

acatech

HORIZONS

Safety & Security



What do safety and security mean?

Where do safety and security play a role?

International cooperation for a safe and secure world

What needs to happen now?

acatech HORIZONS support the public debate on how we can apply and shape new technologies. Each issue is dedicated to a technology field that is economically relevant, opens up new horizons and enables societal change. acatech HORIZONS examine these technology fields in a sound and illustrative manner. On the basis of current research, they explain the facts, social, economic and political aspects, as well as options for the future.

acatech **HORIZONS**

Safety & Security





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Seven key messages

- 1.** Safety and security are **basic human needs** and generally mean a state in which we are protected from danger or harm. These needs come into play in many areas of life and range from burglary protection and running water in the home, to the safety of equipment at work, to protection against natural disasters and defence against military attack.
- 2.** Safety and security also have **personal and emotional aspects**. Everyone defines them somewhat differently and sets different priorities. The perception of safety and risk is thus subjective: how safe we feel and how much risk we are prepared to accept depends on the situation and on cultural or individual factors.
- 3.** Nevertheless, there are ways **to classify safety and risk using objective criteria** and make them measurable in order to assist in rational decision-making. Risk assessment, for example, combines the potential extent of possible **damage** and its **probability of occurrence**.
- 4.** No situation in life will ever be **absolutely safe**, there will always be a certain level of **risk which has to be accepted**. If we^a wish to achieve the highest possible level of safety, we will have to make compromises and take measures to mitigate risk. The fact that there is a risk can also be positive: freedom goes hand in hand with uncertainty. Unforeseeable situations and coincidences often have unforeseeable positive outcomes.

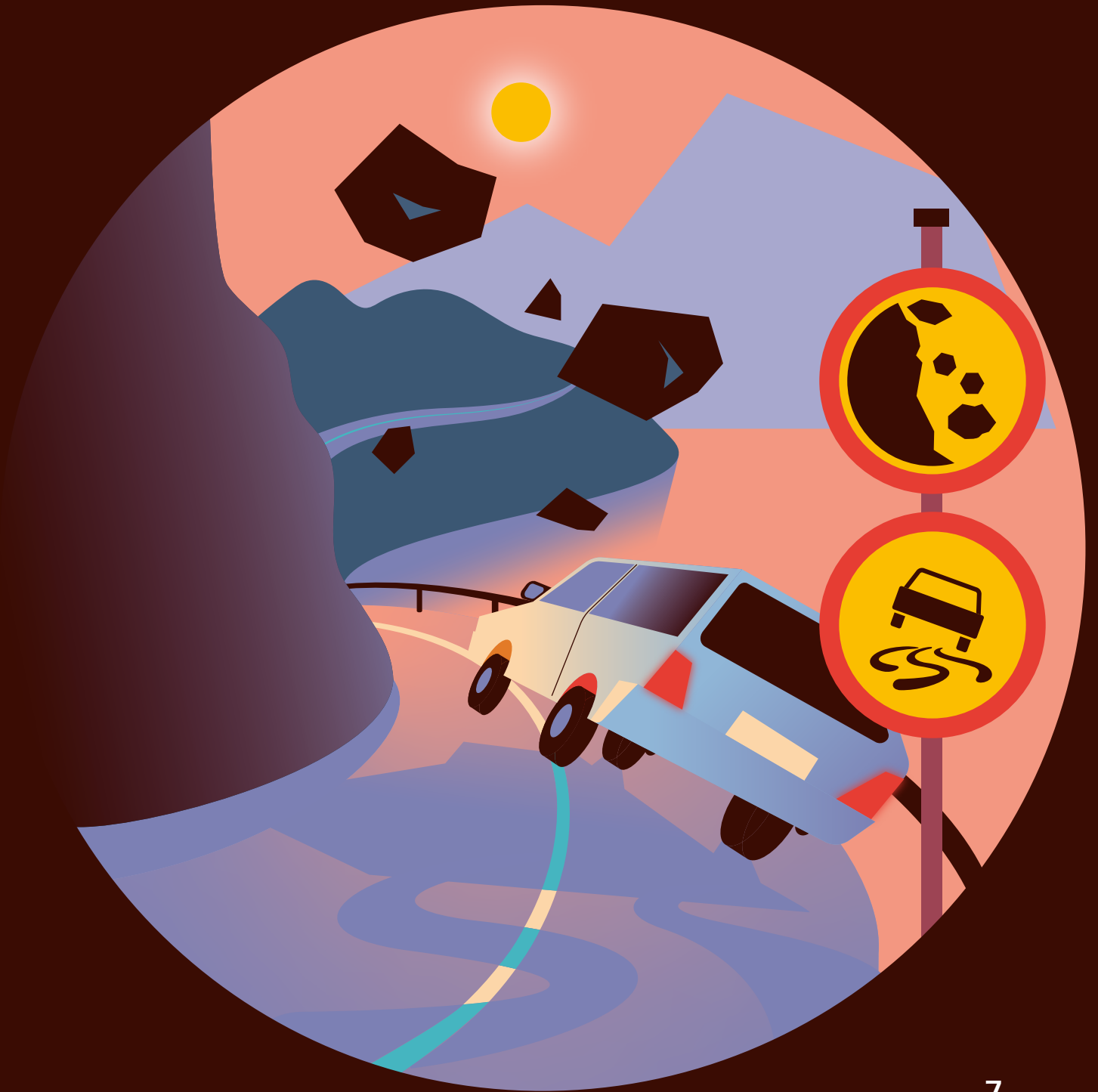
5. Safety is **not a given**, there's **always a price to pay**. It requires effort, the input of material and financial resources, and time. Values and different dimensions of human well-being must be weighed up.
6. Safety is **not static**. It changes over time due to technological developments and innovations or events such as crises or wars. Safety cannot be established solely by short-term responses to acute crises, but also requires **sustained, strategic action planned for the long term** and this applies at a political, corporate and individual level.
7. Safety is a shared task, it concerns **every single one of us**. Accordingly, all stakeholders bear **responsibility**: policy makers, society, academia and business. However, individual caution and a willingness to take responsibility are also required. The more rationally and sensibly we deal with risk, the better our decisions tend to be.

a Who is meant by "we"? For ease of understanding, this issue of HORIZONS makes frequent use of phrases including "we", such as "we have to get going" or "we are at the technological forefront". This is also common in political discourse and facilitates reading and debate. At the same time, it is possible to have a negative view of such "we" phrases. For instance, they could give the (erroneous) impression that all stakeholders, whether they be policy makers, businesses, societal players, or even nation states, might be willing to pull in the same direction when it comes to overcoming global challenges. The realities of a decentralised market economy mean that corporations have their own economic interests and do not necessarily act in the interest of the common good. At global level too, nation states have their own vested interests. Using "we" might lead to an idealised view of the feasibility of the reform and transformation processes involved, for instance, in the energy transition and climate targets. Of course, acting as "we" in these contexts is highly desirable but doing so requires great effort and will not always meet with success. It is important for us to make this distinction because acatech's goal is to provide policy makers and society with independent, fact-based information on a non-profit basis.

1

What do safety and security mean?

Very few people think about safety and security on a day-to-day basis, but the many crises in recent years have shown that we should not take them for granted. The first section of this issue of HORIZONS outlines the many facets of safety and security and what lies behind them.



We live in turbulent times: from the climate crisis, to the COVID-19 pandemic, to the Russian war of aggression against Ukraine with its sometimes global repercussions – from one crisis to another. Our safety and security, which we have often taken for granted, are becoming less certain. How should we deal with this?

In today's world, characterised as it is by rapid change and many and varied challenges, we might well wonder whether we are still safe at all. This issue of acatech HORIZONS focuses on answering this question. We will clarify the current challenges to our safety and security and consider how to meet them, given that safety and security need to be protected and enhanced. Take a deep dive with us into the world of safety and security and find out not only how it can be defined, protected and reinvented in a changing environment but also what each and every one of us can do to help.

But let's first take a look at **how our experts define safety and security**. Or skip straight on to section 2 if you are more interested in the areas of life where they come into play.

So, what are safety and security?

Safe and sound is a saying you'll have heard before but what does "safe" or "secure" mean? Safety and security are basic **human needs**. We want to be safe, whether at home within our own four walls, at work or when we're getting from A to B. Safety and security can thus be defined as a state in which, as far as possible, we are **protected from danger or harm**.

"Safety and security are not something that can be simply created once and for all. Because we may all have differing needs, we face the constant challenge of boosting safety and security."*

The emphasis is on "as far as possible" – there's no such thing as absolute, one hundred per cent safety. We can never eliminate all risks. The aim is to avert unacceptably high levels of risk and contain them with the help of safety and security measures. What remains is an **acceptable risk** which we have to live with. But what is acceptable? For example, when we drive to work by car, there is a risk of a traffic accident. We can minimise the risk of being injured in a possible accident by driving responsibly, using seat belts and airbags. Any potential damage to the car can be financially covered by car insurance. Nevertheless, there is still a risk of a car accident which we cannot completely avert. That is what constitutes an acceptable risk. What is generally acceptable depends on various factors and everyone assesses this differently.

How are risk and safety related? A **safe situation** is one in which the prevailing risk does not exceed the acceptable risk (*safety: prevailing risk ≤ acceptable risk*).

We have to take steps to ensure safety. For this purpose, we need intangible resources such as time, but also financial resources. So **safety is not a given** and **there's always a price to pay**. A house or flat only becomes secure when we can lock windows and doors and are thus protected against burglary. We can also take out burglary insurance which, although not protecting us from the burglary itself, does help us out financially if our laptop or gold jewellery is stolen. An effective police force also helps to prevent burglary.

* Some selected key ideas expressed by interviewees are included in the text as anonymised quotes.

"Safety and security cannot be taken for granted, they demand effort and education."

But who is actually responsible for our safety and security? Who makes sure that my workplace is safe, that the brakes on the train work, that my private data is not hacked or that I don't have to worry about being mugged in public spaces? The answer is that we all are! **Safety and security concern us all and we all bear some responsibility for them.** This applies to every individual in private life, companies in the working environment, and government or policy makers. Of course, differing levels of responsibility apply here and this is what we'll look at in the second section.

"Safety and security starts with you."

Our decisions and actions usually affect not only ourselves, but **also others.** One example is wearing face masks during the COVID-19 pandemic, when masks helped to protect oneself and prevent others from becoming infected. This was done in particular to protect the elderly and the sick. This act of solidarity had an impact on my safety and on that of my fellow human beings. The **consequences of our actions** or inaction sometimes only **become apparent much later.** One example is CO₂, which once released into the atmosphere by our consumption of energy, warms the Earth and, in the long term, drives climate change which jeopardises the survival of humanity. We cannot see or feel CO₂ and its effects are not usually apparent until much later. Nevertheless, our current actions and decisions have an impact on our future global security.

So what exactly is cybersecurity?

