (2015 to 2023) Annex 8: Climate Change Adaptation*, Mar. 2014
In English:
https://library.ukpowernetworks.co.uk/library/en/RIIO/Main_Business_Plan_Documents_and_Annexes/UKPN_Climate_Change_Adaptation.pdf

4) Select and Implement Adaptation Measures

a) Selection of adaptation measures

Options with regard to adaptation measures can be broadly divided into the three categories below.

[19] Electricity distribution company with approximately 8 million customers in London and elsewhere

In addition, each of them can be subdivided into physical measures and behavioral measures. Specific adaptation measures should be selected in light of a company's adaptation objectives, the costs and time associated with implementation, and balance with other management issues. It is also important to consider how to prevent the implementation of adaptation measures from leading to "inappropriate adaptation" that causes unintended negative impacts, etc.

Table 4.4 Typical Examples of Climate Change Impacts (Risk Countermeasures) and Adaptation Measures

Specific impacts	Adaptation measures		
	Avoid (prevent) materialization of impacts by taking protective measures, etc.	Mitigate (minimize) impacts that do materialize by building resistance to effects, etc.	Avoid impacts entirely through fundamental measures such as relocation of factories, changes in business models, etc.
Shutdown of production functions due to flooding	Flood protection measures	Formulation of business continuity plans	Relocation of production facilities
Employee heatstroke due to abnormally high temperatures	Improvement of air conditioning facilities	Employee health management	Outsourcing of work to other companies
Decline in sales of major products due to changes in temperature	Adjustment of product sales timing	Product improvement to meet consumer preferences	Switching of major products
Shortage of water resources due to changes in precipitation patterns	Installation of water storage facilities Development of alternative water sources	Efficient usage of water Stockpiling of products, etc. during drought	Restructuring of production lines Relocation of business sites

Table 4.5 Examples of Physical and Behavioral Measures

Impact	Purpose of measures	Physical measures	Behavioral measures
Sudden impact	Controlling a flood	Installation of water stops Relocation of facilities	Introduction of an early planning system Use of insurance
	Managing heatstroke	Installation of air-conditioning facilities	Change in work style
Long-term impact	Managing drought	Development of alternative water sources Installation of water storage facilities	Water conservation
	Controlling maintenance and management costs	Introduction of cost-saving equipment	Power saving Change of electric power purchasing plan

b) Timing of implementation of adaptation measures

Companies should implement adaptation measures in a planned manner based on when the impacts of climate change are expected to materialize. Coordinating the implementation of adaptation measures with facility improvement plans and the timing of management system reviews may enable duplicated efforts to be prevented, and adaptation measures to be implemented efficiently and economically.

Table 4.6 Examples of Adaptation Measures by Industry

Industry category	Examples of adaptations
Financial	In selecting locations for new branch offices, companies consider the risk of natural disasters such as flooding. In order to ensure the safety of employees and maintain service in the event of a natural disaster, BCPs are established for each branch office and companies make provision for a shift to telecommuting and the establishment of alternative offices.
Energy	Increases in warm winters could reduce energy demand, such as heating in winter, and reduce sales. Therefore, companies are reducing climate change risk through diversification of business areas.
Real estate business	Companies are introducing highly efficient air-conditioning equipment in their own tenant buildings in preparation for increases in air-conditioning usage and power consumption due to extreme heat and severe winters in the future.
Transport and logistics	Companies are evaluating the risk of storm surges, rises in sea level, flooding, etc. affecting warehouses located on coastal and river shores and examining the need for relocation to elevated ground, etc., as necessary.
Food production and sales	Since agricultural products currently handled may become impossible to harvest in their present production areas, companies have started research and development to address the possibility of introducing new varieties and crops from southern countries in cooperation with farmers.
Manufacturing	Companies are preparing for facility damage due to natural disasters and production line shutdowns due to water shortages by developing BCPs that include their supply chains to identify potential risks in advance and take smooth initial measures.
Construction	Because of increasing risk of damage to facilities and delays during construction due to abnormal torrential rain, construction plans are made so that construction work vulnerable to such risk is carried out at times when rainfall is low.
Advertising	In order to prevent increased electricity costs for air conditioning due to heat countermeasures, as well as decreased business efficiency and health impacts on employees working outdoors, companies are introducing energy-saving air conditioning systems in their buildings. Additionally, in summer, companies are taking measures such as adjusting working hours to avoid outdoor work during daytime.

