Chronic Risks Analysis

HM Government

Cabinet Office

Government
Office for Science

Foresight

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Ministerial Foreword

The world order is shifting at breakneck speed. A once-in-a-generation pandemic, war on the continent of Europe, a cost of living crisis, fluctuations in global energy and financial markets - all within the past decade. But in this period of upheaval, the first duty of any Government remains the same: keeping the public safe.

No Government or business can afford to sit idly as the world changes around us. This Chronic Risks Analysis should act as a practical tool to help businesses, academia, Government and civil society to plan for the future. While the National Risk Register outlines the more immediate, acute risks confronting us all, this assessment details long-term challenges that pose a sustained threat to our way of life.

What this assessment makes clear, beyond any doubt, is that these challenges cannot be tackled alone. They are deeply interconnected. Many are underpinned by new technologies, global mobility or turbulence in international markets. It is not possible to mitigate the effects of climate change, or manage our collective reliance on global supply chains, by going it alone.

If the Government and industry can grasp opportunities to tackle these chronic risks and introduce robust contingencies, the benefits will be felt across society and our economy. Whether that's growing our reputation for the safe and responsible use of AI, boosting growth in industries like cyber, or creating new skilled jobs in sectors from anti-fraud to biosecurity. Or acting decisively to thwart the spread of misinformation, ensuring we maintain strong supplies of critical minerals and shaping policies to prepare for demographic shifts, including an ageing population.

But our resilience also depends on strong foundations. Covid-19 was a once-in-a-generation pandemic, with devastating impacts on our national health and finances. But the impact was undoubtedly worsened by years of underinvestment in public services and a collective long term failure to address widespread inequality.

Through our Plan for Change we are rebuilding the country and changing the way the Government does things. And as we repair our NHS, open opportunities for people across the country and make our streets safer, we are making the UK more resilient to the shared risks that may be on the horizon.

This report will make an important contribution. By building our understanding of the long term risks we face, this report will not only help businesses and organisations to plan, it will strengthen national resilience. And, because we want to empower firms right across our economy to raise the bar on their resilience, the insights you will find in this document reflect the shared findings of Government and experts in a range of industries.

None of the risks are static; each one is evolving - every hour, every day.
This assessment represents a snapshot in time, which is why we plan to publish a new analysis before the end of this Parliament.

The Rt Hon Pat McFadden MP
Chancellor of the Duchy of Lancaster

Foreword

The UK's resilience remains a priority in light of ongoing global geopolitical and economic shifts, rapid technological advancement and a fast-changing climate, which means that the risk landscape is constantly evolving. The risks we face are unpredictable, interconnected, and demand a whole society approach to resilience in response. It is important that we embed the treatment of these risks in comprehensive policy making.

In addition to acute risks, the UK also faces a range of chronic risks. These are longer-term challenges that can erode our economy, community, way of life and/or national security.

Chronic risks cause their own harms, but they can also make acute risks more likely and serious. For example, climate change is making severe weather more likely and impactful, and antimicrobial resistance is exacerbating the risk of infectious disease outbreaks. It is therefore increasingly important to consider the risk landscape within the context of these longer-term, interconnected challenges.

As the UK bolsters its actions on resilience, we have established this new analysis of chronic risks to identify and assess these continuous challenges facing the nation. This analysis sits parallel to the National Risk Register (NRR), which remains the government's principal risk assessment for acute risks. Used as a package and embedded in policy making, these products not only enable the risk practitioners and resilience community to improve understanding of the immediate risk landscape but also improve understanding for how the risks and drivers we face in the future could evolve and manifest. In doing so, we will see the achievement of the long-term thinking and comprehensive policy making required when considering risks.

The Chronic Risks Analysis will be an important resource to help the UK face a wide range of persistent, interconnected issues in the coming years, from serious and organised crime to the reliance on global supply chains. The Cabinet Office and the Government Office for Science have collaborated to develop this approach, drawing on expertise in both organisations. The use of Foresight methods in this work is innovative and draws on the team's structured methodologies for thinking about the future. The joint team have engaged extensively across government departments, the devolved nations and external experts to identify a set of 26 chronic risks and rigorously analyse and evaluate them. The result is a framework to support policy makers, as well as risk and resilience professionals, to understand the longer-term challenges we face in our society.

Thank you to all the stakeholders who have supported this important work by providing their extensive input, comment and challenge.

The chronic risks are grouped into seven broad themes: security; technology; geopolitical; environmental; societal; biosecurity (including health); and economic. Building a stronger understanding of these chronic risks will help us all to support a more resilient nation.

Professor Dame Angela McLean, Government Chief Scientific Adviser

Introduction

The UK is contending with a range of chronic risks. These are longer-term challenges that erode our economy, community, way of life and/or national security. They can also increase the likelihood and impact of acute risks — those events severe enough to require an emergency response from the UK civil contingencies system.

This assessment of chronic risks complements the acute risks in the National Risk Register (NRR). It has been developed to:

- Build a shared understanding of these challenges across government and among risk and resilience practitioners.
- Give businesses and other organisations as much information as possible about the risks they face, so that they can use this knowledge to support their own planning, preparation and response.
- Allow risk professionals to think about the interconnected nature of chronic and acute risks.
- Facilitate discussions across government, and among risk and resilience communities to address the risk landscape and implement preventative measures to stay ahead of potential threats.

This analysis is not about predicting the future. It is based on a rigorous, interdisciplinary approach that has been developed and tested both within and outside of government. Its primary purpose is to assist government, organisations and professionals in preparing for long-term changes in the risk landscape. It is designed to complement, not replace, existing plans or strategies. Further, this analysis represents a snapshot in time, and therefore does not necessarily endeavour to present a regularly updated view across all risks.