Cybersecurity protects information on computers or in computer networks from intentional, malicious attacks and external threats which are of human origin. This could be an attack by a hacker on a private computer or on the entire IT system of a public authority or a company in order to obtain sensitive data or cause a malfunction. IT security measures ensure security and privacy in digital space and protect (digital) identity, making them indispensable. You can find out more about cybersecurity in our German acatech publication "HORIZONTE Cyber Security".¹



"Safety and hazard prevention affect each and every one of us in all areas of business and life, so we all bear responsibility for them both."

What are safety and security?

What is "human security"?

Human security is an ideal which extends into every area of life. The United Nations (UN) define it as follows: "... Human security is a child who did not die, a disease that did not spread, a job that was not cut, an ethnic tension that did not explode in violence, a dissident who was not silenced. Human security is not a concern with weapons – it is a concern with human life and dignity."²



How safe do you feel?

The perception of safety is subjective and individual. Here are some examples from a study by BKA, Germany's federal criminal police agency:³

- Women feel much less safe in public at night than men.
- 42 per cent of the population are worried about falling victim to online fraud.
- People of a migrant background are more worried about becoming victims of crime than people of a non-migrant background.



Better safe than sorry, right?

You'll know the feeling – let your imagination run wild and the craziest fears bubble up. What if we get abducted by aliens? Or I'm jilted at the altar? And horror of horrors – your favourite football club gets relegated!

Fun fact: you can actually insure yourself against these eventualities and even against mobile phone dead spots,⁴ which just shows how individual our perceptions of safety are.

How much of a risk-taker are you?

The willingness to take risks is also an individual matter. Do I dare to go on an adventurous journey or should I play it safe? Should I invest my money in shares? Do I spend my leisure time on the couch or climbing mountains?

Fun fact: people evaluate risk differently depending on how the information is presented. For example, we are more cautious when risks are presented in absolute numbers (e.g. one in a hundred people) in comparison with relative numbers (e.g. "1 per cent").⁵



What is safety worth to you?

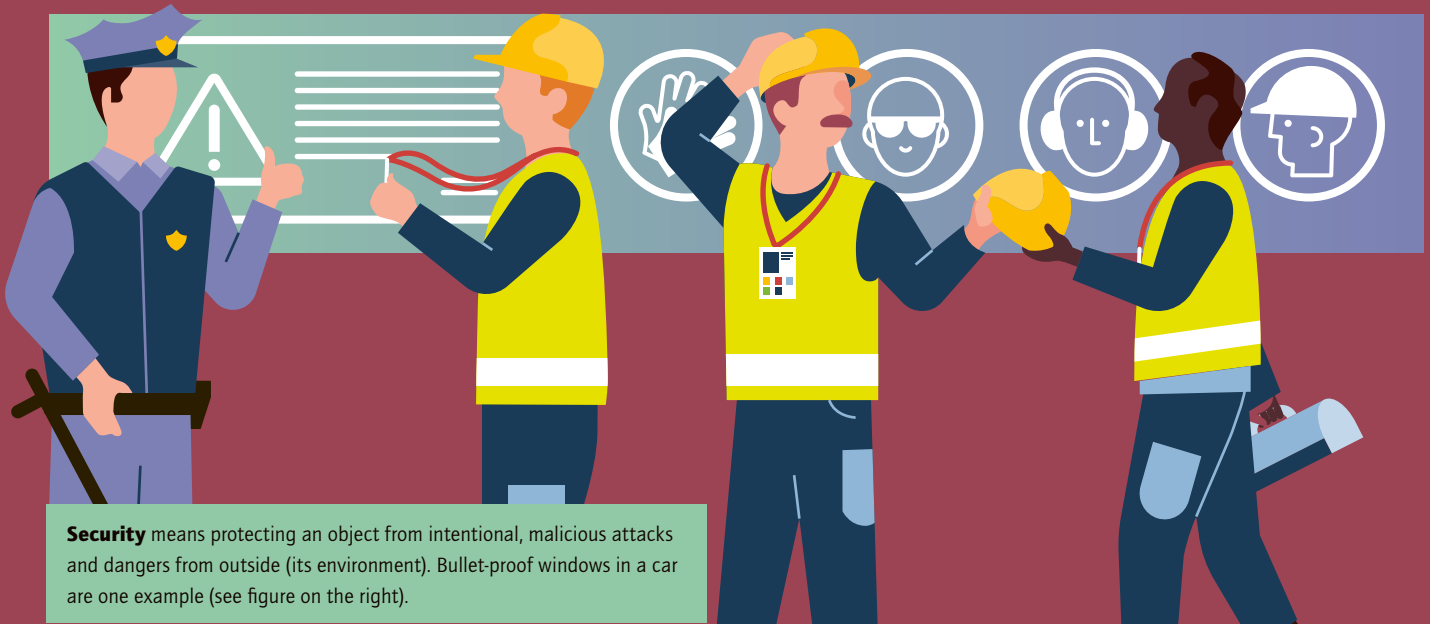
What is a reasonable price for security? This relates to financial expenditure for insurance or healthcare as well as emotional and social factors. People have different ideas about how much personal comfort they would sacrifice to ensure their own or others' safety. This leads to thorny societal debates, such as those around vaccinations and masks during the COVID-19 pandemic.



The many facets of safety and security

Safety and security are complex, multi-layered topics that require many definitions. In order to define them, precise terms and situation-dependent perspectives are needed. The terms **safety** and **security** mean quite different things. The following figures explain the underlying differences.

Safety describes the protection of the environment from an object. The aim is therefore to design, build and maintain devices, machines or buildings (objects) in such a way that they do not endanger people or nature. This may also be known as **operational safety**. For example, a circular saw on a construction site should be technically flawless in order to minimise the risk to users.



Security means protecting an object from intentional, malicious attacks and dangers from outside (its environment). Bullet-proof windows in a car are one example (see figure on the right).



Security and safety can sometimes conflict, as in the case of an **emergency exit** which has to enable a rapid escape from a building in the event of a fire but can pose a security risk by allowing intruders unauthorised access. It is therefore important to **weigh up** what precautions are required to meet both.



What does a head of government's car have to do with safety and security?

Safety and security are an issue when it comes to high-profile politicians travelling to work. Bullet-proof windows, armoured bodywork and bullet-proof tyres provide **security, i.e. protection from external attacks**. At the same time, the clean air system, airbags and automatic fire extinguishers ensure **safety, i.e. protection from hazards in the car**.



Safety - protection from internal hazards:

- Clean air system
- Airbags
- Automatic fire extinguishers

Security - protection from external hazards:

- Bullet-proof windows
- Armoured bodywork
- Bullet-proof tyres

It's all a matter of perspective

As you may already have noticed from reading the first few pages, it's less than easy to provide a simple definition of safety and security. They're not copper-bottomed, are not a given and there's always a price to pay. We have to accept risk and are all responsible for it – sounds kind of complicated, doesn't it?

At the same time, perceptions of safety and risk assessment in the private sphere vary between individuals. What does a person need to feel safe and secure? How much risk are they willing to take? In many areas, that's an individual decision. Skydiving, daredevil climbing tours and deep-sea diving are not for everyone! Many people are tormented by a fear of flying, but the likelihood of being involved in a car accident is much higher. Perceptions of safety and risk also have to do with fear. We do not always evaluate safety and risk entirely rationally, but often emotionally and subjectively.

"It's not possible to provide a general definition of safety, it would take too many words."

Cultural differences also shape how we deal with risk and how much risk we are willing to accept. The concept of "German Angst" is familiar to many around the world, the Germans having a, not entirely undeserved, reputation for being more cautious about safety and security than other countries or cultures. The desire to create security and protection for oneself and one's family clearly has deep roots in German culture, as is apparent from the widespread use of **insurance**. Insurance policies create a sense of security and cover risks which cannot be prevented by other measures alone. In any event, our upbringing, nationality, cultural circumstances and many other factors have a major influence on what we need in order to feel safe. This also has an impact on how much risk we are willing to accept on our journey through life.

"The dangerous thing about risk is not the risk itself, but how you deal with it."

Safety and security thus always have to be set against other factors. What other values are important to me apart from safety and security? For instance, what does **freedom** mean to me? One example is the debate around government surveillance in the name of domestic security, especially in the fight against terrorism. On the one hand, there is demand for greater security and defence against terrorist threats. This can entail governments intercepting and monitoring chats and phone calls from suspect citizens in order to prevent potential attacks. On the other hand, such measures infringe freedom and privacy.

Or am I willing to sacrifice **convenience** to enhance my security? This is something which often applies in digital space. Many people find using the same password and a simple login more convenient and quicker. However, different passwords and additional security measures such as two-factor authentication make a significant contribution to protecting sensitive data such as account access details. I also have to weigh up how many **resources** and how much **money** I'm willing to spend on security. IT security measures or military hardware are important to the security of a company or a government, but they do cost money. The challenge is to find an appropriate balance between different societal goals and necessary measures.

"Communication can alleviate fears and create an understanding of measures or any residual risks."

However, a lack of security and omnipresent risk are not synonymous with danger. Risk is not solely negative, it can also be an opportunity. There's a reason why they say: "no risk, no fun!". Risk can lead to something unexpectedly good if we take the plunge. Investing in the development of an advanced new technology can be risky because it is not

yet clear whether it will be a success. On the other hand, innovation and progress may be the outcome. Freedom may bring uncertainty, but it also always brings opportunities. Don't be afraid to take risks should be the motto.

This also applies to policy makers: **political risk-taking and courage are important** for driving innovation and progress in society, solving complex problems, adapting to a changing world and promoting societal change. However, political risk-taking does not mean making rash or impulsive decisions. Instead, political risk-taking is based on sound analysis, good judgement and careful consideration of risks and opportunities to ensure responsible decisions.

Risk assessment: how can risk be measured?

The precise meaning of safety depends on the context and who's doing the talking. For instance, a civil engineer will define safety on the basis of a clear formula, whereas a social scientist will discuss it in terms of its cultural context.

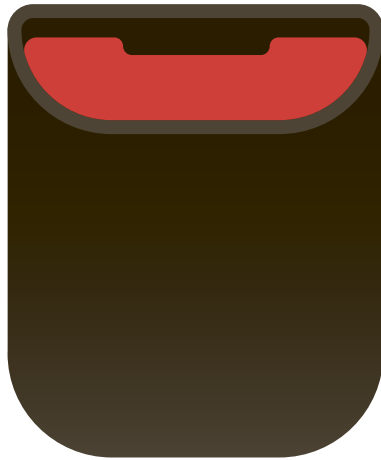
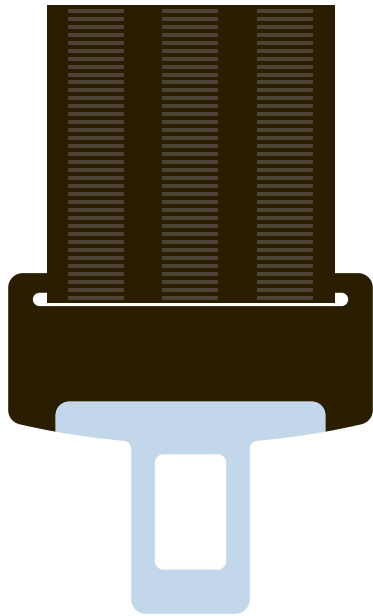
In a professional context, however, it is important to define and assess risk and safety to allow safety measures to be devised. A **risk assessment** is one possible way of evaluating and classifying risk. Not only corporations and government but also private households, for example, want to be able to assess the risk of an accident or natural disaster in order to take measures to prevent the worst from happening.