Box 4.2 Inappropriate Adaptation (maladaptation)

The Summary for Policymakers of the Working Group II contribution to the IPCC's Fifth Assessment Report states on p. 28 that "poor planning, overemphasizing short-term outcomes, or failing to sufficiently anticipate consequences can result in maladaptation (*medium evidence, high agreement*). Maladaptation can increase the vulnerability or exposure[20] of the target group in the future, or the vulnerability of other people, places, or sectors. Some near-term responses to increasing risks related to climate change may also limit future choices. For example, enhanced protection of exposed assets can lock in dependence on further protection measures."

Corporate climate change adaptation may include "inappropriate adaptations" as follows:

- Water with nowhere to escape due to flood prevention measures during torrential rain causes inundation of surrounding land
- Greenhouse gas emissions increase due to additional air-conditioning facilities for cooling
- Groundwater development in preparation for drought risk affects the use of groundwater by neighboring residents

In order to prevent such inappropriate adaptations, companies are encouraged to consider not only the short-term effects of implementing adaptation measures, but also the effects on the surrounding environment, and potential issues from a long-term perspective.

Box 4.3 Adaptation Options

UKCIP in the UK (formerly known as the UK Climate Impacts Programme)[21] publishes guidance on identifying and selecting adaptation options to address climate change risks[22]. In this guidance, "When it comes to identifying appropriate adaptation measures, a prudent approach begins by recognizing that there are several viable options that result in effective adaptation yet which minimize the risks associated with implementation (and are cost-effective) even in the face of associated uncertainties." The four categories of options below are presented.

Climate change adaptation is a future challenge characterized by uncertainty, but it is undeniably extremely difficult for current science to accurately predict the impacts of climate change on individual (business) operators. For this reason, many business operators may be reluctant to take action due to uncertainty even if they are aware of the need for future preparations. The four option categories outlined in this guidance will be helpful in making management decisions in such cases.

・No-Regret Adaptation Options

Adaptation measures that are worthwhile (ie. They deliver net socio-economic benefits) whatever the extent of future climate change.

[20] For a description of vulnerabilities and exposures, see Part 1.2 “Actualization of the Impacts of Climate Change” in the supplementary material that accompanies this Guide.

[21] A research institute established in 1997 by the UK's Department for Environment, Food & Rural Affairs (Defra) to assess climate-change impacts. At present, the Environmental Change Institute (ECI) of Oxford University is the main operator, and Defra funds the institute’s activities. The scope of activities has been expanded from the initial purpose at establishment and the institute provides support for adaptation initiatives at governmental agencies, various organizations, and enterprises through practical research activities and provision of information, as well as offering evaluation tools, support, and advice.

[22] Identifying adaptation options (2007)
In English: https://ukcip.ouce.ox.ac.uk/wp-content/PDFs/ID_Adapt_options.pdf

-Building/designing property and buildings to minimize over-heating in summer months;
-Reducing the consequences of flooding through the use of water-resistant materials for floors, walls and fixtures, and the siting of electrical controls, cables and appliances at a higher than normal level;
-Avoiding building in high-risk areas (eg. flood plains) ;
-Actions or activities directed at building adaptive capacity as part of an overall adaptive strategy; and so on.

・Low-regrets (or limited regrets) options

Adapting measures for which the associated costs are relatively low and for which the benefits, although primarily realised under projected future climate change, may be relatively large.
-Building extra climate headroom in development to allow for further modifications (eg. Increased ventilation, drainage) consistent with projected changes in temperature and precipitation;
-Restricting the type and extent of development in flood-prone area;
-Sharing in developing and operating additional water storage facilities;

・Win-Win options

Adaptation measures that have the desired result in terms of minimizing the climate risks or exploiting potential opportunities but also have other social, environmental or economic benefits
-Improving preparedness and contingency planning to deal with risks (including climate);
-Improving the cooling capacity of building through increased shading and/or alternative less energy intensive cooling strategies;
-Green roofs and green walls which have multiple benefits in terms of reducing building temperature and rainfall runoff from buildings, and increased green spaces within urban areas, but also reduces energy use for both heating and cooling;