The Government cannot tackle these challenges alone. Due to the increasingly complex and interconnected world, all of society needs to work together to strengthen our defences and build a more resilient nation. By focusing on our collective resilience, we can all help the nation be more safe, more secure – and in turn, more prosperous.

Methodology

Chronic risks require a novel assessment approach. Their systemic and enduring nature make traditional, probabilistic impact assessments less effective. To address this, the Government Office for Science and the Cabinet Office developed a new method using futures and systems thinking to help policymakers understand their implications and develop potential mitigations.

For each of the 26 identified chronic risks, we provide an assessment that includes a snapshot summary of their current status, alongside a forward-looking analysis exploring potential future developments and their system-wide impacts. Mitigations included are examples of the types of activities or policies that have been or are being implemented to address risks, but may not represent current government policy. While these assessments differ from traditional risk evaluations, the terminology used highlights the seriousness and importance of these risks. The risks were chosen through consultations with both government and external experts, and each assessment follows a consistent and thorough methodology.

- **Evidence gathering:** Each assessment draws on an extensive range of literature, which has been tested and iterated via challenge from cross-government and academic experts. This evidence feeds into all sections of the assessment but is particularly important for those sections that describe the snapshot current status of the chronic risk.
- **Futures work:** To develop those areas of the assessments looking to the future, we used a combination of pre-existing government scenarios and futures workshops to generate ideas where this thinking didn't already exist. More information on the tools and techniques used can be found in the GO-Science Futures Toolkit.[1]
- **Impact mapping:** Finally, we conducted an impact mapping exercise to identify which chronic and acute risks were most likely to interact with each other to develop the systematic risk scenarios and the case study system to provide policymakers with more challenging situations to test their policy areas against.

1 Government Office for Science (2024) Futures Toolkit (About the Toolkit)

Who should use the Chronic Risks Analysis?

The Chronic Risks Analysis is designed for a broad range of risk and resilience practitioners.

This includes, but is not limited to:

- Practitioners, including in voluntary and community sector organisations, who may play a central role in planning for and responding to risks, and therefore require an in-depth understanding of the complete risk landscape.
- Businesses, including small- and medium-sized enterprises, and those who operate critical national infrastructure (CNI), who have a need to understand the most critical long term trends facing our society that could impact their business continuity.
- Academics and experts from a wide range of disciplines and backgrounds, who play a critical role by providing external challenge.
- Policy makers, who need to develop and implement effective policies that address emerging risks and challenges, and for whom tailored versions of this analysis will be of increased relevance.[2]

Advice for individuals, households and communities on preparing for a wide range of risks can be found on GOV.UK/prepare.

Resilience Practitioners, Businesses and Academics: Preparedness advice

The information included here is for those that may want to strengthen their organisation's resilience and ability to respond to future challenges. These steps provide an example of how the Chronic Risks Analysis can be used to explore the manifestation of chronic risks and the appropriate strategies needed to combat them. It can and should be adapted to reflect the unique needs of organisations.

This guidance is based on the GO-Science Futures Toolkit.[3] The aim is to test out how certain risks in combination would affect your organisation or area of expertise.

For the best results, we advise workshopping this with a mixed group of experts from your organisation and completing the stages over several sessions. We recommend following these steps several times with different combinations of chronic risks to cover a broader range of scenarios and implications.

2 For advice on this report and general advice for policy on futures and foresight, please contact foresight@go-science.gov.uk
3 Government Office for Science (2024) Futures Toolkit (About the Toolkit)

1. **Select multiple chronic risks.** You may want to do this at random, allowing the group to spot unexpected connections and be less reliant on individual pre-conceptions of what matters. Alternatively, if you are more time constrained, you may find it useful to specifically target the chronic risks which are the most problematic for your business or area of expertise. For each chronic risk, make a note of the key features of the risk landscape, including the key vulnerabilities stated, possible futures, and causal relationship to other chronic and acute risks.

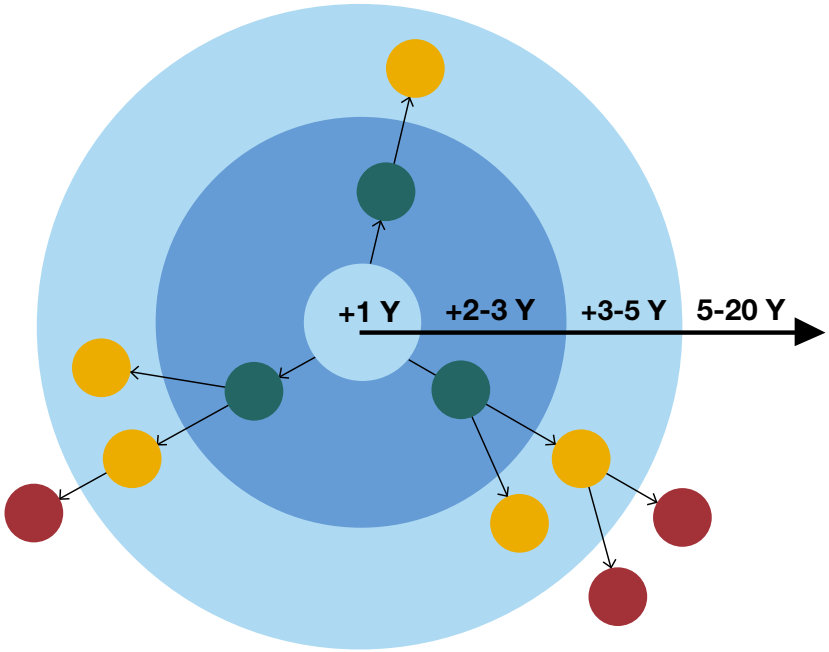
2. **Write a number of short scenarios of how these risks could intersect to impact your organisation.** Building upon your reflections and notes in the previous stage, you can begin to consider how these chronic risks can combine to produce a vast array of real world scenarios.