A **risk assessment** is a method that evaluates the prevailing risk in terms of two factors: the **probability of occurrence** and the resultant **harm or damage**. Risk is therefore related to the probability of, for example, an accident occurring and the potential harm or damage which would be associated with it. What is known as a "**risk matrix**" is often used to classify the risk for different scenarios. Depending on how high the probability of occurrence and how severe the potential harm or damage are, the risk is either low (green zone), moderate (orange) or high (red zone). Take a look at our risk matrix [graphic](#) below.

Some risks can be approximated quite well using computer models and data from past events. The probability of an incident occurring in the future is accordingly often determined on the basis of past experience, but this only works if the circumstances in which the previous incidents occurred are very similar to future circumstances. Other risks, on the other hand, are **not easy to estimate or even measure**, such as chain reactions in environmental disasters. An earthquake can trigger a tsunami, flooding can lead to environmental destruction and power cuts, and so on. In this case, it is difficult to simply derive the probability of occurrence and thus the risk using data and models. There are also always unknown risks where there is no past experience.

It's important to remember that, as always with scientific, in this case statistical, procedures, the values determined are only ever an approximation, which may sometimes be very precise but are often only a rough estimate. But even a rough estimate can help in dealing with risks. A rough idea is certainly better than absolutely no idea of the extent of a risk. However, people and societies repeatedly find themselves in precisely this situation when they enter new technological territory, for example, or when natural disasters or historical changes occur which were not foreseeable - primarily because they have no precedents in the past. Science can help to ensure that such situations occur less frequently, but it cannot prevent them completely.

Assessing risks often involves processing large volumes of data and dealing with complex interrelationships. **Artificial intelligence (AI)** applications are increasingly helpful here. However, even the use of AI will not always make all risks predictable and calculable. New problems are also arising because, despite all efforts to uphold ethical standards through regulation or laws, AI can also be misused to pursue individual interests. AI systems can even unintentionally lead to discriminatory decisions, for example by disadvantaging women or ethnic minorities in the area of human resources. AI systems are thus helpful, but not a panacea.



In the field of cybersecurity, it is difficult to quantify the probability of **hacking** because such attacks are carried out by technically skilled individuals or groups using unknown, complex methods. The potential level of harm can also vary from person to person and is difficult to measure. How much harm is caused by the loss of hacked personal data? How can the resulting fears and loss of trust be quantified?

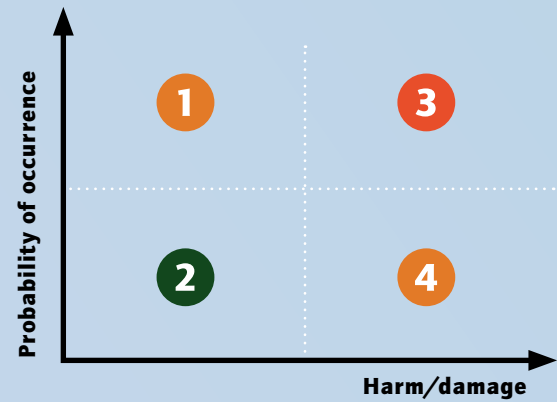
If you would like to find out more about quantifying risks, take a look at the German acatech publication "Beiträge zu einer Systemtheorie Sicherheit".⁶ The publication provides detailed and clear insights from leading experts into various models for describing security and risk.





How can we assess risk?

For example using a **risk matrix**. Using this method, we can classify and visualise risks in terms of their probability of occurrence and their impact (harm or damage). Companies, insurers or policy makers apply this method to classify and quantify risks.



1

Traffic jam on the way to work

**Probability high,
harm/damage low → risk moderate**

Traffic jams are an everyday event in many urban areas. Given a lot of patience and a good audio book, the chances are that no great harm will occur.

Slipping on a banana skin

**Probability low, harm/damage low
→ risk low**

Although such accidents sound comical, they normally only lead to minor, if any, injury and are pretty rare.

2

Online identify theft

**Probability high, harm/damage high
→ risk high**

If someone falls victim to online identity theft, it can have significant financial and personal consequences, which is why protecting personal data in cyberspace is extremely important.

3

4

Meteorite impact

**Probability low, harm/damage high
→ risk moderate**

The Earth's atmosphere and the nature of space mean that meteorite impact is very improbable. If a large meteorite were to reach the Earth's surface, the safety of our planet would be significantly jeopardised. This is why it is important to research and monitor celestial bodies.

2

Where do safety and security play a role?

Whether in road traffic, in digital space or indeed in foreign policy, safety and security extend over many areas of society's life. Safety and security are also important at the private, public and international levels, so it's easy to lose track. This is why the second section of this issue of HORIZONS presents areas in which safety and security play a central role.



Safety and security in all areas of life

At home (section 2.1)

When do we feel safe and secure within our own four walls? Who makes sure we have access to electricity, water and food?



Locally (section 2.2)

What dangers await us when we leave home, for example on the street, in traffic or even at work? How are safety and security ensured here?



An illustration of a landscape with wind turbines, a road, and a city skyline. The scene is set against a blue sky with a yellow sun and a white cloud. The ground is yellow and green, with a winding road and a bridge. In the foreground, there is a colorful, pixelated city skyline. The overall style is modern and abstract.

Nationally (section 2.3)

What do **public safety and security**, i.e. safety and security within a country, mean? What is the response in the event of a crisis or disaster, how is economic security ensured or digital disinformation handled?

An illustration of a man and a woman in business attire standing in front of flags. The man is wearing a blue suit and a red tie, and the woman is wearing a red blazer and a red skirt. They are standing on a green field. In the background, there are two flags: the flag of Argentina and the flag of Italy. The overall style is modern and abstract.

Internationally (section 2.4)

What does **external security** mean and what is the current geopolitical situation worldwide? What role does the military play in this and what digital dangers are there?

An illustration of a man and a woman in business attire standing in front of a city skyline. The man is wearing a blue suit and a red tie, and the woman is wearing a red blazer and a red skirt. They are standing on a green field. In the background, there is a colorful, pixelated city skyline. The overall style is modern and abstract.

Digitally

Why is cybersecurity essential at home, in urban or rural areas, within our own country and worldwide? What dangers are lurking in the digital world and how can we best tackle them?

Safety and security affect many areas of life. Let's take a look at these different areas from the everyday perspective of citizens. Safety and security affect us not only within our own four walls and outdoors in urban or rural settings when we are out and about, but also within our national borders (domestic security) and even internationally (external security). What's necessary to ensure a safe country like Germany, who takes care of it and how do they do it? At the **global level**, the question of international security arises. What does a secure Europe look like, what role does security play in the geopolitical context and what are the current challenges? We also want to be safe when we're out and about in digital space: **cybersecurity** measures play a role in all of these areas in the digital context, which is why we've given some examples in each section.

These **various areas of safety and security are closely interlinked** and cannot be completely divorced from one another. If war threatens a country's external security, it can also have an impact on security of supply, i.e. the provision of energy and food, as Russia's war of aggression against Ukraine has amply demonstrated.

Ultimately, the question arises as to who is responsible for safety and security in which area and what can I contribute as an individual? Levels of responsibility often differ between governments, companies or individuals. I can also make **a personal contribution to our common security**. I can comply with security regulations or report suspicious activities. I can also demonstrate sensible safety behaviour in everyday life or at work.

2.1 At home

We feel safe at home, within our own four walls. We have a roof over our heads, are protected from the wind and weather, can make ourselves something to eat, turn up the heating in winter and shower for as long as we want. We can take it all for granted, can't we? But who makes sure that everything runs smoothly? What's required for a secure supply of energy, water and food? And where do we as private individuals bear some responsibility?

Operational safety also plays a role in our homes. Our everyday appliances, kitchen mixers, hairdryers and ladders, are tested and have to comply with standards. Household safety technologies are constantly being developed and improved. In the past, technicians regularly serviced lifts, but this only provided a snapshot of the safety status. Today, "predictive monitoring" is often carried out with smart sensors which continuously detect significant anomalies, so enabling countermeasures to be taken in good time. At the same time, new technologies can also give rise to new risks, such as applications of AI algorithms. This in turn requires new security technologies and measures, as well as an informed and sensible approach. In this case, the responsibility for safety lies with the manufacturers and with end users.

"Safety and security are basic human needs."

From farm to fork: challenges and pathways to a sustainable food supply

For us in the Global North, we can almost take it for granted that every day there will be a profusion of food available in the supermarket, at the weekly market or online. Water also just seems to be infinitely available, you just have to turn on the tap. Whatever we choose to eat, one thing is certain, our water and food system is part of a complex and critical infrastructure involving numerous stakeholders, resources and activities.

However, this complex interplay can be **disrupted at any time by external intervention**. We are now becoming increasingly aware of this, just think of the global shortages during the COVID-19 pandemic or since the Russian war of aggression in Ukraine. For many people, especially the younger generations, this situation has probably been the first time that not all food and household items have been immediately, permanently available. Flour and sunflower oil were in short

supply at times; they were either no longer available on supermarket shelves or only at higher prices. For the first time, it became clear that security of food supply is not unshakeable and can be left reeling by crises and wars.

The Federal Office of Civil Protection and Disaster Assistance's recommendation to stock up on **emergency supplies of food and water** at home is not new, but has increasingly become the focus of public attention over the course of the crises of recent years. For many people, it was also the first time that they had heard of Germany's "**civil emergency reserve**" and **federal grain reserve** intended for securing basic supplies. Some 800,000 tonnes of food are stored for emergencies in over 100 secret locations throughout Germany.⁷ The intention is to maintain security of supply even in the event of short-term bottlenecks lasting a number of weeks.

So how do food and water safety and security come about? What challenges need to be overcome? How can we make our food supply sustainable and secure? **Food security** relates to the supply of food. What needs to be ensured is that everyone has enough safe and nutritious food. Access to clean water is another facet.

Food safety relates to the safety and quality of the food itself. Foods are safe if they have undergone and passed statistical test plans before they end up on our plates. For instance, random samples are tested to determine whether they contain bacteria that could lead to illness when consumed (e.g. testing of raw poultry). Monitoring foodstuffs for bacteria, viruses or toxins is particularly important as these (e.g. noroviruses or salmonella) are the most common causes of food-borne illnesses.⁸ But the chain doesn't end at the supermarket: sensible decisions regarding storage and preparation at home minimise the risk of food-borne illnesses. Following good hygiene practices and observing expiry dates are crucial to ensuring the health of your household. The last metre is therefore the responsibility of the individual.

At present, a number of **challenges**, such as climate change in particular, are jeopardising our food safety and security: **rising temperatures**, extreme weather events and either too little or too much water due to droughts or floods are causing problems for **agriculture**. In southern Spain, where very large amounts of Europe's vegetables are grown, temperatures topped 30°C as early as spring 2023, resulting in parched soil and water shortages. The **food industry** consumes huge volumes of water and a great deal of energy, so contributing massively to climate change, with food manufacturing accounting for roughly one **third of global greenhouse gas emissions**.⁹ In addition, food is transported all over the world, so it is directly affected by political conflict.

