



A BSI Executive Briefing

From Vulnerability to Resilience – Future-proofing My Organization

A guide to BS 8631:2021 Adaptation to climate change
– Using adaptation pathways for decision making



1 Overview

We have all heard of climate change.

Although there have been many meetings about climate change across the globe, year-on-year progress to address its challenges has been slow. Currently it seems unlikely that we will be able to prevent a rise in the global average temperature to below 2 °C above pre-industrial levels, which was the aim agreed by world leaders as part of the Paris Agreement in 2015. The agreement committed the majority of the world's countries to try to control their national greenhouse gas emissions so that, collectively, the world could stay below a 2 °C increase. There was even an ambition to reduce the average down to less than 1.5 °C. Whether it is 1.5 °C, 2 °C or more, the climate will still change, and some current thinking is that 4 °C is not unlikely.

This leads us to two thoughts. Firstly, the world will not be affected equally. What does the global rise of mean annual temperature (1.5 °C or 2 °C) look like where you are? Scientists continue to adjust their predictions as we learn more, so we are not that sure. Secondly, whatever the predictions we will still need to come back from the impacts our organizations experience over the next several years (decades, more realistically).

Wherever we are and whatever we do, we are all vulnerable to some degree – individually as well as within our communities, organizations, the sectors in which we work, and in our countries. Being able to deal with that vulnerability and still prosper is called resilience.

The process of anticipating the future and developing a strategy to minimize the effects of shocks and stresses of future events is called future-proofing. It is a process because it is not a one-off course of action; it will be ongoing. When our organization is vulnerable, we need to adapt, become resilient and future-proof it.

BS 8631 guides us as to how this could be accomplished through a nine-step process. Note that it is a 'process' – a structured approach to the challenge of moving from vulnerability to resilience. Isolated, quick fixes will not work. The impacts of climate change will be relentless, so a measured and systematic way of coping with them will be profoundly more beneficial.

BS 8631 shows us the way

Although many standards include information on climate change, it is only BS 8631 that guides organizations through the process of making decisions, specifically in the context of adaptation. There could be many routes to future-proof an organization, but it is BS 8631 that shows us how to use adaptation pathways for decision-making purposes.

This executive briefing explores how organizations can use the adaptation pathways for decision making featured in BS 8631 using a hypothetical company named *Prudento*, which sells security alarms and provides consultancy on security matters in general.

Every morning in Africa a gazelle wakes up. It knows it must run faster than the fastest lion or it will be killed. Every morning a lion wakes up. It knows it must outrun the slowest gazelle or it will starve to death. It doesn't matter whether you are a lion or a gazelle – when the Sun comes up, you had better be running.¹

**The sun is coming up ...
somewhere near your
organization. It is time to act.**

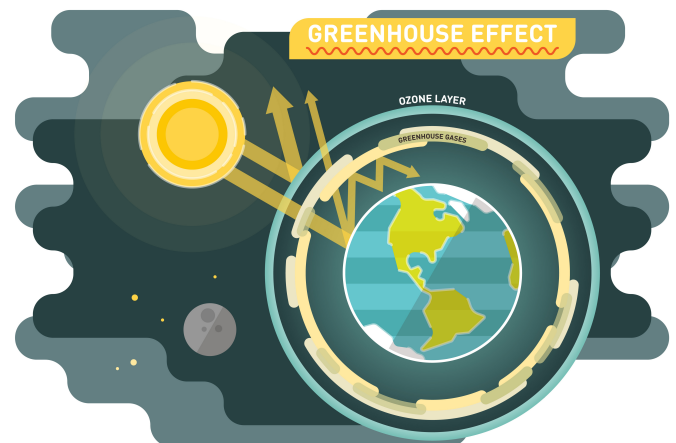
¹ Montano, D (1985) *The stock exchange: Deregulation and new technology*, Oyez International Business Communications, London Conference of Stockbrokers, June 5, 1985

2 Future-proofing my organization

2.1 Climate change, adaptation and my organization

2.1.1 Climate change basics

Some of the sunlight coming from the Sun to the Earth is reflected directly back into space, especially by ice and clouds. The rest is absorbed by the surface of the planet and the atmosphere, some of which is then re-emitted as heat. Any change to this balance of incoming and outgoing energy will affect the climate. The greenhouse gases in the atmosphere include water vapour, carbon dioxide, methane and nitrous oxide. These absorb and emit heat energy in all directions (including downwards), keeping the Earth's surface and lower atmosphere warm. This is a good thing, otherwise we would not be here. Adding more of these gases to the atmosphere makes it even more effective at preventing heat from escaping into space.