   For example, having chosen the chronic risks 'changes in the nature of cybersecurity threats', 'Impacts from the use and capability of artificial intelligence (AI)' and 'Skills shortages and mismatches', a possible scenario may be as follows:

   Cyber security threats increase in volume and severity due to the advance in AI designed ransomware. In order to combat this, firms attempt to increase their cyber defence workforce, but a lack of skills in the market leaves many firms unable to sufficiently resource their cyber defence and these are left vulnerable to attacks.

   Continue to generate ideas for possible scenarios, making use of the Future's Toolkit guidance on exploring scenarios[4] as needed. Once you have finished - select one scenario to focus on as a group. Keep the most challenging scenario where you will learn the most. Remove the least challenging and least important.

3. **Consider how this scenario may evolve beginning from 1 year ahead, and extending to 20 years and beyond.** You may wish to use the Futures Wheel Tool[5] to assist you with this.



- First ring: 2-3 years out, first order consequences (use PESTLE[6] categories to ensure a range of factors are considered)
- Second ring: 3-5 years out, second order consequences
- Third ring: 5-20 years out, third order consequences

4 Government Office for Science (2024) Futures Toolkit (Scenarios)
5 Government Office for Science (2024) Futures Toolkit (Futures wheels)
6 PESTLE stands for Political, Economic, Social, Technological, Legal and Environmental factors.

As you do this, remember the following:

Embrace a range of outcomes. A common challenge with Futures thinking workshops is focusing on overly utopian or dystopian perspectives. The world in the future will most likely be a mix of appealing and disagreeable things – as it is today. If the discussion seems to be heading to either extreme, then asking "what is the upside/downside of this situation" is a way of changing the dynamic.

Recognise different perspectives. People may view the same situation in different ways, welcoming or fearing different things. For example, rapid technological advancements may be seen by some as driving innovation and convenience, but by others as daunting and potentially alienating. You should try to capture all these perspectives and resist allowing one particular value set to dominate.

Be challenging. You need people to step outside the prevailing mindset. A thought shower exercise – where nothing is rejected as too improbable – is often a good starting point. Do not limit yourself to what seems likely or acceptable. You may want to adopt a 'day in the life' approach to fully explore how this scenario would impact on all areas of your life. Imagine you wake up in this future, 10-20 years from now - how is life different from today? What challenges might you meet?

4. **Develop mitigation strategies and interventions.** Consider what mitigations your current organisation already has in place to tackle these challenges, in addition to the gaps. Now, you can begin to develop your own interventions to mitigate the risk and / or develop opportunities.

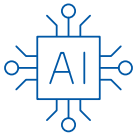
We recommend classifying your interventions according to the following categories, ensuring your ideas cover all areas.

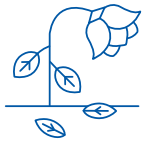
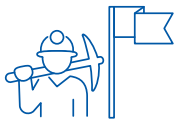
- Mitigate: what to change now to reduce the impact
- Adapt: what to change to cope with the impact
- Exploit: what to take advantage of
- Continue: what you can keep doing regardless
- Terminate: what do you need to begin closing down

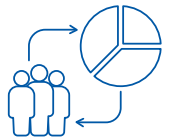
5. **Finalise your interventions.** Consider which are the most important interventions to work on in order. Prioritise your top three. Think about how you can implement these strategies to combat chronic risks within your organisation, any challenges or costs related to implementing them effectively, and how you could monitor progress or measure success. Test these ideas with your stakeholders to gather feedback and make changes as necessary. Consider whether pilot testing may be a useful way to test the feasibility and acceptability of a proposed intervention on a smaller scale.

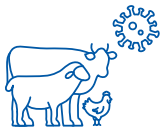
List of risks

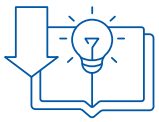
Theme	Drivers chronic risk
Security	Changes in the nature of terrorism 
	Changes in the nature of serious and organised crime 
	Fraud and illicit finance 

Theme	Drivers chronic risk
Technology and cyber security	Changes in the nature of cyber security threats 
	Impacts from the use of end-to-end encryption* 
	Impacts from increasing reliance on digital platforms 
	Dominance of global technology companies and concentration of risk 
	Impacts from use and capability of artificial intelligence (AI) 

Theme	Drivers chronic risk
Geopolitical	Challenges to international institutions 
	State threats 
Environmental	Climate change 
	Biodiversity loss 
	Increasing competition for critical minerals 
	Pollution and environmental degradation 

Theme	Drivers chronic risk
Societal	Impact of demographic change 
	Disproportionate impact on vulnerable persons 
	Disinformation and misinformation 

Theme	Drivers chronic risk
Biosecurity	Antimicrobial resistance (AMR) 
	Animal diseases 
	Foodborne diseases 
	Plant pests 
	Impacts from the expansion of engineering biology 
	Increasing collection and use of human biological data 

Theme	Drivers chronic risk
Economic	Reliance on global supply chains 
	Impacts from emerging financial systems 
	Impacts of ongoing skills shortages and mis-matches 

*End-to-end encryption is a rapidly evolving risk with wide-ranging implications for the UK's national security and public safety. Analysis of both the short and long-term impacts, and implications for the UK's resilience system, are under review.