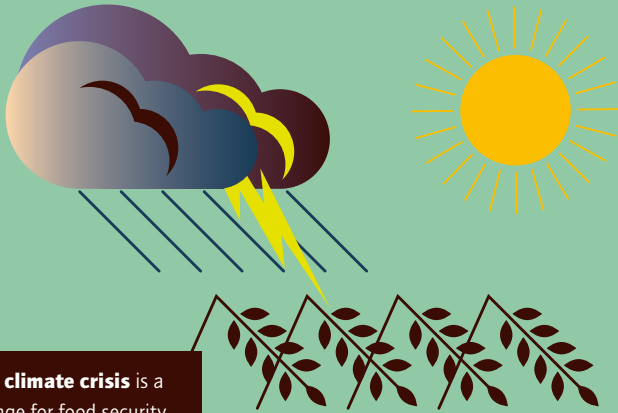
The food sector faces a long list of challenges. What is needed is a **resilient, sustainable and future-proof food system** that produces enough healthy food for an ever-growing population without harming nature. Achieving this means making agriculture ecologically sustainable and wasting less food. These are just some examples from a series of necessary measures. The EU Commission's "Farm to Fork" strategy, for example, envisages cultivation methods using fewer pesticides and more land for organic farming.¹⁰

However, our consumption and purchasing decisions also have a part to play. In the long term, buying regional and seasonal products or choosing plant-based foods instead of meat more often will have a positive impact on the environment and climate. In this way, every individual can take small steps to contribute to food security. Take a look at the following **graphic**.

"Security of supply goes hand in hand with minimising waste and the principle of sufficiency. Implementing sufficiency does not mean sacrifice or shortage, but rather anticipation, planning and cooperation."

How secure is our food supply?

Food security means that everyone has access to enough food to lead a healthy life. However, our food system^b is facing a number of challenges, which we'll take a look at here.



2. The climate crisis is a challenge for food security because it's leading to **extreme weather events and crop losses**. This can make food prices fluctuate, which is particularly problematic for low-income groups of the population.

3. Increasing water scarcity is an additional threat as it affects agricultural production and access to clean drinking water.



1. The world's population is growing continuously, so the demand for food is also constantly rising.



4. Diseases in crops (and livestock): monocultures in which just one plant species is cultivated are particularly susceptible to disease. "Citrus greening", for example, primarily occurs in monocultures and is currently threatening our supply of lemons and oranges.¹¹



5. The **loss of biodiversity** is harmful to the ecological processes which are crucial to food production and supply. One example is the pollination of crops by insects.

6. Another issue is poverty and **social inequality** which can restrict access to sufficient and healthy food. Such **unfair distribution** can be further exacerbated by **political conflict** and trade restrictions.



Various solutions are needed to deal with these challenges. These include the promotion of ecologically sustainable cultivation methods, improved water management, a focus on research and innovation, the use of climate-resistant plants, the education in nutrition and the strengthening of international cooperation.

Our consumer behavior can also make a difference. For example, if we choose regional and seasonal fruit varieties, we reduce our ecological footprint. Consuming **less animal-based food** reduces greenhouse gas emissions and conserves important resources such as water and land. In this way, we contribute to the sustainability of our food system.



How safe is our food?

Food safety relates to the safety of food itself, which should be hygienic and safe for consumption when it ends up on our plates. To achieve this, society, science, business and politics must work together at various levels.



2. Food safety is not just about hygiene but also about **protecting food** from other influences. Researchers are working on **active packaging** that, for example, protects the food from UV light or oxygen. Intelligent packaging uses sensors to indicate how fresh the food is or whether there is a leak in the packaging.

1. Food-borne **illnesses and contamination** are strictly controlled. New bacteria can, for example, emerge in animal husbandry, which makes monitoring and safety measures in food production essential.



3. When handling food, paying attention to **careful production** is also essential. Excessive heat or longer processing times can destroy nutrients such as materials or vitamins. This can also affect the natural taste and texture.

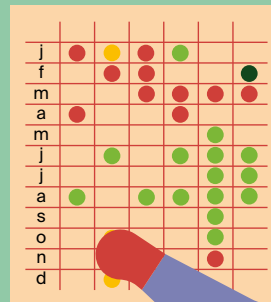




4. Did you know that around eleven million tons of food end up in the bin in Germany every year?¹² Protecting food also means reducing food waste.

5. That is why it is important to **handle food responsibly** at home. The Federal Ministry of Food and Agriculture explains this in the initiative "Too Good For The Bin". There you can find information, for example about the correct storage of food, the sensible use of leftovers or conscious planning of groceries.

6. The **consumption of seasonal and regional food** can counteract food waste. These must travel shorter transportation distances, which automatically reduces the risk of spoilage and loss of quality. Regional fruit and vegetables can be harvested at the optimal time, which usually makes it tastier, fresher and longer lasting.



How secure is our energy system?

We take it for granted that we can charge up our phones, cook a hot meal or turn on the lights at night. We need electricity, i.e. energy, to do these things. Most recently since Russia's war of aggression against Ukraine, it has become clear that the constant availability of energy cannot be taken for granted. Various things have to be in place for our sockets to be able to reliably supply electricity at any time of the day or night.

One starting point for these considerations is the realisation that Germany's energy security is inevitably based on the **import of energy sources**. Up to now, these have mainly been fossil fuels such as oil, coal or natural gas. However, the burning of fossil fuels around the globe has led to the massive climate change that we are currently trying to limit. This why the goal of the **energy transition** is to turn our backs on oil and the like and switch to renewable energy sources such as wind or solar - on the one hand directly by using them here in Germany and on the other by importing green energy sources produced using the wind or sun, such as green hydrogen.

Another problem with our current approach is that importing fossil fuels from other countries has made us dependent on individual countries, as the Russia-Ukraine war has made only too clear. Dependence on Russia as a supplier of natural gas led to bottlenecks and higher prices, especially over the winter of 2022. When it comes to importing green energy sources, we now have an **opportunity to avoid similar dependencies by spreading the risk**, i.e. by deliberately choosing several sources of supply. We have not made life easy for ourselves, because we have set ourselves ambitious targets and also want to achieve everything at the same time, both switching to renewable energies such as solar and wind and no longer being dependent on individual countries (**strategic sovereignty**). In addition, we have phased out nuclear energy.

A second major factor for energy security, i.e. ensuring constant availability of electricity, **is the security of our power grid**, which should be both stable and secure. This requires the coordination of a large number of renewable energy systems, storage facilities and consumers. This can only be achieved by comprehensively digitalising the energy system. Because this kind of control is usually internet-based, the energy system is susceptible to hacking that can shut down systems and so destabilise the power grid. Germany's electricity supply is currently one of the most secure in the world.

Nevertheless, security measures in this area need to be constantly updated in order to be able to respond to disruptive events both old and new (**resilient energy system**).¹³

Would you like to find out more about energy supply issues? If so, have a look at the following acatech publications: "Security, Resilience and Sustainability" (Schmidt and Wörner); "Rethinking and Reshaping Engineering: Challenges, Application Scenarios and New Advanced Systems Engineering Model" (Albers); Hydrogen, acatech HORIZONS; "The Impacts of the War in Ukraine on Energy Prices and Security of Supply in Europe (Discussion Paper)" (ESYS).¹⁴⁻¹⁷

Fun fact: secure space, secure Earth!

Did you know? Space security is closely linked to our security on Earth. If there are problems in space, they can have an impact on our satellites and space stations. These technologies are essential for everyday things such as weather forecasting, communications and navigation on Earth. It must also be ensured that dangerous objects such as space debris or asteroids do not threaten the Earth. Space security therefore not only affects space, but also our daily lives on Earth.

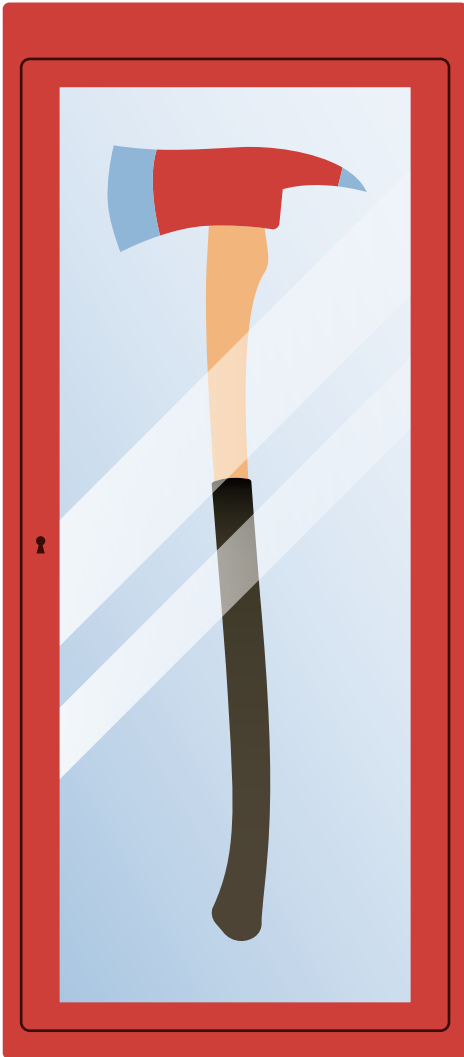
The digital pitfalls of everyday life

Today, every household has many digital electronic devices: smartphones, laptops, PCs and smart TVs. Voice assistants are also becoming increasingly popular. In the home of the future, almost every technical device will be interconnected with all the other devices and with the internet (**smart devices**) - including the washing machine, electricity meter and fridge. This has many advantages and makes everyday life easier. However, when these devices are used, a lot of data is generated which the devices store and pass on. Moreover, digital applications such as online banking or other online services usually require user accounts, which must be protected by passwords, which themselves often include sensitive and personal data. Unfortunately, these data are an easy target for attackers.

"In the digital world, some people walk through cyberspace with the door open and don't even notice."

While new **cybersecurity** technologies can help here, now and in future it is also each individual's responsibility to protect their own data. It is up to us to inform ourselves, develop an awareness of the digital risks and put appropriate measures in place. For example, the choice of individual passwords alone can have a major impact on security on the internet. Therefore, guidelines for creating passwords that are as secure as possible should be followed instead of using names, dates of birth or other personal details. Automatically generated passwords (digital keyring) and 2-factor authentication are simple measures that significantly improve security. Also take a look at the "Smart Home" [graphic](#) in acatech HORIZONS Cyber Security.¹

"Our instincts are not designed for the dangers of a dynamically changing world; they are not enough in the digital world. I don't feel the risk when I'm using an old operating system, but something rustling in the undergrowth sends a shiver down my spine."



2.2 Locally

Of course, we don't just want to be safe at home, but also when we're outside, at work, jogging in the park or consulting the doctor. We leave our home and are out and about locally. We cycle to work and go away on holiday using cars, public trains and buses, walking along streets and driving over bridges and through tunnels. When it comes to mobility, i.e. when we're on our way from A to B, perhaps even to another city or another country, there are many factors to consider to ensure that we're safe while we're travelling.