Greenhouse gases can be emitted by human activities. We also affect the climate by changing the nature of the land (for example, by clearing forests for farming) and through the emission of pollutants that affect the number and type of particles in the atmosphere. Scientists have determined that, when all human and natural factors are considered, Earth's climate balance has been altered towards warming, with the biggest contributor being increases in carbon dioxide. This is not such a good thing.

What will happen in the future? There are many different factors to be considered, and over a variety of timescales. Taking everything into account, all computer model projections indicate that the Earth will continue to warm considerably more over the next few decades. If there were no technological or policy changes to reduce emission trends from their current trajectory, then further globally averaged warming of 2.6 °C to 4.8 °C (in addition to that which has already occurred) would be expected during the rest of this century.

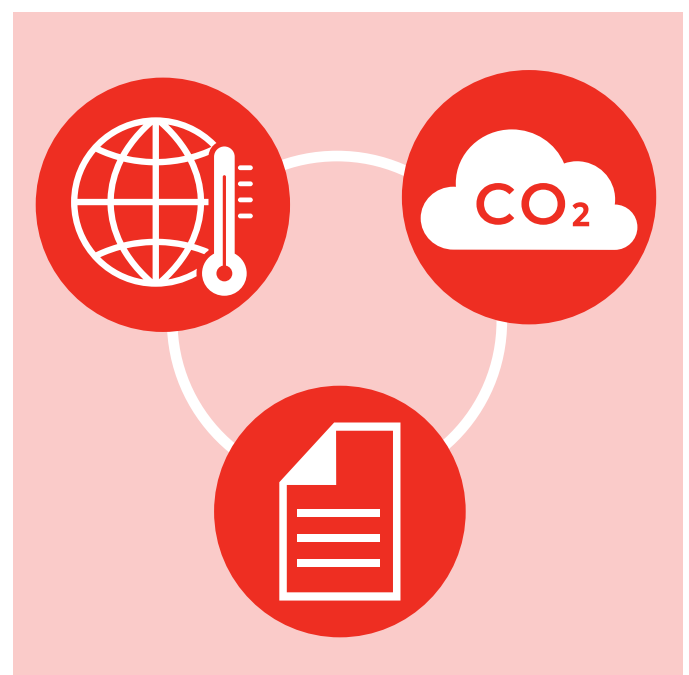
So, what are we doing about it? Well we have conferences to talk about it and try to scope strategies to deal with it. The first, the World Climate Conference, was in 1979 and we have been having them regularly ever since. In 1994 the United Nations Framework Convention on Climate Change entered into force, and 197 countries have ratified it. Each country is called a 'party' and becomes a Party to the Convention. The convention has an annual summit called Conference of the Parties (COP). This year sees the 26th COP and its objective is simple: how to reduce the amount of carbon dioxide entering the atmosphere each year, and how to adapt to it anyway. How to do that is anything but simple. Even if we can reduce the amount we produce, there is still too much in the atmosphere already.

So that is why we need to adapt. That is why we need to start running... but in which direction?

2.1.2 Adaptation basics

Because the extent of climate change is so uncertain, we do not really know what we have to adapt to. In the short term, we have some idea how it might manifest itself in terms of rainfall and temperature, but it is still very uncertain – especially concerning frequency and volume. Given this uncertainty, it is clear that there could be several different versions of future change. It follows that there could be more than one sequence of adaptation actions that might need to be considered, at different times and under different climate regimes. In other words, there are several different paths that we could follow when we start running. Having several possible adaptation pathways forms an effective way to respond to climate change and its associated uncertainties. These paths are, in effect, sequences of potential actions that can be implemented as conditions evolve and as we learn more about climate change risks.

BS 8631 provides a nine-step framework that can be used to manage the process of choosing a particular path.