Security

The rapid advancement and widespread adoption of technology could lead to an escalation in financial crimes, particularly due to the dual-use applications of certain technologies which can be exploited to pursue fraud and illicit finance activities. This poses an increasing risk to individuals, organisations, and government entities. The swift evolution of technology enables criminals to engage in continuously new forms of illicit activities, complicating the challenge of mounting an effective response and heightening the threat of serious and organised crime in the UK. Furthermore, global instability alters the origins, motivations, methods, and objectives of terrorism and state threat activity on both a global and international scale. In light of this, the UK's security strategies must evolve in response to international events to withstand a spectrum of isolated and converging threats.

Chronic Risk:
Changes in the nature of terrorism

Definition

The Terrorism Act[7] defines terrorism, both within the UK and internationally, as the use or threat of specific actions intended to influence the Government, intimidate the public, or advance a political, religious, racial, or ideological cause. These actions include serious violence against individuals, significant damage to property, threats to life, risks to public health or safety, and major disruptions to electronic systems.

Current evidence

The UK faces an enduring, evolving and complex terrorism threat from various ideological and geographical sources, mainly from religious and extreme right-wing terrorism, which is increasingly organised around online communities. While extreme left-wing, anarchist and anti-government extremism also exists, they pose significantly smaller threats to the UK.[8]

Technological advances are both an opportunity and a risk for counter-terrorism enforcement operations. The UK's response to terrorism, as set out in CONTEST, consists of four core pillars all underpinned by technology: Prevent, Pursue, Protect and Prepare.[9] However, technology can also be exploited by terrorists, for example, the internet can be an enabler of radicalisation.

The UK's counter-terrorism strategy consists of four pillars: Prevent, Pursue, Protect and Prepare

7 HM Government (2006) The Terrorism Act 2006
8 HM Government (2023) CONTEST: The United Kingdom's Strategy for Countering Terrorism 2023
9 Ibid

Rapid technological advancements can also be weaponised by terrorist groups to access previously unobtainable capabilities, for example, the use of Artificial Intelligence (AI) to uplift their capability to perform cyber attacks, run disinformation campaigns and facilitate the design of biological weapons.[10,11] There is some evidence that the proliferation of extreme violent material online is accelerating the process of self-radicalisation, including for those who are drawn to violent measures but lack an ideological motive.

Between 2018 and 2023, nine terrorist attacks took place in the UK, killing six people and injuring 20.[12] Since March 2017, MI5 and the police have together disrupted 43 late-stage attack plots.[13] Longer-term measures to control access to explosives precursors and firearms controls have seen a shift towards more easily accessible methods, for example, knives and cars, with bladed or blunt force weapons used in almost 80% of terrorist attacks in the UK since 2018.[14] Over the past decade, the average impact of terrorism has increased in three of the nine regions: Europe, South America, and sub-Saharan Africa. Every other region has recorded a decrease in the average impact since 2014.[15]

The personal, societal and economic effects of terrorism are significant. For survivors, witnesses and loved ones there can be enduring impacts, including life-changing injuries, stress, anxiety and financial hardship.[16,17,18] At a societal level, acts of terrorism and the threat itself can impact social cohesion and community resilience, making communities vulnerable to hate crime.[19]

Example vulnerabilities

- High-profile attacks receive significant media attention, allowing terrorists to amplify their messages and undermine trust in government and law enforcement's ability to ensure safety.
- Certain groups may become more vulnerable to hate crimes after international terrorist events, as terrorists target specific communities to create division and foster ethnic, religious, or political tensions.

10 Ibid
11 DSIT (2023) Capabilities and risks from frontier AI
12 HM Government (2023) CONTEST: The United Kingdom's Strategy for Countering Terrorism 2023
13 MI5 (2024) Director General threat Update
14 Ibid
15 Institute for Economics & Peace (2025) Global Terrorism Index 2025 report
16 García-Vera, Sanz and Gutiérrez (2016) A systematic review of the literature on posttraumatic stress disorder in victims of terrorist attacks
17 Barker and Dinisman (2016) Meeting the needs of survivors and families bereaved through terrorism. Victim Support.
18 Counter Terrorism Preparedness Network (2019) Humanitarian assistance and psychosocial support
19 HM Government (2023) CONTEST: The United Kingdom's Strategy for Countering Terrorism 2023

Example mitigations

- The UK has a published counter-terrorism strategy (CONTEST) which is structured around a framework of Prevent, Pursue, Protect and Prepare.[20]
- The Terrorism (Protection of Premises) Act 20251, also commonly referred to as Martyn's Law, will improve protective security and organisational preparedness at certain premises and events across the UK.
- The Counter-Terrorism Operations Centre (CTOC) brings together the right teams, data and technology to more effectively identify, investigate and disrupt threats.[21,22]
- The UK, Australia, Canada, New Zealand and the United States, form the Five Eyes intelligence alliance,[23] who work together to deliver and enable counter-terrorism investigations.

Examples of additional benefits from taking action

- Enhanced regulations for online spaces like the Online Safety Act 2023, alongside higher standards and monitoring by social media firms to detect disinformation and radicalisation, can improve their overall safety.
- Technological improvements in surveillance, communications and analysis aimed at detecting and preventing terrorist activity can also be used to tackle other types of serious and organised crime.
- Protective security measures, for both individuals and places, can both discourage attacks and mitigate their impact.