We often don't consciously think about safety in everyday life. We assume that we'll be safe enough if we follow standard rules, for example in road traffic. And we're not wrong. Nevertheless, safety plays a major role in almost everything we do in our daily lives, except that here others are responsible for our safety. Just think, for example, of an **everyday situation such as your journey to work**.

All the **buildings** you pass, the bridges and roads you drive over have been built to high, tried and tested safety standards. Moreover, they are inspected on an ongoing basis and, if necessary, renovated to ensure safety at all times. Engineers, construction experts and inspectors work hand in hand to ensure that these structures meet the most stringent safety requirements. In addition to architectural aspects, **modern technologies such as sensors and monitoring systems** further improve safety in many urban areas. These measures make it possible to identify potential risks at an early stage and provide a suitable response.

Transport systems such as buses or trams also meet high safety standards and are regularly inspected, not only for their functionality but also for passenger safety. Safety is the top priority here. The following **graphic** provides some more examples of "safety in the city".

"It's not enough for me to test something before it's put into operation – effort also has to be taken to minimise risk over its life cycle."

Now we've arrived at work. There is often machinery in the workplace which is mainly used in manual trades or in production plants. Here too, a great deal of effort is put into designing this equipment in such a way that it poses as few risks as possible to users and it must also continue to meet this requirement especially in the event of malfunction. Of course, the responsibility here also lies with each individual worker since responsible handling of equipment and machinery reduces accidents and increases occupational safety for everyone.

"Although there may be many causes of an accident, technical, organisational and human factors are the commonest. The final link in the chain, the worker carrying out the work, should be the focus of operational safety."

Digital world: how safe is a visit to the doctor?

Safety also plays a huge role in the healthcare sector, i.e. in hospitals or a doctor's surgery. Anyone going into hospital primarily wants to be properly treated in order to get well again. **Operational safety** is crucial here to ensure, for instance, that the X-ray machine works faultlessly and only emits as much radiation as is absolutely necessary.

Another aspect is **sensitive medical data** which the hospital or the doctor's surgery stores about their patients. **Cybersecurity** measures are used here too, to ensure that such data does not fall into the hands of hackers wanting to steal data from hospitals and sell it or use data encryption to extort money for decryption, see also the "Critical infrastructures at risk in the healthcare system" [graphic](#) on p. 16 of HORIZONS Cyber Security (in German).¹

"What we mean by security has changed over time. In business, companies could formerly be compared with a medieval castle. Once the gate had been closed, nothing could get in and nothing could get out, i.e. the castle was secure. But today companies are more like a marketplace than a castle as everything is interconnected. In the past, we built walls, now we 'build' knowledge to protect ourselves."

However, knowledge has to be constantly updated and any additions should have a firm basis in data. The reliability and availability of health data will therefore become increasingly important in the future so that high-quality healthcare and nursing care can be provided.

Digitalisation means that operational safety and cybersecurity are becoming increasingly intertwined. For instance, cybersecurity assists with hospital access, such as the admission of patients into the accident and emergency department. Hacking can also jeopardise this critical process and so paralyse the entire operation of the hospital, not just individual items of medical equipment.

"In medical applications, the boundary between safety and security is blurred. Safety means patient safety while security means protecting medical practices, hospitals and data from unauthorised access. But both are always personal because they have an impact on treatment and thus on health."

Safety in the city

Old and historic buildings

Drones are used to examine historic buildings for microcracking. Analysis of the material used in construction can provide information on how old buildings need to be restored in order to contain potential hazards.

Infrastructure

Modern sensors in bridges, tunnels, rails etc. can assist with collecting and evaluating data and so help with predicting possible risks.

Activities using heavy equipment and machinery

Some activities require the operation of heavy and dangerous machinery. These must be designed in such a way that they pose as little danger as possible to people and the environment during operation, but also do not become a major source of danger in the event of malfunctions. To this end, they must be safe to operate by the relevant personnel and have safety mechanisms for foreseeable and unforeseeable malfunctions. In addition, personnel must be thoroughly trained in all aspects of safety.





Transport systems

Not only **operational safety** but also passenger safety are important in public transport systems. This is why engineers and designers include important safety features right from the design stage (safety by design). In addition, sensors and simulations can improve safety alongside conventional test procedures.

Office

When working in the office, the main focus is on **cybersecurity** aspects. An error by a member of staff can often be enough to allow a successful attack on a company's IT system. This is why it's important for staff to receive ongoing cybersecurity training and development.

New buildings

Safety concepts are implemented right from the design and construction stages. This applies to the stability of the building, to sufficient, safe escape routes and well-planned fire protection. Digital copies of the building can be used to simulate and test these features in different scenarios. In the spirit of **sustainability**, environmentally friendly materials and energy-saving technologies are used to ensure long-term safety and environmental compatibility.

2.3 Nationally

What is the government doing to maintain “domestic” security?

What does **domestic security**, i.e. security within a country, mean? We will take Germany as an example, though some aspects will also be applicable to other countries. Countries tend to have very different policies regarding the organisation of their domestic or public security. Conventionally, domestic security means **public security**, i.e. **protection of the population, the constitution and the common good**. Government institutions and bodies such as the **police, the public prosecutor and the courts** are responsible for this. Social measures which contribute to protecting citizens’ lives and property also play a part.

“There will always be conflict – domestic and external.”

In the event of crises or disasters, such as an environmental disaster or a war, the **Disaster Management Agency** is responsible for keeping the population safe and secure. Did you know? In Germany, the Disaster Management Agency uses a technology called “Cell Broadcast” to issue public warnings by broadcasting important messages to mobile telephones in specified geographical areas, so warning the people there about disasters or hazards.

The COVID-19 pandemic was just such a crisis situation. Health disasters can also be a threat to the population and so become matters of domestic security for which policy makers must assume at least a major share of the responsibility. A further threat to domestic security is **terrorism**, which applies to many countries around the world. Security agencies are constantly working to prevent and uncover terrorist activity, so as to protect national security. One aspect of combating terrorism in Germany is the intensive monitoring of extremist groups and individuals by security agencies such as the Federal Office for the Protection of the Constitution and the police. Germany also cooperates closely with international partners and secret services when it comes to information sharing and acting jointly against terrorism.

Strong economy, secure country?

A strong economy makes for a stable, secure country. But what constitutes a strong economy and how does it become and remain strong? There is no uniform definition of **economic security**, and as is so often the case, it all depends on perspective and context. The Red Cross defines **economic security at an individual level as the ability of individuals, households or communities to cover their essential needs sustainably and with dignity**. The focus of the Association of German Chambers of Industry and Commerce, on the other hand, is on all of **Germany’s companies** and primarily on their compliance with existing legislation, such as those for preventing money laundering and the funding of terrorism.

The EU, in contrast, adopts a **macroeconomic perspective**, looking first and foremost at **supply chain resilience, protection of critical infrastructure and keeping the European technology sector secure**. Although these perspectives all tackle different hazards and challenges, they are nevertheless closely interlinked and important for economic security as a whole.

“What is economic security? The security of being able to earn a living and secure your livelihood.”

At present, economic security in Germany and many other countries is under strain. The COVID-19 pandemic has had a serious impact on the economy and many companies have had to fight to survive. Current global political tensions are also a threat to Germany’s domestic economy, with the country’s status as a location for industry being at risk from companies migrating abroad for example due to high energy costs. Ongoing advances in digitalisation are making it particularly important to preserve, restructure and create new jobs. A further challenge for the German economy is the

shortage of skilled workers. Businesses and government need to work together, fully sharing responsibility (and not passing it back and forth) to meet these challenges and guarantee economic security.

At government level, it is important to **make the German economy resilient in the face of multiple crises**. This includes having **stable supply chains** as this is the only way we can ensure permanent availability of sufficient raw materials, foodstuffs and energy. One example is the **supply of raw materials**: rare earths and metals are important for the electrical industry, while iron and aluminium are needed by other sectors. To achieve this goal, we should develop our supply chains into **multidimensional supply networks**, which are more resilient in times of crisis.¹⁴ This means that at no point should we depend on individual providers or suppliers.

"In this era of major change, businesses must be flexible and adaptable if they are to ensure security for both their customers and their employees."

Security vs. freedom

"There's no security without freedom, and no freedom without security."

Security and freedom are two of the most important, but sometimes conflicting human needs. This issue is one that has already been addressed by philosophers such as Thomas Hobbes in the 17th century and Immanuel Kant in the 18th. How important is domestic security to us? How many security measures are we happy to see taken in order to achieve it? And how far are we willing to have our freedom limited? Some people would like more security measures, such as surveillance cameras or chat monitoring, to combat crime and so feel safer. These issues are complex, for instance many people are against governments using facial recognition or location tracking but, in a private context, are perfectly happy to use products which have precisely these two functions built in. Balancing security and freedom is therefore subjective and depends on individual perceptions. People have differing opinions about the level of security they want and how willing they are to give up personal freedoms to achieve it. Different countries and political systems have different values and priorities, resulting in diverse views on this topic. In the best-case scenario, social dialogue will succeed in balancing this conflict and thinking through how to make society more secure without infringing people's fundamental rights and freedoms.

"Security policies are not really about finding solutions, but rather about containment, diminishing the problem and achieving a balance. It is not possible to resolve trade-offs individually for every citizen or politically without any inconsistencies."

It would also make sense to **gradually reduce our existing dependencies**. If we are to bring about stability and limited levels of dependency, we need reliable partnerships which will persist at times of crisis. It can prove risky to be dependent on countries built on very different values, of which we don't approve. It is no small undertaking to achieve this ideal situation, though, and in such a highly globalised world complete independence is neither achievable nor desirable. In any event, we should in future look at supply chains and partnerships as a complex whole, rather than focusing solely on short-term economic benefits such as the lowest possible price.

Technology and innovation also play a part in a country's economic security. Technological innovation leads to progress and a secure technology sector will create employment opportunities and strengthen a country's economy. It is crucial to create a reliable **legal framework** for dealing with new technologies. This framework needs to be sufficiently flexible to address the rapid changes that are taking place in some fields of technology, while at the same time ensuring that regulations are not so strict as to hold companies back and put the brake on technological progress.

Disinformation and deep fakes

Digital technologies have fundamentally changed the way international conflicts and even wars are conducted. **Cyberattacks** are no longer unusual. They can affect both businesses and private individuals, as well as politicians, academia or even the military. Governments and organisations are increasingly counting on **digital espionage**, in particular in the business and industrial sectors, to give themselves a competitive advantage internationally.

Another alarming new development is **disinformation campaigns**, in which false information is deliberately spread. Their aim is to mislead society or influence specific people and so push political or economic interests. Such disinformation campaigns use everyday media, including social media, as well as political organisations and cultural associations, to spread their messages. They are a multifaceted threat to our security.