2.1.3 My organization

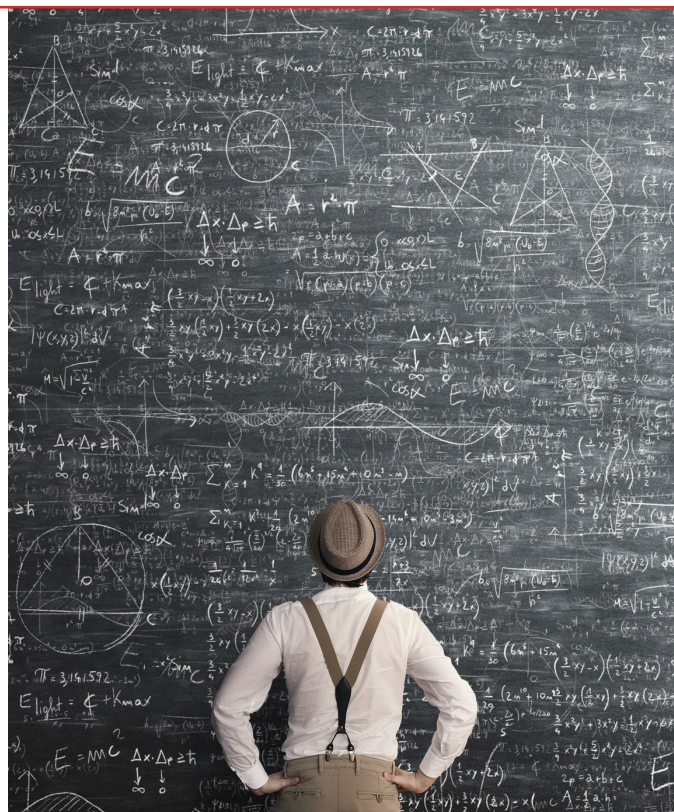
Organizations are almost infinitely variable, yet there are three commonly defining features into which most generally fit:

- private or public
- manufacturing or services
- direct and indirect customers

Climate change will affect all of these defining features; the extent to which it does will depend on the precise organizational activity.

The private sector can range from single person entities to multi-nationals. In this sector climate change is another business risk to be weighed with all other risks, to identify how and where to allocate resources. For small- and medium-sized businesses, there is generally little choice. Most resources have to go towards managing immediate risks such as late-paying customers, though some may also go towards managing known climate-related events – such as preparation for possible flooding. Some private sector organizations may also be influenced by their customer bases, which could include significant numbers of people who are sensitive to climate issues.

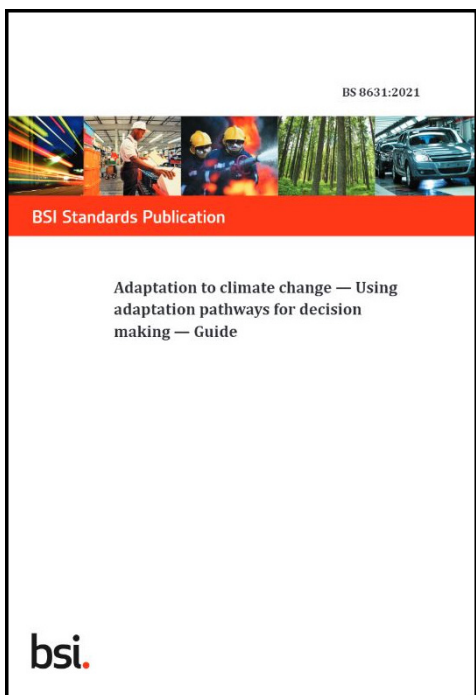
The public sector is largely driven by political requirements at national level, as well as a mixture of political direction and the need for delivery of services at local level. There is generally less freedom of choice in this sector, which also has to act in line with overall government policy.



Until the advent of social media, it was much harder for customers to attract the attention of organizations. A few letters here or a petition with just a few names there barely gained any traction. However, social media now provides the means to disrupt an organization, large or small. Used well, it can be a force for good in helping organizations assess risks. Direct and indirect customers have a voice at the table, and it can provide a useful perspective on climate risks.

Rationalizing all the various organizational data, vulnerabilities, threats and risks over different timescales is not only potentially overwhelming, but also it may not be necessary or so complicated. Different levels of detail are possible, which is indicated by the case studies within BS 8631.