What the future might hold

Short-term trajectories:

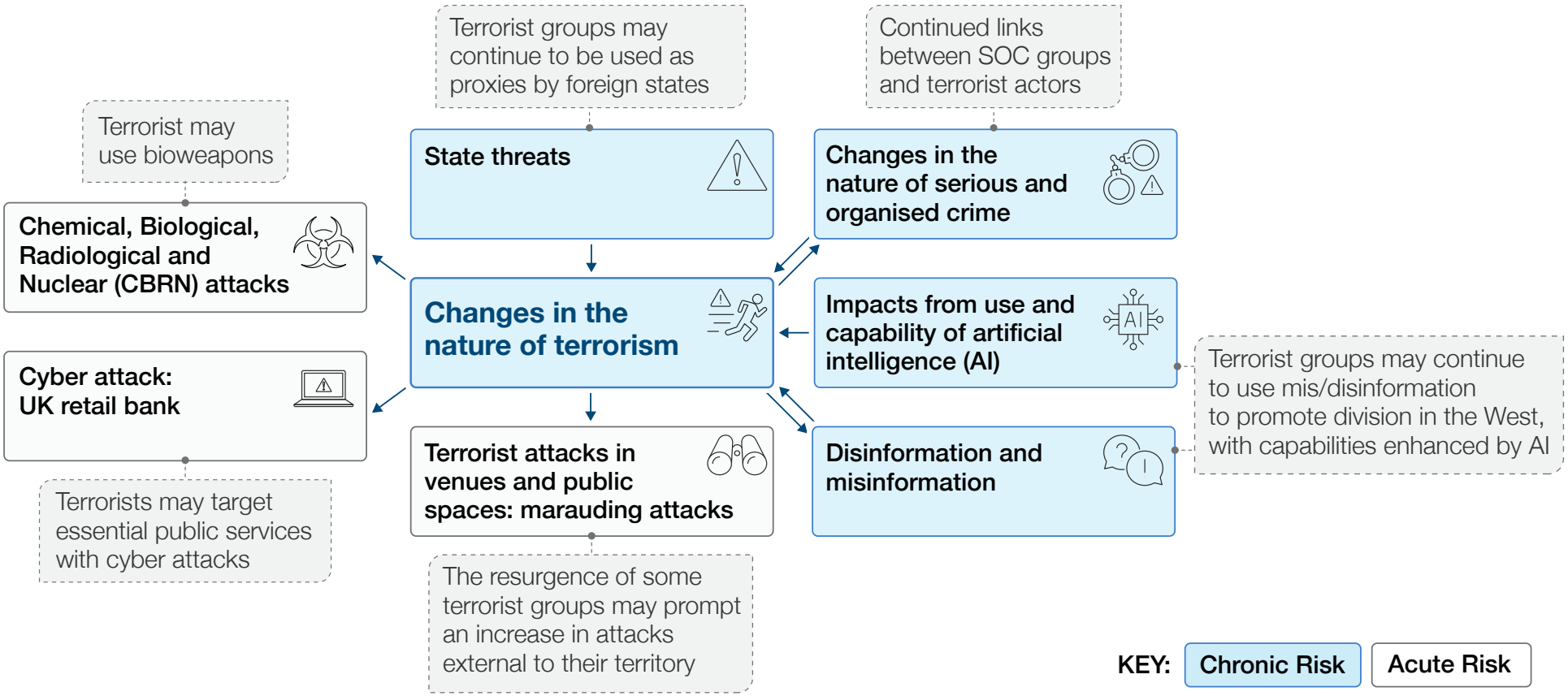
- The terrorism threat to the UK may become increasingly dominated by self-initiated terrorists acting outside of organised networks.[24]

Longer-term uncertainties:

- Reduced barriers to accessing technologies like AI could allow terrorists to diversify their methods of attack towards more sophisticated and technical approaches in the future.
- Increasingly unregulated or unmonitored online spaces have the potential to increase opportunities for vulnerable individuals to access harmful or radicalising material.

20 Ibid
21 Ibid
22 MI5 (2021) Counter Terrorism Operations Centre unveiled
23 HM Government (2023) CONTEST: The United Kingdom's Strategy for Countering Terrorism 2023
24 Ibid

Example connections with other chronic and acute risks



Chronic Risk:
Changes in the nature of serious and organised crime

Definition

Serious and organised crime (SOC) is defined as individuals planning, coordinating and committing serious offences, whether individually, in groups and/or as part of transnational networks. The threat to the UK from SOC continues to grow. Criminals may exploit the rapid evolution of technology to engage in illicit activity, making responses increasingly complex. Here, we cover SOC as a whole, while specific crimes, such as fraud, illicit finance and cyber crime, are covered in detail in other chronic risks.

Current evidence

SOC is primarily driven by the relentless pursuit of financial gain, through trade in commodities or the exploitation of people. SOC affecting the UK often has an international focus, either because the commodities and/or people being exploited are from overseas, or because the criminals are based overseas. Technology can be exploited as part of all SOC, being used to conceal communications or financial payments.[25] Many people are involved in drug-related activities, with drug use, drug seizures, and drug offences continuing to rise within the UK, resulting in an annual societal cost of over £20 billion.[26] Additionally, there were 6,268 firearms offences recorded in England and Wales in the year ending March 2024, an increase of 6% from the previous year.[27]

The yearly cost of SOC to the UK is £47 billion

25 HM Government (2023) Serious and Organised Crime Strategy 2023-2028
26 National Crime Agency (2025) National Strategic Assessment
27 Ibid

Illicit activities are rising in the UK, including modern slavery and human trafficking. National referrals for exploitation in the UK have increased, with 4,758 potential victims of modern slavery referred to the Home Office from July to September 2024, representing a 10% increase compared to the previous quarter (4,312) and a 15% increase from July to September 2023 (4,132).[28] Organised crime groups are increasingly using technology to secure their operations and stay ahead of law enforcement. For example, Artificial Intelligence (AI) generated videos of Martin Lewis and other celebrities have been used to entice victims to sign up to scam investments.[29]

However, law enforcement and government are also adopting modern technology to pursue offenders and help prevent individuals falling victim to these crimes.