Disinformation is often underpinned by "**deep fakes**". Deep fakes are realistic media content such as videos or photos which have been generated or faked using artificial intelligence. Deep fakes are extremely realistic and often difficult to distinguish from authentic material. This means it is increas-

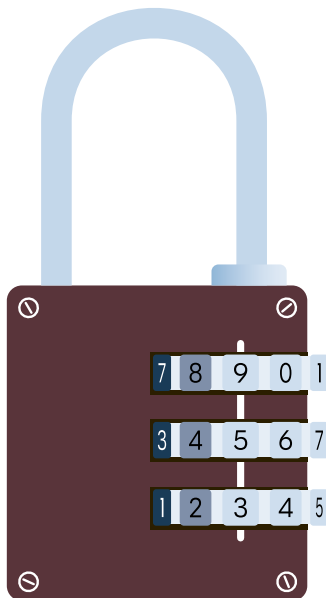
ingly difficult to work out whether we are communicating with a real person or a robot and whether or not photos or videos on the internet are genuine. The quality of these fakes is increasing all the time, making it ever harder to identify them. It is not likely that this development will stop. Banning deep fakes seems futile, as easy-to-use AI tools are freely accessible and deep fakes have already become a mass-produced product.

"Only believing what I have seen with my own eyes will soon become an outmoded concept, as we will see everything imaginable!"

How do we handle this situation and what countermeasures can we take? We should push forward effective measures for identifying and defending ourselves against deep fakes, to ensure that information remains trustworthy. One possible weapon against the confusion caused by deep fakes could be **digital signatures and certificates for trustworthy media content and sources**, rather than directly identifying deep fakes themselves. These signatures could identify the provenance, i.e. the source, of video or audio media, so guaranteeing its trustworthiness and reliability. Cryptographic methods (encryption) would in turn guarantee the authenticity of these digital signatures/certificates, in order to distinguish truth from lies. The Content Authenticity Initiative is one example where businesses are working together to develop common standards to make the origin of digital content reliably traceable.¹⁸ Work is ongoing on the technical and organisational implementation of this idea.

There is also a need for legislation with uniform requirements and minimum standards for all social media platforms, which are the channel by which deep fakes are mostly spread. Germany's Network Enforcement Act (NetzDG) is designed to take action against the spread of deep fakes.¹⁹ NetzDG, the specific form of which is currently hotly disputed, obliges the platforms to remove or block non-permitted content as soon as they are notified of it. Averting this threat requires not only

legislation but also increased international cooperation along with greater societal awareness. An awareness that seeing or hearing alone does not guarantee the authenticity of content needs to be built up as quickly as possible. The following [graphic](#) shows the impact disinformation campaigns and deep fakes can have on (domestic) security.



NATO – an Atlantic alliance promoting global security

NATO (“North Atlantic Treaty Organization”) is a defence alliance of currently 31 European and North American countries. It was founded in 1949, initially with twelve member countries, to guarantee joint defence of their territory and at the same time contribute to **global political security and stability**. NATO’s member countries have undertaken to provide mutual support in the event of a military attack on a NATO member. If, for example, Germany came under attack, the other NATO countries would assist Germany militarily. NATO also sees itself as a community of values made up of free democratic states.

In **2022**, NATO adopted a **new security strategy**. NATO’s fundamental missions remain unchanged and consist of deterrence and defence, crisis prevention and management and the promotion of cooperative security. However, its strategic focus has changed. Russia is now considered the greatest threat in the Euroatlantic space (the community of European states and the Western states bordering the North Atlantic). China is also playing an increasingly important role in security policy considerations. This reflects the changing geopolitical situation and shows how NATO’s security priorities are evolving.

How deep fakes threaten our security

Why are deep fakes so worrying? Do they have the potential to endanger a country's domestic security? The boundary between facts, disinformation and lies is becoming increasingly blurred. Convincing deep fakes have the potential to shatter the population's trust in a shared knowledge base and in the long term could even endanger the stability of democracy. Have a look at our hypothetical scenario to find out why.



1. Preparations for the election are going ahead at full tilt. Polling suggests this politician is the clear favourite.

"Today a recording of a video call was published in which a high-ranking politician is bribed. The recording, which was leaked anonymously to our editorial team, has already attracted nationwide interest and triggered violent protests in several cities!"



2. A newsflash with a video showing the politician appears on all news stations and social media platforms.

3. The politician has no choice but to step down from the campaign. The population likewise has no choice other than to trust the recording of the telephone conversation, where the voice and face are unmistakably those of the politician.



Did the politician's video call and the violent mass protests really take place?

4. At the moment, social media content can be verified using a **notice and takedown mechanism**.¹⁹ Users thus have the option to inform platforms when deep fake content is posted. However, this method is much too slow given how quickly recordings spread. **It is irreversible: public opinion has been strongly influenced just before the election.**



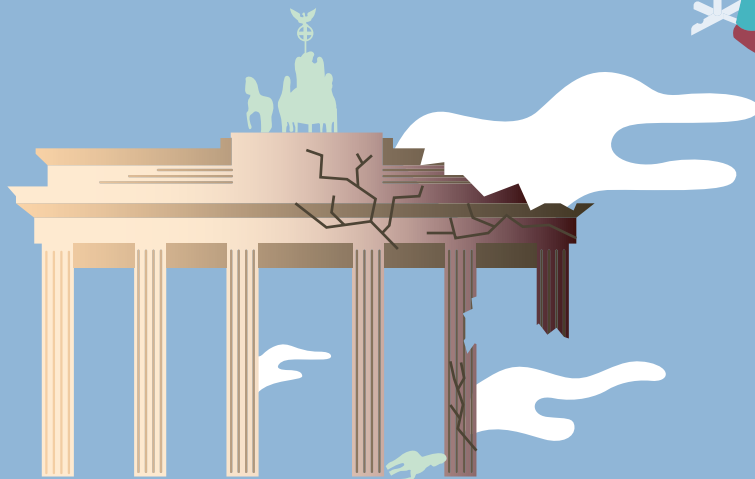
5. The example shows that public **trust** in politicians can be undermined by disinformation and manipulation. If such deep fakes become widely used, public discourse is likely to be damaged. In the long term, even democratic institutions such as parliament and the integrity of elections could be at stake.



6. However, the story doesn't end here. The challenges of disruptive deep fake technology are complex. Consequently, individual and isolated measures are not going to help. Strategies for dealing with this problem are already being worked on at various levels:

Technical approaches

Public awareness



The technology can also be put to positive use, for example to awaken empathy. The "Deep Empathy" project simulates how other cities would appear if faced with similar conflicts, such as the war in Syria.²⁰

2.4 Internationally

Of course, a government's security efforts do not stop at its borders. You'll very likely have heard of **external security**, but what exactly does it mean? **Military defence** will probably come to mind. External security is first and foremost about defence against external attacks on a country. These may be acts of war, but also politically motivated cyberattacks on critical infrastructure.

"The boundary between domestic and external security is becoming increasingly blurred."

However, external security means more than a country arming itself so that it can defend itself in times of war. **Globalisation**, i.e. the global interconnectedness of countries, has greatly increased in recent decades. Examples are greater international trade in products from different countries or the dissemination of information and data via the internet. Climate change is also a problem for global security and demands a global approach. It knows no borders and its impact on the whole world requires transnational cooperation. On the one hand, globalisation has brought security and increased economic prosperity to many countries. However, at the same time, it is leading to new risks and uncertainty such as economic dependencies and global conflict.

Cooperation in **international alliances** plays a decisive role for Germany in establishing security at a global level. The first among these are the NATO defence alliance (see box on page 39) and the European Union (EU). The United Nations (UN) and the Organization for Security and Co-operation in Europe (OSCE) are also committed to security and peace in Europe and the world. Read **section 3** of this issue of HORIZONS to find out more.

Between innovation and responsibility in the arms industry

German companies are among the world's most important developers and distributors of **defence technology**, including not only weapons and vehicles, but also sensor technology, radar systems and electronic warfare. Many countries procure arms from Germany. Modern weapons are often complex systems that require well-trained specialists to operate them effectively.

In the future, interfaces between people and machines, automation and unmanned systems will become increasingly important. However, there is still a lot of research to be done here, especially in the field of artificial intelligence (AI). It is assumed that those countries which are the first to develop mature **AI systems and autonomous weapons systems** will have a major advantage ("first mover advantage"). However, experts also have concerns and warn of the dangers of AI in the military, such as the possibility of conflicts involving self-determining weapons systems escalating out of control. In-depth research is therefore required as **issues around values and responsibility** need to be clarified. International agreements on the regulation of AI in the military are also absolutely essential.

"Private security is not possible without public, military security."

Have you come across the concept of **"dual use"**? Dual use refers to technologies which can be used in both the civilian and military sectors. The same products and technologies can thus be used for both peaceful and military purposes. Examples of such technologies are avionics, marine technology, special materials and software. When dealing with dual-use technologies, it is also important to carefully weigh up the advantages of civilian use against the potential risks in the military sector. Achieving this will require appropriate regulation, monitoring and international cooperation to ensure that such technologies are used responsibly.

Zeitenwende

We are currently living through tense geopolitical times. Russia's truly surprising war of aggression against Ukraine, which turned most political and public expectations upside down, has changed Germany's security and foreign policy. Federal Chancellor Scholz even referred to it as a **Zeitenwende**, heralding a certain rethink in German foreign

and security policy on how to guarantee the security of Germany and its allies in Europe. Its core focus is thus moving away from international crisis management to alliance and national defence. The demands on Germany's armed forces are changing accordingly. Military equipment needs to be modernised, operational readiness increased and personnel resources boosted.

Against this background, the federal government has provided funds, in particular through the armed forces special fund, amounting to 100 billion euro²¹ for enhancing defence readiness and modernising the armed forces. However, the availability of financial resources alone is not enough. There is also an urgent need to reduce red tape and simplify the procurement system, which is so complicated that the funds cannot be spent as quickly as they are made available, so further delaying modernisation of the armed forces. Take a look at our [Zeitenwende graphic](#) below.

Opinions about the armed forces are many and varied in Germany and often controversial. Some people regard the armed forces as an important institution which contributes to national safety. Some citizens, on the other hand, are generally sceptical about the military and take a critical view of the armed forces. This point of view is often based on historical experience and memories and leads to concerns about the plans to rearm. Transparent information and public debate are important in order to deal with these differing opinions in society.

"'Never again war' originates from the brutality of the Second World War. West Germany was heavily armed but from 1990 onwards we all thought peace would be eternal, freedom had won, and we massively disarmed."

The National Security Strategy of the German Federal Government

2023 saw the publication of the federal government's first official National Security Strategy. Although there has been criticism that the paper does not set out any clear priorities, it nevertheless lays the foundation for improving security in every area of life. In addition to conventional security issues such as defence and averting threats, many other aspects are considered from a security perspective. The federal government calls this **integrated security** – an all-encompassing concept of security based on the three pillars of defence **readiness, resilience and sustainability**. Apart from a realignment of the armed forces and their missions, the strategy also covers issues such as pandemic prevention, food security and food safety, combating the root causes of refugee flight, raw material security, resilient supply chains and even space security. This is a new, broader understanding of security and safety. It shows that the federal government is prepared to respond to the current situation in order to create a safe and secure future for us all.

Zeitenwende: What's changing and why?