Our hypothetical organization *Prudento* is a private company that sells its security alarms directly to consumers, while also operating in the public sector by providing consultancy to government and local authorities on a variety of security issues. The security issues it consults on are water, food and energy security, all of which are being increasingly affected by climate change. It has direct customers (people buying alarms, and government departments and local councils receiving advice) and it has indirect customers (those being affected by government policy, as advised by *Prudento*).



BSI Standards Publication

Adaptation to climate change — Using adaptation pathways for decision making — Guide

bsi.

2.2 Investing in my organization

Part of running a successful organization is managing risks. Many standards help businesses to manage risks, such as BS EN ISO 9001 *Quality management systems – Requirements*, BS EN ISO 14001 *Environmental management systems – Requirements with guidance for use* and BS ISO 55000 *Asset Management – Overview, principles and terminology*, and BS 8631 is simply another one of those risk tools. This executive briefing covers how to use it and explains why you should.

The notion of climate change seems pretty distant. The occasional extremely cold snap, unusual heatwave or even days of flooding cannot typically be attributed to it. However, these events are in accordance with what we would expect from climate change; they fit the pattern, and scientific expectations are that they will become more frequent and generally more extreme in future.

Even if your organization's building is not going to be affected by these more obvious effects, your staff, customers and supply chains may be. The 2010 eruption of an Icelandic volcano called Eyjafjallajökull – hitherto relatively unknown to most organizations – led to the largest air-traffic shut-down since World War II. It disrupted thousands of supply chains and, in some cases, caused massive business interruption. Obviously, this was not caused by climate change, but it does demonstrate how seemingly well-organized supply chains were, in fact, very fragile. While predicting such disruption events in the future is not possible, we can start to learn generic lessons from them, and apply these to our business planning.

Any organization that uses air space as part of their supply chain is vulnerable, not just to sudden closures of air space but also foreseeable disruptions, such as extreme storms and wind. Organizations that use rail and road for just-in-time deliveries are also susceptible to unseasonal and large snowfalls, deluges and prolonged heatwaves. Organizations that use any materials from abroad can be affected by climate change acting at the point of origin of those materials. All of this is foreseeable.

An important part of running any private or public organization is cost management, which occupies significant time in each business day. Being able to bounce back from business interruption costs efficiently is all part of being resilient. Investing in the organization is not just about managing capital, cash flows and cost management, it is also about investing in people and information, and being smart about our reliance on technology. In the event of a power outage, batteries only last for so long.

Resilience is a key word these days. It is about an organization being able to cope with some form of adverse event or string of events in the short term, to be able to bounce back in the longer term. To do that, we need to look at the vulnerability of what we do.

How does *Prudento* invest in its resilience? It already spreads its risk by:

- **working in both the private and public sector**
- **selling both products and services**
- **having both direct and indirect customers**

Is it fortunate by spreading its risk, or has it just doubled it? Perhaps its capital and cash flow are spread too thinly to allow it to be able to invest in its people, information and being smart about technology?

Firstly, *Prudento* needs to look at its more obvious potential vulnerabilities:

- **leadership and governance**
 - is *Prudento*'s top management aware?
- **location**
 - is *Prudento* physically at risk?
- **utilities**
 - does *Prudento* have a plan of action in the event of power or water interruption?
- **finance**
 - can *Prudento* survive for a period without revenue, and which costs are fixed?
- **product provenance**
 - from where does *Prudento* source its products, and do they comply with technical, health, safety and ethical requirements?
- **supply chains**
 - how long are *Prudento*'s supply chains, how exposed are they to any disruption, and do they have any interlinking nodes?
- **staff/contractors**
 - is *Prudento* aware of any training needs, and how is its reputation being managed?
- **technology**
 - is *Prudento* aware of how robust its technologies are, do they have any built-in redundancies, and could the organization still function without them?
- **vehicles**
 - is *Prudento* aware of any forthcoming emissions controls?
- **knowledge**
 - does *Prudento* have the capability to understand all of these issues?

Secondly, *Prudento* needs to look at any potential threats for each of its possible vulnerabilities and then look at the risk – while remembering that there could also be opportunities, not just downsides.

Thirdly, *Prudento* needs to be aware that it may need some help to assess its vulnerabilities – does it have sufficient resources to do so, or (if not) could it link with other organizations (e.g. through a chamber of commerce or trade association). With information on its vulnerabilities, threats and some idea of its relative risk, it is then time for the organization to begin to build some resilience in a systematic manner. By providing a framework for how to assess an organization's key vulnerabilities and multiple threats, as well as how to facilitate a rational consideration of its choices, BS 8631 shows us the way.