・Flexible or adaptive management options

Flexible or adaptive management options – involve putting in place incremental adaptation options, rather than undertaking large-scale adaptation in one fell swoop. Measures are introduced through an assessment of what makes sense today, but are designed to allow for incremental change, including changing tack, as knowledge, experience and technology evolve.
"Delaying" introducing a specific adaptation measure (or suite of measures) can be part of a flexible or adaptation management strategy as long as that decision is accompanied by a commitment to continue building the necessary adaptive capacity while continuing to monitor and evaluate the evolving risks.
A decision to delay introducing a specific action is often taken when the climate risks are below defined thresholds or when the required adaptive capacity (eg. regulatory or institutional circumstances) is insufficient to allow effective action.
-Introducing progressive withdrawal from coastal areas and creation or re-establishment of floodplains consistent with risks and development lifetimes
-Progressive development and investments in recreation consistent with projected changes in climate (eg. progressive investments towards developing and promoting multi-seasonal recreation activities).

5) Confirm and Review Progress

a) Periodic review

The government will regularly review the progress and effectiveness of planned adaptation measures in light of the objectives of addressing climate change impacts. If climate change adaptation is incorporated into an existing management system, it can be reviewed within that framework.

b) Review based on new forecast information

Climate change has a variety of long-term impacts. Therefore, it is necessary to regularly review adaptation measures. Examining adaptation measures requires forecast information on future climate change and its impacts; the forecasting technology is advancing every day, and it is expected that the accuracy of information will continue to increase in future. In addition, even in areas of interest where insufficient forecast information has been gathered at present, new findings may be made public due to the progress of future investigation and research. In order to proceed with climate change adaptation in a timely and appropriate manner, a cycle of regularly collecting such up-to-date forecast information, reconfirming risks and opportunities based on this information, and considering adaptation measures, will become very important.

The Japanese national government collects the latest scientific findings approximately every five years and conducts the "Climate Change Impact Assessment. Based on this, it reviews Japan's Climate Change Adaptation Plan. A Climate Change Impact Assessment Report is scheduled to be prepared in 2020 and the latest scientific findings on climate change impacts will be made available to the public.

Case Study 4.4 Examples of Measures Accounting for Uncertainties Regarding Climate Change Impacts

If rising sea levels due to climate change start exerting increased external force, this could affect the functioning and safety of river management facilities. Japan's Ministry of Land, Infrastructure, Transport and Tourism therefore intends to employ design concepts and concrete measures to facilitate the development of river management facilities that will not require redesigning in future. Approaches include constructing facilities such as floodgates and gutter gates that can be modified as easily as possible in response to future sea level rises, etc., and considering future needs in advance when designing facilities such as gateposts and foundations, which are difficult to modify.

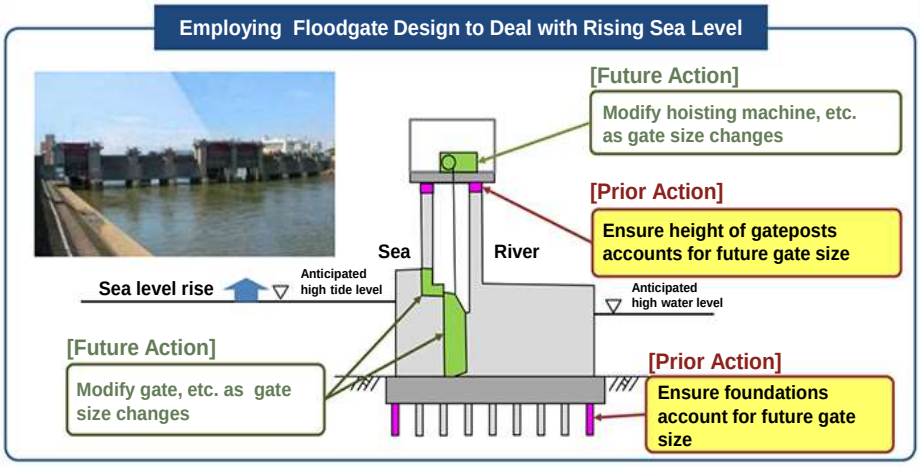


Figure 4.3 Example of floodgate design accounting for sea level rise
Source: Ministry of Land, Infrastructure, Transport and Tourism (2015) Report on Climate Change Adaptation Measures in the Field of Water Disasters

5. For More Detailed Information

The purpose of this Guide is to deepen understanding of the relationship between climate change and business activities and promote proactive initiatives among those who are engaged in the management and practice of private sector seeking to tackle climate change adaptation. For more detailed information, please refer to the supplementary material that accompanies this Guide.