Recent estimates put the cost of SOC to the UK economy at £47 billion per year - although this is highly likely to be an underestimate.[30] Increasing SOC also leads to direct harm to people. For example, drug-related deaths have risen to the highest levels since records began in 1993 in England and Wales.[31]

Example vulnerabilities

- Increased online activity, especially by younger individuals, may see an increase in online interactions between children and offenders.
- Technologies such as encryption are becoming more common, which may hinder law enforcement's ability to counter SOC.

28 Home Office (2024) Modern slavery: National Referral Mechanism and Duty to Notify statistics UK, quarter 3 2024 - July to September
29 MoneySavingExpert (2023) WARNING: Beware frightening new 'deepfake' Martin Lewis video scam promoting a fake 'Elon Musk investment' – it's not real
30 HM Government (2023) Serious and Organised Crime Strategy 2023-2028
31 ONS (2023) Deaths related to drug poisoning in England and Wales: 2022 registrations

Example mitigations

- In collaboration with 75 partner organisations, the NCA pursues offenders in order to disrupt their criminal activities and bring them to justice. These actions help to prevent and divert would-be offenders from engaging in SOC; protects individuals, organisations and systems so that they are less likely to become victims; and prepares for when crime occurs to minimise its impact and reduce the likelihood of further crime.
- In December 2023, an updated SOC Strategy addressed the use of new technologies by criminals, cross-border operations, and highlighted the nexus with other transnational security threats to the UK such as illicit finance or state threats.[32] It emphasises collaboration with international partners to disrupt high-harm criminal networks and a multi-agency approach to combat SOC. The strategy also focuses on building resilience against domestic vulnerabilities.

Examples of additional benefits from taking action

- Improved coordination with international partners to combat SOC can help set the standards for cross-border cooperation.
- Reducing drug and firearms offences will create a safer society, making vulnerable individuals less likely to be exploited by organised crime groups.

What the future might hold

Short-term trajectories:

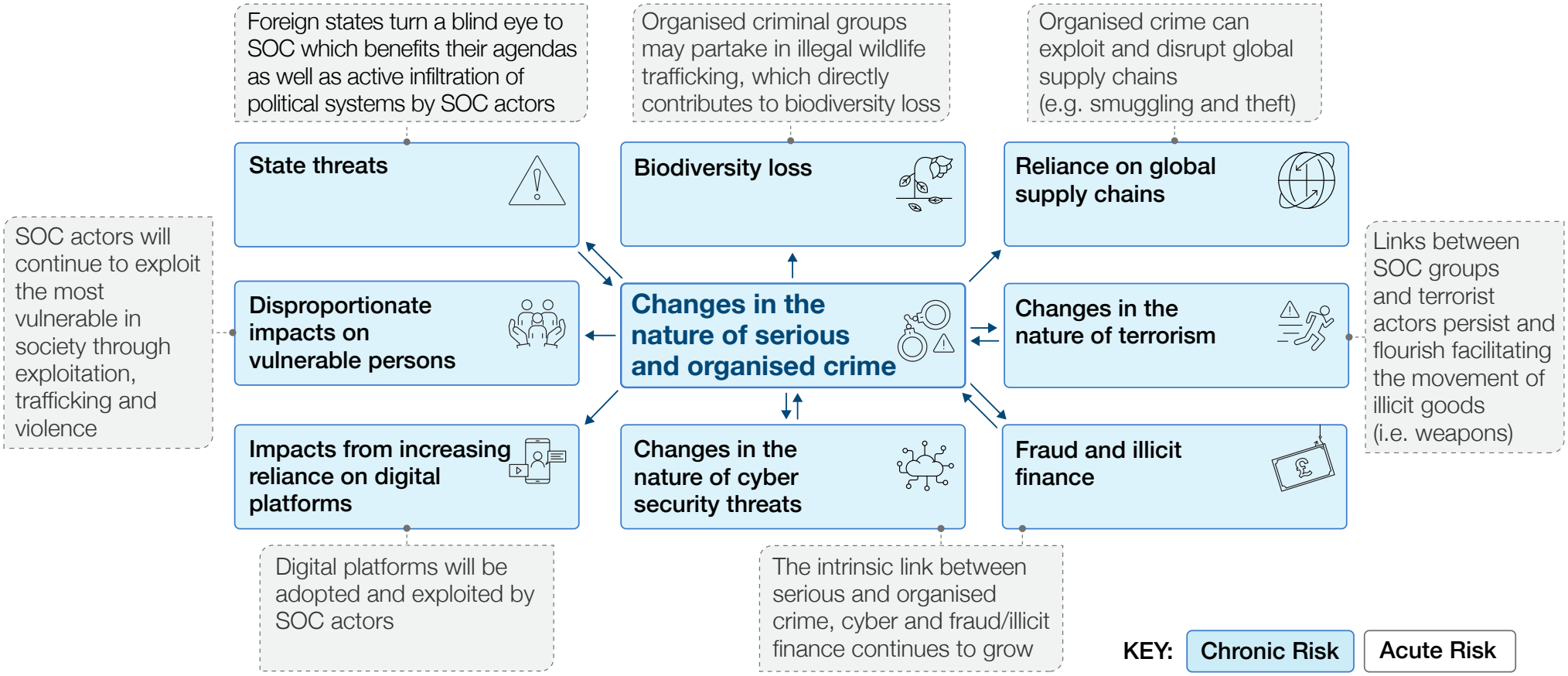
- Climate events, global economic crises, and persistent conflict may impact the supply of traditional plant-based drugs, possibly driving an increase in synthetic drug production and trafficking.
- As increasing amounts of personal data is available online, 'digital identity' theft, ransom and fraud may become more prevalent, with organised crime groups developing techniques to bypass security verification measures.