Given all the uncertainty there is on what future climate change(s) might mean for *Prudento*, BS 8631 provides an effective approach that allows the organization to plan for how to respond to climate change and its associated uncertainties. Its approach allows sequences of potential actions to be considered, which can be implemented as conditions evolve in response to climate change risks and opportunities. The standard's approach also adopts multiple pathways that reflect a range of adaptation options, including how they can be sequenced over time and how they might be navigated or implemented as the future unfolds and becomes clearer.

If we already have a business planning process, then BS 8631 shows us how resilience planning can be applied within the broader processes of existing planning or any similar strategic planning that an organization might already be using.

Investing in our organization does not have to mean additional cost. It is more about readiness and being prepared for foreseeable possibilities in an uncertain future. It is then about being able to deal with those possibilities, allowing the organizational operational functionality to bounce back. This is resilience.

By applying BS 8632, *Prudento* has started to run.

By applying BS 8632, Prudento has started to run.



2.3 Making a Decision

The fundamental premise of decision-making is that there are several choices to be made, involving trade-offs between short-term and long-term goals and values.² An adaptation pathway involves identifying and making choices that are meaningful, and avoiding what is called maladaptation – this is making a choice that leads to a failure to adjust adequately or appropriately to a situation.

BS 8632 sets out a nine-step process for developing and applying such a pathway. It includes guidance on each step, decision-making within the steps and continual learning across the approach. Clause 4 of the standard establishes that 'the level of detail involved in developing and applying adaptation pathways should be proportionate to the anticipated significance of climate change risks and opportunities'. Further, it adds:

The decision lifetime should be considered. Reversing or revising a decision on taking adaptation actions can be difficult and costly. The organization should continually review, respond and adapt to new conditions, information, methods and solutions as they emerge, including its commitment and capacity to deliver. The organization should use continuous improvement and adaptive management processes.

This means 'iteratively planning, implementing and modifying strategies for managing resources in the face of uncertainty and change' (see Subclause 3.3).

2.3.1 The nine steps

1 2.3.1.1 Step 1: Planning

Planning involves scoping and setting objectives, timescales, resources and information sources needed, and establishing who is involved and who makes decisions.

Prudento has joined a study group at its local chamber of commerce, where it can pool resources and data and also gain publicity for establishing a focus group of its customers. At this step, current and future risk and opportunity should be identified with the input of customers and suppliers, informed (where necessary) by internal analysis or additional expert input. *Prudento* is being careful to document the results of this step, noting any constraints (such as regulatory requirements) or lack of resources or data on which it may need to follow-up.

2 2.3.1.2 Step 2: Understand the risks and opportunities from current climate

In this step, which is a technical one:

the organization should carry out a baseline assessment of current levels of risk and opportunity [...] associated with current climatic conditions and extreme weather events. [...] The organization should identify opportunities arising from current climate impacts, including those as a result of taking action. Where opportunities for action have been identified, the organization should evaluate and record any trade-offs with other sustainability priorities.³

Prudento is fortunate in that one of its activities is to advise government on a range of security issues, including weather, so while it carried out surveys looking at its infrastructure, utilities, customer preferences and behaviour, there was also an opportunity to provide services in kind to members of its chamber of commerce.



² In this context, short term means fewer than 10 years and long term means more than 20 years.

³ See Subclause 5.2.

3 2.3.1.3 Step 3: Understand risks and opportunities from a range of future climate change scenarios, including the highest climate scenarios

As there is so much uncertainty associated with what ‘future climate’ means, be it a description of the world in 10, 50 or even more years’ time, the term ‘scenario’ is used. In essence this is a description of a specific set of circumstances of possible climate change, around which there is a certain amount of uncertainty. It is basically a set of assumptions, which are being updated regularly by both UK and international authorities (see Resources).

The organization should identify and prioritize risks and opportunities associated with a range of different projections of future climate change scenarios and their uncertainties. [...] Using appropriate sources [...], the organization should assess the exposure and vulnerability of [its activities] to potential changes in climate impacts and extreme weather conditions during the planning horizon across a range of climate change scenarios.⁴

It is recommended that organizations should check the latest Intergovernmental Panel on Climate Change (IPCC) reports (see Resources), identify sources of uncertainty and factor these into their planning. There is considerable guidance in BS 8631 on what to look for.