Table 5.1 Table of Contents and Information in Supplementary Material

No.	Major Items	Information in Supplementary Material
1	Basic Information on Climate Change Countermeasures	・ Mechanisms of global warming and climate change ・ Materialization of the impacts of climate change ・ Carbon budget ・ Climate change projections and future scenarios ・ Outline of the Paris Agreement and role of adaptation ・ Outline of the Climate Change Adaptation Act Etc.
2	Information on Climate Change and Its Impacts	・ Climate Change Adaptation Information Platform (A-PLAT) ・ National Climate Change Impact Assessment Report ・ Integrated Report on Climate Change Observation and Projection and Impact Assessment ・ Meteorological Agency Global Warming Projection Vol. 9 ・ Historical data by region and prefecture published by the Meteorological Observatories ・ IPCC AR5, 1.5℃ Report Etc.
3	Corporations' Awareness of Risks and Opportunities with Regard to Climate Change Impacts	・Industry-specific analysis of risk and opportunity awareness among corporations with regard to the physical impacts of climate change, based on the CDP report
4	Examples of Efforts by Companies outside Japan	・Representative examples of initiatives by industry included in the CDP report ・Summary of examples of adaptation listed in the PSI
5	Current Efforts by Japanese Companies	・List of concrete examples of climate change adaptation measures included in the CSR reports of the top 200 companies in the TOPIX
6	Impediments to Adaptation	・Summary of the impediments to climate change adaptation by private sector based on literature and interviews
7	Climate Change Adaptation Efforts in Cooperation with Local Communities	・Summary of the value and nature of collaboration between cities and companies, and public-private partnerships in vulnerable areas, based on overseas literature
8	Climate Change Adaptation Using Business Continuity Management Systems	・Description of methods for incorporating climate change adaptation into existing BCMs, using reference books prepared by the UK Environment Agency, etc.
9	Introduction to the TCFD	・Outline of the TCFD's background and recommendations, and description of the scenarios analysis approach
10	Overview of References	・Overview of Japanese and non-Japanese books helpful in obtaining more detailed knowledge on climate change adaptation, and their content
11	Other Information for Reference	・Administrative guidance on climate change adaptation ・Description of water risk assessment tools Etc.
12	Glossary	・Explanation of terms used in supplementary material

6. Review Committee on Promotion of Climate Change Adaptation by Private Business Operators

In preparing this Guide, we received guidance and advice from the Review Committee on Promotion of Climate Change Adaptation by Private Business Operators. We would like to express our sincere appreciation to all of its members.

List of Review Committee members (titles omitted; affiliations and positions are as of March 2019)

Name	Affiliation, position, etc.
Kaoru Ishigaki	General Manager, Purchasing Division, Calbee Corporation
Ai Kishioka	Project Manager, CDP Worldwide-Japan
Yoshinao Kozuma	Professor Emeritus, Sophia University
Toshihiko Goto	CEO, Sustainability Forum Japan, Incorporated Nonprofit Organisation
Koji Tsusue	General Manager, General Affairs Department, & Legal Affairs Department, Aeon Company Limited
Masaaki Nagamura	General Manager, International Initiatives, Strategy and Synergy Department, Tokio Marine Holdings, Inc.
Hideo Harasawa (chairman)	Vice President, National Institute for Environmental Studies (NIES)
Yukihiro Masuda	Professor, Department of Planning, Architecture and Environmental Systems College of Systems Engineering and Science Shibaura Institute of Technology
Hitomi Miura	Senior Manager, ESG Management Department, Sekisui Chemical Co., Ltd.
Toshiaki Yamanari	General Manager, Sustainability Promotion Group, Corporate Affairs Headquarters, Tokyu Corporation

Publisher / Contact

Climate Change Adaptation Office,
Policy and Coordination Division,
Global Environment Bureau,
Ministry of the Environment

Editing

Kokusai Kogyo Co., Ltd.