Longer-term uncertainties:

- Increasing use of electronic devices in young children could increase the risks from online groomers. In parallel, new technologies may allow offenders to hack the Internet of Things and GPS software to track and monitor their targets.

32 HM Government (2023) Serious and Organised Crime Strategy 2023-2028

Example connections with other chronic and acute risks



Chronic Risk:
Fraud and illicit finance

Definition

Fraud describes criminal deception intended to result in financial or personal gain and illicit finance refers to the movement of money that is illegal in its source, transfer, or use. The threat from fraud and illicit finance posed to individuals, organisations, public bodies and the Government continues to grow.

Current evidence

The most common types of fraud in the UK are payment diversion fraud, investment fraud, romance fraud, courier fraud and bank account fraud.[33] The internet has given fraudsters more opportunities to target people, especially given increased digital footprints and internet anonymity. Technological advances like artificial intelligence (AI) have enabled fraudsters to become more sophisticated in their scams.

Fraud is the most prevalent crime in the UK, with an estimated 3.9 million fraud offences in the year ending June 2024.[34] While it is difficult to calculate exactly, it is likely that hundreds of billions of pounds is laundered in the UK annually.[35] Illicit finance can also involve businesses violating UK government sanctions.

£87.9 billion laundered in the UK every year

33 National Crime Agency (2023) Fraud
34 ONS (2024) Crime in England and Wales: year ending September 2024
35 National Crime Agency (2024) Money laundering and illicit finance

For instance, the extensive sanctions imposed on Russia and the intricate economic ties to the UK mean that individuals linked to Putin currently present the highest risk of sanctions evasion.[36]

Illicit finance and fraud have a range of negative impacts across society. In the UK, the Public Sector Fraud Authority estimates that the cost of fraud and error to the public sector is at least £33 billion per year—equivalent to 15p in every £1 of taxpayer money.[37]

Example vulnerabilities

- As more UK financial services transition online, criminals exploit individuals who are less proficient with technology.
- London's status as a leading global financial centre makes it a prime target for individuals looking to launder illicit funds or evade sanctions.

Example mitigations

- The Procurement Act 2023 came into force in February 2025 and includes tougher action on fraud and corruption in the public sector, excluding suppliers who pose unacceptable risks from government procurement processes.
- The Government has appointed an Anti-Corruption Champion and committed to bringing forward an Anti-Corruption Strategy in 2025.[38]
- The Economic Crime Plan 2, released in 2023 and endorsed by this Government, sets out a holistic approach to tackling economic crime and illicit finance.[39]

Examples of additional benefits from taking action

- Enhancing law enforcement's ability to investigate and combat fraud helps raise awareness of fraudulent activities, fostering a more informed society where individuals and institutions are better prepared to address fraud while simultaneously strengthening public trust in authorities.
- Improved coordination with international partners to combat fraud can help set the standards for cross-border cooperation, which can be adopted across other sectors such as counter-terrorism.

36 National Crime Agency (2023) National Strategic Assessment 2023
37 Cabinet Office and Public Sector Fraud Authority (2023) Baroness Neville-Rolfe Annual Fraud Conference speech
38 HM Government (2024) Prime Minister's Anti-Corruption Champion: Terms of reference
39 HM Government (2023) Economic Crime Plan 2, 2023-2026