Prudento accessed various resources and consulted experts to assist (not only its own organization but also those of the other members of its chamber of commerce) in calculating potential future climate scenarios that could impact on itself and its co-members. By the end of the process, *Prudento* and its co-members had sufficient understanding of the degree to which future change in climate and weather extremes might cause thresholds to be crossed in terms of impact(s) on their organizations’ activities. Not only that, but there was also some idea of which conditions would indicate that those thresholds were being approached. All of this was carefully documented throughout.

4 2.3.1.4 Step 4: Consider adaptation options for different levels of risks and opportunities, and their thresholds

The organization should now be able to identify potential adaptation actions for each of its identified climate change scenarios. This should be documented along with all supporting information, so that when engagement and consultation is undertaken with staff, suppliers and customers, it is clear to all stakeholders exactly how these options were identified, together with any associated levels of uncertainty. The next action is to prioritize and possibly exclude some of the identified adaptation actions if, for instance, there were any unacceptable trade-offs. This is the point of the stakeholder engagement – to review from a range of perspectives.

Prudento began to consider divesting its alarms division after identifying that it was at risk from a) its long supply chain (which originated in south-east Asia), and b) from the fact that its fossil-fuelled service vans were clearly going to be increasingly regulated on their emissions until they would have to be retired or replaced with electric vehicles. In addition to its financial considerations (financial resilience of the company must, of course, be a consideration), the organization considered that its advisory division would be inherently more resilient than its product-based activity, and that focussing on services could be more nimble as events related to future climate change unfolded.

5 2.3.1.5 Step 5: Identify and evaluate the implications of interdependencies with other drivers

The organization should identify how other drivers could influence its thresholds and how they might affect the selection and implementation of its adaptation actions. For instance, some drivers ‘might cause thresholds to be crossed much earlier or more rapidly [...], for example a rapid growth in the demand for water (due to economic expansion) or a sudden reduction in water availability (due to regulatory change)’ (see Subclause 5.5).

Prudento began to consider the following various drivers:

- **socio-economic** (e.g. customer demographics)
- **economic** (e.g. tax incentives)
- **environmental** (e.g. potential ground contamination from its service vans)
- **political** (e.g. global political change affecting supply chains)
- **utility dependence** (e.g. issues with power and communications)
- **technological** (e.g. products becoming outdated)
- **government regulation** (e.g. increasing emission reductions)

It then began to update its step 4 findings to consider these interdependencies with other drivers and re-evaluated them as necessary.

⁴ See Subclause 5.3.

6 2.3.1.6 Step 6: Assemble a route map of adaptation pathways

Subclause 5.6 of BS 8632 notes:

Using information from steps 4 and 5 the organization should assemble sequences of adaptation actions in the form of a route map of potential adaptation pathways that address the identified risks and opportunities associated with climate change over the course of the chosen planning horizon. Automated pathways can be created by first drawing a decision tree in which each action is a branch and where each implementation point is a node that indicates a threshold is being approached and that an adaptation decision needs to be taken.

The organization should identify what actions are feasible and desirable at each decision-making point. [...] Sequences of adaptation actions within the route map can then be identified. Commonly, each action within an automated pathway will be effective for a range of climate conditions. This can be shown by a line, representing the activity, that starts at the decision point (i.e. the threshold where climate conditions require the action to be introduced) and ends at the next threshold where the limit of the action's effectiveness is reached.

An automated pathway route map should indicate, using a node, the limit of each action's effectiveness. At each node alternative follow-on actions that could be taken are shown as linked to the preceding action. Where the adaptation action relates to, for example, infrastructure development, the follow-on action might be that the infrastructure would stay in place and be added to. Where the adaptation action relates to policy or services, the activity might be expected to stop and be replaced by another adaptation action.