Russia's attack on Ukraine has greatly changed society's awareness of the military. Chancellor Scholz even called it a historic turning point or a "**Zeitenwende**" - a German term referring to the change from one age or era to another. There is greater political will to strengthen the armed forces than there has been for a long time. Nevertheless, challenges remain along the way. This **graphic** illustrates some of the milestones along the way to the current Zeitenwende.



1. Starting point: historically rooted **reticence towards the military** in Germany since the horrors of the Second World War. When the Cold War came to an end in 1990, Germany began to disarm. Trust in the ability of the USA and NATO to ensure security and defence.



4. Following Trump's election as US President in 2017, he has repeatedly called for compliance with the NATO two per cent target: every NATO member is contractually obliged to spend at least two per cent of its gross domestic product (GDP) on defence. The idea is that member states should take more responsibility for their own defence instead of being heavily dependent on the USA.



5. **Russian war of aggression in Ukraine (2022):** Russia's threats to the West lead to concerns about an expansion of the war. Reports that the federal armed forces would be incapable of defending the country in an emergency. Growing awareness of the necessity of a properly functioning army. Federal government approves a special fund to rearm the armed forces. **Chancellor Scholz speaks of a Zeitenwende.**

2. The German armed forces are geared towards carrying out relatively small missions as part of international cooperation, mainly in a supportive capacity, such as training local security forces in Afghanistan. Peace missions and humanitarian operations.



3. A rude awakening in 2014 with **Russia's annexation of Crimea**: armed conflict is still a possibility, even in Europe.



6. Challenge: Germany's armed forces have not been geared towards this for a long time. The structures required for wars between nation states differ from those used on relatively small peace missions abroad. The bureaucracy is also very complex. The **armed forces are realigning** and increasingly focusing on national and alliance defence instead of interventions abroad. A difficult process, even if the political will is there.



3

International cooperation for a safe and secure world

In today's globalised world, everything is intertwined. Even seemingly distant crises can have a tangible impact on us. Cooperation is essential for creating international peace, security and stability. This third section is for you if you want to know how and why states cooperate in matters of international security and which organisations and institutions exist for this purpose.



Security measures often vary due to national frameworks; each country has its own individual approach. One example are internal security measures, such as the use of video surveillance in public places.

There are, however, some areas of security that are extremely complex and internationally intertwined. In such cases, national solutions are not enough to tackle the challenges and **international cooperation** is needed instead. Issues such as cross-border crime, terrorism and cyberattacks require coordinated efforts and information sharing between countries in order to identify effective solutions and ensure global security. It is also necessary to develop **security strategies at an international level**.

International cooperation plays a central role in security. There are a number of institutions which create a framework for cooperation between states. These are primarily NATO, the **United Nations (UN)**, the **European Union (EU)** with its “Common Security and Defence Policy (CSDP)” and the **OSCE** (Organization for Security and Co-operation in Europe). The aim of these organisations is to institutionalise security cooperation. The missions of these organisations are hugely diverse and often go beyond purely military cooperation.

For Germany and Europe, participation and involvement in such organisations is extremely important as crises, even in distant countries, can have a major impact on security in Germany and cannot usually be resolved by certain states acting alone. The following **graphic** provides an overview of political conflicts around the world and how we can counteract them with international cooperation.

The United Nations’ SDGs: sustainability and security go hand in hand

“Security and safety should always be a hallmark of a society, even in crises, so that even its weakest members can feel safe during a crisis.”

The United Nations’ (UN) Sustainable Development Goals (SDGs) are a comprehensive framework for promoting sustainable development worldwide and tackling various social, economic and environmental issues by **2030**. The United Nations is an international organisation with 193 Member States which focuses on **promoting peace and security** in the world. It works to prevent and resolve conflicts, provide humanitarian aid and protect human rights worldwide. Security is a recurring theme throughout the United Nations’ Sustainable Development Goals. Almost all SDGs are directly or indirectly linked to security, demonstrating quite how closely security and sustainability are linked. **Global social justice** is one facet of this work. SDGs are directed at all countries, but have a particular emphasis on protecting the poorest. No one should be left behind. The aim is to create a fairer, more secure and more sustainable world for future generations.

Important sustainability goals of the United Nations (SDGs) that relate to security:

- **SDG 1 (no poverty):** it is crucial for people, especially those in the poorer regions of the world, to be economically secure. This means that even in times of natural disasters or a pandemic, they do not have to fear for their survival. This economic security is also indirectly linked to job security. No one should be compelled to accept degrading work in order to earn a living.
- **SDG 2 (zero hunger):** food security is fundamental. Rising prices due to crises pose a major threat to the poorest in particular. Access to food should be guaranteed for all.
- **SDG 6 (clean water and sanitation):** a supply of clean water must be ensured (direct link to SDG 2).
- **SDG 7 (affordable and clean energy):** emphasises the need for security of supply. Stable energy grids should remain resilient and reliable even in times of natural disasters or crises.
- **SDGs 14 and 15 (life below water/on land):** emphasise environmental protection and the conservation of our environment. This also includes safety in relation to the operation of machinery and vehicles which should be designed in such a way that they do not pose a significant risk to the environment in the event of malfunction. For instance, the safety of oil rigs and oil tankers must be guaranteed in order to prevent environmental disasters.

Time for new security strategies

Recent years have been characterised by a series of crises. Stakeholders at all levels have recognised that the time has come to rethink security policy and adapt it to current circumstances. It is therefore no coincidence that the EU and NATO and most recently the federal government have published strategies for realigning security policy (see box in section 2). The EU Compass on **Security and Defence** (2022) and the **NATO Strategic Concept** (2022) address new challenges associated with the changing geopolitical environment. It is repeatedly emphasized that these complex, multi-layered challenges demand action, investment and cooperation in many areas. In particular, defence and crisis management capabilities need to be significantly enhanced. Operational readiness and capacity to act should be guaranteed at all times, with the focus not solely being on military action. We also have a need to be ready and able to recognise and avert dangers in the context of new digital technologies.

"Sustainability is no longer 'nice to have', but an obligation."

The global view: examples of international conflicts and security cooperation

In an increasingly connected world, international cooperation is key to ensuring global security. Our **graphic** highlights some current conflicts that are making waves in more than just one country. We also take a look at major international organisations and how they are working towards their mission of global security.



The **United Nations (UN)** is a global organisation with 193 Member States which is dedicated to promoting **peace, security, cooperation and development** at an international level. The UN's main tasks include conflict prevention and peacekeeping, promoting human rights, providing humanitarian aid, combating poverty and hunger and protecting the environment.



The aim of the EU's **Common Security and Defence Policy (CSDP)** is to ensure the security and defence of EU Member States. It includes crisis management and peacekeeping missions and operations in various parts of the world, including anti-piracy missions and security force training.

The **Colombian conflict** is one of the longest most complex armed conflicts in the world and has had a devastating impact, with a death toll of over eight million or approximately 16 per cent of the population. To date, there have been periods of military conflict and a number of attempts at negotiation. Despite efforts by the present government to achieve peace, the security situation remains problematic and the population's sense of security has worsened rather than improved.²²

The **Sahel region** extends from West Africa to the Horn of Africa and is one of the poorest regions of the world. It suffers from droughts, food shortages and population growth. The region is at the epicentre of international terrorism: the number of extremist and terrorist groups has risen steadily since the 2000s. The link between terrorism and cross-border organised crime is a threat to security not only in the region itself but also in Europe and Germany.²³



Russian war of aggression in Ukraine: in February 2022, Russia's military marched into Ukraine. Millions of Ukrainians fled to the west of the country or abroad. This conflict has had a serious impact on Ukraine and also on geopolitical stability in the region and worldwide, for example resulting in energy and food security issues in various regions around the world.²⁵

osce

The **OSCE (Organization for Security and Co-operation in Europe)** is an organisation made up of

57 European, North American and Central Asian states. It is dedicated to promoting regional security and cooperation. Its activities: preventing conflict, monitoring elections to strengthen democracy, promoting human rights, and supporting arms control and economic cooperation.

In October 2023, the almost century-long **Middle East** conflict escalated when Hamas launched a major military attack on Israel. The Israeli government immediately declared a state of war and launched defensive action. This led to political tensions not only within the region but also internationally. According to the UN, the population of Israel and the Gaza Strip is faced with the most serious escalation since 2006 and is living in a state of considerable insecurity.²⁴

Taiwan considers itself to be an independent, democratic nation, while Beijing views it as part of China and does not rule out the use of military force to achieve unification. The Taiwan conflict threatens the geopolitical stability of the Far East and may have an impact on international relations and trading partnerships. Taiwan is a major player in the global high tech industry.²⁶



The **NATO alliance** has been in existence for more than 60 years and unites 31 European and North American countries. It prioritises the protection of **freedom and security** as its most important goal. Its activities include monitoring and securing airspace, military alliance exercises, peace missions and cooperation in the area of cyber defence.

4

What needs to happen now?

What can policy makers, business, academia and society do to strengthen fair and sustainable safety and security in every area of life and at all levels? This final section provides some insights and food for thought.



In our increasingly connected world, safety and security cannot be guaranteed by short-term reactive measures. Safety and security need wide-reaching, long-term, systemic thinking. We should also take account not only of technical and military aspects but also of environmental, climate and societal risks. What is crucial is to focus on **prevention** and to strengthen the **resilience** of our systems. This integrated approach is key to the security and safety in our complex, globalised world.

Safety and security are a common concern shared by the whole of society. Ensuring safety and security is not just the task of governments or security services, **it involves us all!** We are all responsible for safety and security. In this final section we will look into what all the stakeholders should be doing now.

Understanding scientific context

Science and academia play a decisive role in improving our safety and security and in transparently communicating any residual risks that society needs to accept. They help us to explain and understand the world better, by increasing knowledge and reducing uncertainty. However, science and academia are not perfect either. Our knowledge is constantly changing and earlier assumptions or conclusions may suddenly be disproved. Ignorance about precisely these processes in the academic world often led to public confusion and misunderstanding during the COVID-19 pandemic. Science and academia need not just to create knowledge, but also to communicate and explain it as comprehensibly as possible. Only then can a well informed population handle risks in a

What needs to be done to achieve safety and security in digital space?

Society: to guarantee digital safety and security, **awareness of cybersecurity needs to be strengthened at an individual and organisational level.** Training and skills development can help make citizens more aware of cyberthreats and so protect them better. It would be even more effective, however, if IT security were to be made an integral part of training, study and business processes, whatever one's branch of study.

Policy makers: the **division of responsibility** for cybersecurity between different German states and different organizational units is increasingly problematic. Experts are calling for a rethink of responsibilities and are questioning whether Germany's federal approach can guarantee more efficient, coordinated processes. International cooperation is also needed. Since cyberthreats are a cross-border phenomenon, cooperation between countries is crucial when it comes to developing joint defence strategies and combating criminal activity.

Business: experts are also calling on companies to assume more responsibility. The motto "**Safety by Design**" is intended to encourage the production of equipment and software in such a way as to minimise risk to end users and improve user friendliness from the outset. Manufacturers thus also have to bear some responsibility.