In some cases, it might be found that incremental change is no longer an option, e.g. infrastructure needs to be re-positioned or a service needs to be closed because it is no longer viable and re-positioning is economically unfeasible. Adaptation pathways planning enables these thresholds to be spotted far in advance, so that strategic implications can be considered in good time, and those implications can thus be mitigated, or costs saved. The standard continues:

Reviews of this sort need to be built into the monitoring framework developed in step 9. [...] Once the route map has been developed, it can be useful to review the climate change scenarios being considered and identify when the different thresholds for starting or stopping action are likely to occur under the different climate change scenarios being considered. If a particular scenario is being used for planning, the adaptation plans could be made for implementing actions when thresholds are reached under that scenario. Adaptation plans should also be open to change if the monitoring system identifies that climate change is unfolding with a different scenario than the one being used for planning.

Prudento used the decision tree approach and mapped out the risk represented by the long supply chain for its products.

7 2.3.1.7 Step 7: Evaluate and choose adaptation pathways

Subclause 5.7 of the standard notes:

The organization should assess the economic, social, environmental, political and other relevant costs, benefits and attributes of each adaptation pathway developed in [step 6]. In carrying out this assessment, the organization can aggregate the attributes of the series of individual adaptation actions that make up a pathway, seeking to identify those pathways that embody the most flexible and robust adaptation actions.

The evaluation can apply one or more decision-making approaches such as cost-benefit analysis, multi-criteria analysis and/or robust decision-making, as required. Analysis should be carried out against individual climate change scenarios, using an adaptation timescale in line with each scenario. Sensitivity analysis against more severe climate change scenarios should be carried out, evaluated and documented.

When assessing its vulnerability to supply chain failure, *Prudento* also ensured it:

- used an appropriate methodology for evaluation
- allowed for the required effort to assess pathway options
- provided opportunities for meaningful participation
- considered climate modelling, where suitable
- undertook a cost-benefit analysis
- undertook social and environmental impact assessments



8 2.3.1.8 Step 8: Report preferred adaptation pathways

Subclause 5.8 of the standard establishes that the organization's next step is to write down all the key outputs from steps 1 to 7 and set out the processes and analyses that were followed. Further, it notes:

[The report] should explain the climate data and key assumptions on which analyses were based, how these were used in estimating climate impacts, how the implications of uncertainty were dealt with, and how the results of the analyses led to the choice of pathways included in the adaptation plan.

Prudento decided to present as much information as possible using infographics (some with interaction), so if a reader wished to see the effect of different climate change scenarios they could make various choices to see how each one affected the selected adaptation pathway. An important point to remember is that adaptation pathway decision-making is still in its early development, and there will be a continual need not only to remain current with climate predictions but also to be aware of local government practice and requirements, social moods for change and the general response to requirements for resilience.

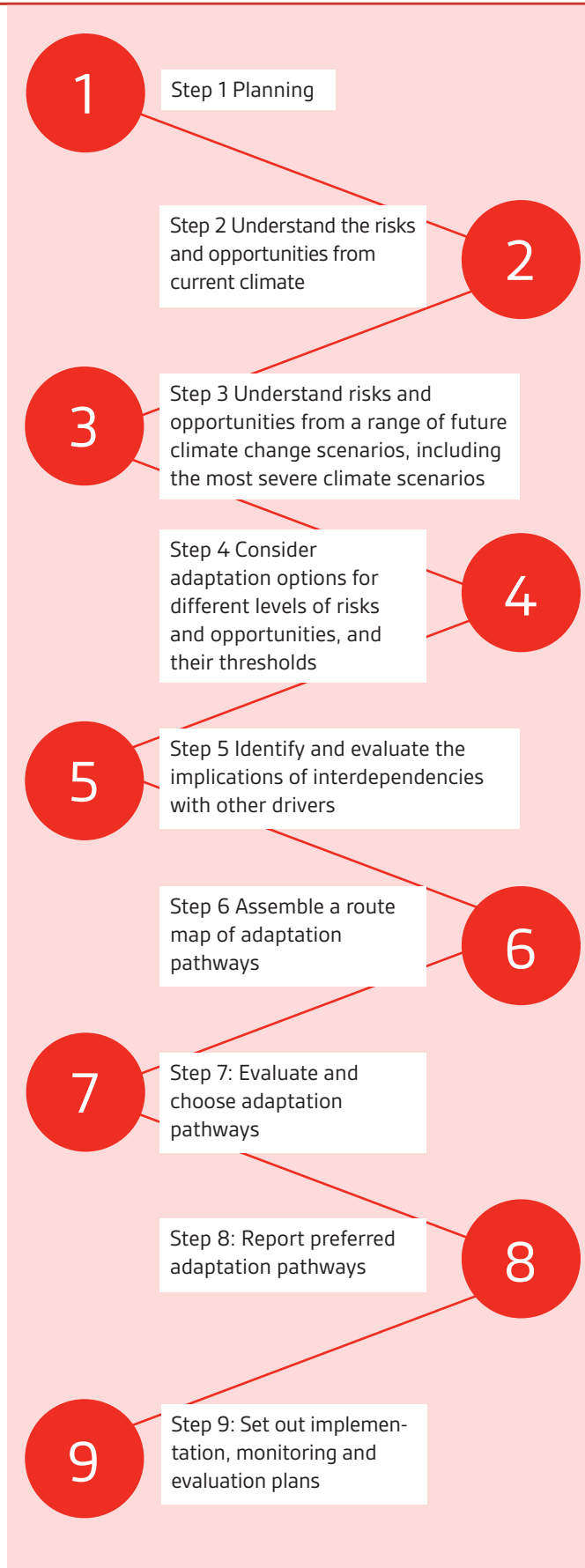
9 2.3.1.9 Step 9: Set out implementation, monitoring and evaluation plans