"Manufacturers must assume more responsibility in matters of IT security!"

One goal of IT security should be **digital sovereignty**. However there is often a high level of dependency on foreign technology suppliers. This comes with a risk for Germany of losing control over its own IT and thus no longer being in a position to ensure information and data protection in accordance with national and EU guidelines. We therefore need to retain the skills to evaluate, verify and assess digital information, technologies and processes ourselves.

rational way and feel safe and secure when using their own skills to classify and handle risks. Representatives of the scientific community have a responsibility to communicate complex topics as clearly as possible. In return, laypeople should develop trust in science.

“Statistical illiteracy is a problem which needs to be tackled urgently in order to improve security and the understanding of risk in society.”

What is the role of the government?

We are living in an **age of upheaval**. Global challenges such as the climate crisis and geopolitical tensions require the development of sustainable, long-term solutions which can nonetheless be dynamically updated in line the current situation. Policy makers need to openly communicate that we are in a time of change. Change is inevitable. At the same time, it is important to know that the government is working continuously to guarantee safety and security. Political decision-makers must also make use of scientific insights, technologies and technology transfer to drive forward a **sustainable transformation**. Examples are the development and expansion of renewable energy sources, environmentally friendly transport systems and sustainable agricultural technologies.

“Our actions need to be more vigorous and our vocabulary humbler.”

Policy makers must create a **legislative framework** which is capable of responding **more quickly and nimbly** to current changes. In addition, regulations should be **reliable and implementable** and should ideally be uniform across Europe. Let's imagine a technology company develops an efficient and groundbreaking method for capturing CO₂ from the atmosphere. If this technology is to be applied quickly on a large scale throughout Europe in order to combat the climate crisis, it is crucial for policy makers to respond flexibly. A legal framework which requires years of jumping through bureaucratic hoops impedes progress. **Digitalisation in healthcare** can improve care but requires clear normative guidelines and a regulatory **framework to ensure health data are kept secure**.

Moreover, policy makers need to initiate and support **societal dialogue about important security and safety issues**. This can be achieved by awareness and information campaigns. One example of this is promoting **responsible use of artificial intelligence (AI)**. Decisions around AI affect citizens in their daily life, and an informed dialogue can help to ensure AI is applied ethically, securely and safely.

What can we do as citizens?

As members of society, we all bear serious responsibility for security and safety, be that at home, at work or elsewhere. Our decisions and behaviour can have an impact on other people and their safety or security. One example of this is IT security: our personal decisions may affect the security of organisations and businesses to which we belong.

It is wrong to think that no one would be interested in our data anyway. If we don't protect our own data, we can make the system vulnerable, so we need to take measures such as selecting secure passwords and taking additional safety precautions seriously. The same is also true of other areas, such as participating responsibly in road traffic or protecting the environment.

Safety and security for all – spotlight on people

Are safety and security fairly distributed? Does everyone benefit from the same level of safety and security? Our society is diverse, consisting of people from different backgrounds and with different experiences and needs. To achieve fairness throughout society and so protect all citizens equally, security and safety measures need to reflect this diversity. This requires a fair distribution of safety and security resources, which takes account of what different groups of different ages, genders or cultures need to participate with full equality in a safe and secure world.

But what does this mean in practice? One example of **social injustice when it comes to safety is lack of accessibility in public spaces**. Many bus stops, train stations and footpaths are not accessible, so impairing the mobility and safety of people with disabilities. A lack of ramps or lifts and the presence of steps and uneven footpaths make everyday life and access to public transport systems difficult. This makes people dependent on help and leads to social exclusion.

“In the past, insurance and safety measures were often only geared towards ‘your average 40-year-old white male’ but today gender and diversity always have to be borne in mind, even when modelling risk.”

Car safety is a prime example: **seat belts and airbags** are life-saving devices in cars, allowing occupants to survive accidents more safely. However, in the past, they were mainly tested and developed using test dummies which had the features of an average male body. As a result, safety standards and devices may very well not be sufficiently well adapted to the safety of women or people with different gender characteristics. This puts women at higher risk of injury in car accidents.²⁷

Health is another example: the **“gender health gap”** describes the fact that medicine is mainly geared towards male patients.²⁸ Medicines are primarily tested on men, and these results are then applied as standard regardless of the gender of the person being treated, which may lead to incorrect medication and harmful side-effects. Women are also more frequently the victims of misdiagnosis because they have different symptoms from men, for example in the case of a heart attack. The reason for this is that medicines and many diseases have not been sufficiently researched in women. More gender-specific research and drug tests are thus needed (gender medicine), to make health care safer and more effective for all.

Not all decisions or responsibilities for safety and security can be taken off our shoulders. We must ourselves address security and safety issues, gather information and form our own opinions. As an enlightened society that is informed about safety and security issues, we can play an active role in shaping our democracy. Potential risks don't necessarily have to scare us. Even situations which look risky or dangerous at first glance may hold opportunities for positive development or change.

Safely into the future

This issue of HORIZONS has shown that there is a lot more to safety and security than meets the eye. Or were you already aware at the beginning of this issue of the many areas in which maintaining safety and security is important?

We are in a time of upheaval and change. Massive climate change and geopolitical conflict require us to adapt our behaviour and thinking. The climate crisis is sure to bring changes with it, and we must be willing to adapt our behaviours. These changes are necessary for ensuring long-term safety and security. They do not necessarily mean giving things up, but may open up new opportunities.

Safety and security are not to be equated with inflexible stability. In a changing world, security and resilience are achieved above all when systems are able to adapt dynamically to new conditions. If we see change as an opportunity and focus on actively shaping our safety and security together, we can step into the future with optimism. That much is certain.

"A risk is the possibility of something happening that we can't influence.

In Germany, this has very negative connotations, but it could be thought of as an opportunity which is basically the same thing."

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Contributors

The project group defined the content of this publication, with the acatech Office interviewing experts from academia, business and society. acatech's Executive Board would like to express their sincere thanks to the project group for their input:

Prof. Dr. Dr. h.c. Christoph M. Schmidt, Head of project group, President, RWI – Leibniz Institute for Economic Research, Essen

Carlos Arglebe, Head of Cybersecurity at Siemens Healthineers

Prof. Dr. Dr. Dr. Konrad Bergmeister, Head of the Institute of Structural Engineering at the University of Natural Resources and Life Sciences, Vienna

Dr. Pia Fuhrhop, International Security Division of the German Institute for International and Security Affairs, Berlin

Dr. Thomas de Maizière, Federal Minister retd., Chair of Deutsche Telekom Stiftung and President of the German Protestant Church Assembly

Prof. Dr. Jörn Müller-Quade, Head of the "Cryptography and Security" group at the Karlsruhe Institute of Technology (KIT), Director of the Research Center for Information Technologies (FZI), Karlsruhe

Kirsten Raapke, Executive Vice President Europe at TÜV Rheinland Group

Dr. Anne Wiese, Head of central Global Real Estate and Services unit at Munich Re

Interviewees

Anna Biegen, Director Supply Chain S&OP at Novelis

Prof. Dr. Andrea Büttner, Executive Director of the Fraunhofer Institute for Process Engineering and Packaging (IVV)

Prof. Dr. habil. Claudia Eckert, acatech Executive Board member, Executive Director of the Fraunhofer Institute for Applied and Integrated Security (AISEC), Head of Department for IT Security at the Technical University of Munich

Dr. Nicole Koenig, Head of Policy, Munich Security Conference

Prof. Dr. Karen Pittel, acatech Executive Board member, Head of the ifo Center for Energy, Climate and Resources, Professor of Economics at LMU Munich

Prof. Dr. Ralph Rotte, University Professor of Political Science in the Department for Political Science at RWTH Aachen

Prof. Dr.-Ing. Jan Wörner, acatech President, Member of the Berlin-Brandenburg Academy of Sciences, Member of the German National Academy of Sciences Leopoldina e.V.

Storytelling, text and graphics, interviews, research

Dr. Sandra Fendl, acatech Office, HORIZONS, lead author

Ana Draghici, acatech Office, HORIZONS

Marco Mitrovic, acatech Office, HORIZONS

Assisted by:

Annika EBmann, acatech Office, HORIZONS

Nardine Abdelmessih, acatech Office, HORIZONS

Verena Küstner, acatech Office (communications and social media)

Lind Rùthers, acatech Office, HORIZONS (communications and social media)

Dr. Anna Frey, acatech Office

Dr. Paul Grünke, acatech Office

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acatech – National Academy of Science and Engineering

OFFICE ADDRESSES**Munich Office**

Karolinenplatz 4

80333 Munich, Germany

T +49(0)89/5 20 309-0

F +49(0)89/5 20 309-900

Berlin office

Georgenstraße 25

10117 Berlin, Germany

T +49(0)30/2 06 30 96-0

F +49(0)30/2 06 30 96-11

Brussels Office

Rue d'Egmont / Egmontstraat 13

B-1000 Brussels, Belgium

T +32(0)2 / 2 13 81-80

F +32(0)2 / 2 1381-89

horizonte@acatech.de

<https://en.acatech.de/project/acatech-horizons-overview/>

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Committee of Board and Vice Presidents:

Prof. Dr. Ann-Kristin Achleitner, Prof. Dr. Ursula Gather,

Dr. Stefan Oschmann, Manfred Rauhmeier,

Prof. Dr. Christoph M. Schmidt, Prof. Dr.-Ing. Thomas Weber,

Prof. Dr.-Ing. Johann-Dietrich Wörner

Registry Court, Munich District Court VR 20 20 21

Board of Management pursuant to § 26, German Civil Code:

Prof. Dr.-Ing. Thomas Weber, Prof. Dr.-Ing. Johann-Dietrich Wörner,

Manfred Rauhmeier

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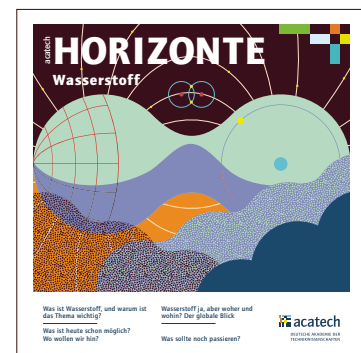
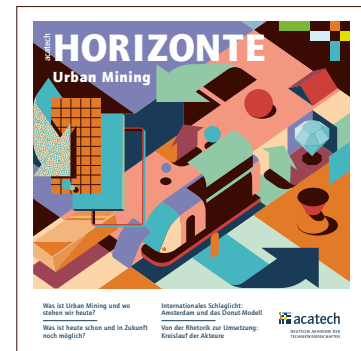
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Safety and security – essential basic needs that we often only think about when we feel threatened. In a world full of new technologies, ongoing digitalisation and global crises, the topic is becoming increasingly important – not just in the world of politics but also in our everyday life. Safety and security impact us on many levels, be it in traffic, in our food systems, at work or in foreign policy. But what do these two terms really mean? How can such a subjective topic be scientifically and rationally analysed? Which areas of life are affected, and how? And above all, how can we guarantee safety and security at all levels not just now, but also in the future? acatech HORIZONS Safety & Security addresses all these questions and offers fascinating insights into this important topic.