The standard's final step is to lay out a plan based on the output of the adaptation pathways report. The organization should formalize a structure with clearly defined roles and responsibilities. Subclause 5.9 notes:

The organization should ensure it can learn from experience to improve over time, embedding knowledge and learning in the implementation of its plan. The organization should create an implementation, monitoring and evaluation plan[, which needs to be reviewed regularly], for example every three to five years for a minor review and every 10 years for a major review (noting that other drivers such as significant new data might result in a review between fixed reviews).

Prudento is aware that this is just the beginning and that it needs to put mechanisms in place to monitor the implementation of its plan. It also recognizes that it needs to keep up-to-date with any new information that might require its plan to be revised. *Prudento* has made arrangements with various providers to monitor actual or predicted changes in the key climate parameters it has identified are critical to the organization.

Prudento is up and running.



3 Suggested Next Steps for organizations

1. Wake up and start running
2. Review the currently available information (see Resources)
3. Consult additional sources of information (see Further Reading)
4. Talk to your chamber of commerce, trade association or professional body
5. Obtain a copy of BS 8631
6. Discuss the standard internally within your organization
7. Talk to your key suppliers
8. Talk to your key customers
9. Consider all the implications of your organization's current vulnerability and potential resilience, and make the decision to proceed with future-proofing it

4 Resources

The basics of climate change:

<https://royalsociety.org/topics-policy/projects/climate-change-evidence-causes/basics-of-climate-change>

UK Climate Projections (UKCP)

<https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/index>

The Intergovernmental Panel on Climate Change

<https://www.ipcc.ch>

Centre for Climate and Environmental Protection

<https://www.cranfield.ac.uk/centres/centre-for-climate-and-environmental-protection>

Grantham Institute – Climate Change and the Environment

<https://www.imperial.ac.uk/grantham>

Further Reading

BS ISO 14033:2019 *Environmental management – Quantitative environmental information – Guidelines and examples*

BS EN ISO 14090:2019 *Adaptation to climate change – Principles, requirements and guidelines*

BS 8631:2021 *Adaptation to climate change – Using adaptation pathways for decision making – Guide*

Chapman, A, Tompkins, E L, Vincent, K, Day, S (2016) *A framework for the design and evaluation of adaptation pathways in large river deltas*. DECCMA Working Paper, Deltas, Vulnerability and Climate Change: Migration and Adaptation, IDRC Project Number 107642

Pagett, R (2018) *Building Global Resilience in the Aftermath of Sustainable Development: Planet, People and Politics*, Palgrave Studies in Environmental Policy and Regulation, Palgrave Macmillan, Springer Nature, Cham, Switzerland

Werners, S E, Wise, R M, Butler, J R A, Totin, E, Vincent, K (2021) 'Adaptation Pathways: A review of approaches and a learning framework', in *Environmental Science & Policy* Volume 116, pp266–275

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Technical reviewers

Nigel Carter, retired Chartered Environmentalist and former Chair of SES/1/7, Greenhouse gas management and related activities

Tim Reeder, Senior Consultant, Technical Advisor Climate Sense

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