What the future might hold

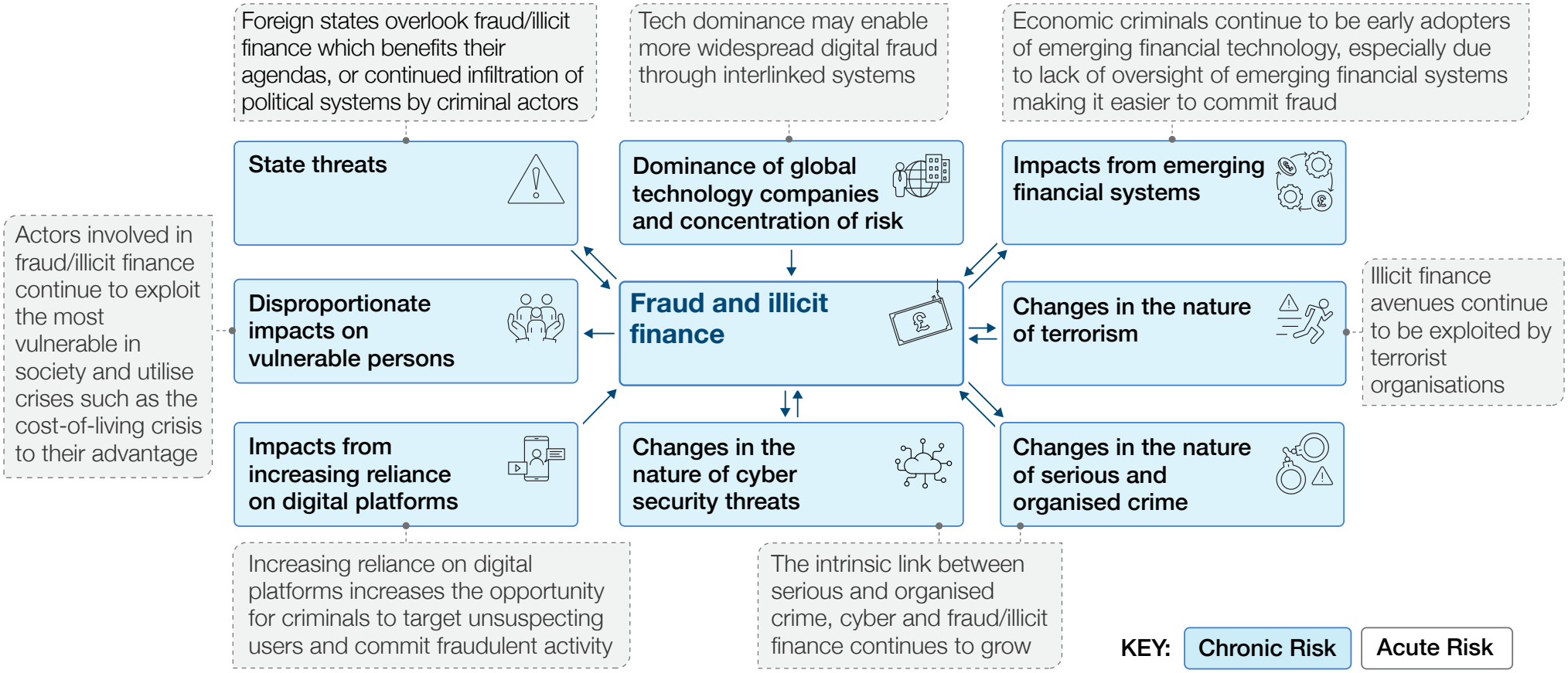
Short-term trajectories:

- AI could result in a higher number of scamming attempts and make them more convincing. However, AI also has the potential to be a powerful tool for detecting scams and money laundering.
- The cost of living could make people more susceptible to investment scams offering 'get rich quick' incentives.
- Strengthening regulatory standards could lead to a decrease in fraud offences, as the UK and its public would be viewed as a less attractive target by fraudsters.

Longer-term uncertainties:

- If the UK moves to a fully cashless society, it could increase the costs for financial crime by making it harder to conceal transactions. However, new forms of illicit finance might arise that exploit untraceable and intangible cryptoassets. Additionally, UK criminals could use cash from countries that still operate with physical currency, allowing them to conduct business in the UK without leaving an audit trail.
- The growing volume of online personal data, advances in AI, and expanded global internet access could lead to a rise in fraud cases. The international and anonymous nature of such fraud could result in fewer convictions, potentially eroding public trust.

Example connections with other chronic and acute risks



Technology and cyber security

The speed and scope of technological advancements are increasing, reshaping human experiences and capabilities. However, the dual-use nature of certain technologies, like artificial intelligence, introduces a growing concern. These technologies can have many positive uses, but can also be leveraged to enable harm. At the same time, competition for key components towards technological supremacy, such as advanced semiconductors, is a driver of geopolitical change and the dominance of a few global technology firms has shifted power dynamics. As our dependence on digital platforms and service providers grows, the swift adoption of emerging technologies and applications is a priority.

Chronic Risk:
Changes in the nature of cyber security threats

Definition

Cyber attacks, such as ransomware, continue to pose a significant and ongoing threat to individuals, businesses and critical national infrastructure. The increasing complexity and severity of these attacks, along with a growing range of perpetrators - many based overseas - intensify the risk landscape.

Current evidence

Consumers expect both convenient access to their personal data and strong security measures, however a significant cyber security skills gap remains, with 44% of UK private sector businesses lacking basic cyber security expertise in 2024.[40] The rapid advancement of digital technologies, along with the centralisation of data in cloud-based services and the rise of remote working, has introduced new vulnerabilities to cyber attacks and intensified existing ones.

The UK faces cyber threats from a complex range of actors, including states, criminals and hacktivist groups[41,42,] many of which operate abroad, complicating law enforcement efforts.[43]

43% of UK businesses experienced cyber attacks within a year

40 DSIT (2024) Cyber security skills in the UK labour market 2024
41 MI5 Countering State Threats
42 NCSC (2024) NCSC Annual Review 2024
43 HM Government (2022) National Cyber Strategy 2022

The cyber crime economy is becoming increasingly sophisticated, with ransomware posing one of the greatest risks to governments, businesses, and critical infrastructure.[44,45] Technologies like the Internet of Things (IoT) introduce additional vulnerabilities. While the Government has legislated to improve consumer IoT security, action is also needed on enterprise devices. In 2024, the National Cyber Security Centre (NCSC) said artificial intelligence (AI) will almost certainly increase the volume and heighten the impact of cyber attacks over the next two years, however the impact on the cyber threat would be uneven.[46] Despite heightened awareness and mitigation efforts, 43% of UK businesses still experienced cyber attacks within the last 12 months of the 2024/2025 period.[47]

The impacts of cyber security breaches are far-reaching, encompassing financial losses, damage to reputations, and theft of intellectual property. Accurately estimating these costs is challenging and often underreported. The cost of ransomware attacks in particular is likely to be significantly higher for some businesses even when a ransom is not paid, as indirect financial and operational costs are incurred; whilst victims who pay a ransom are less likely to report to Action Fraud.[48] Cyber attacks have real world consequences, for example the high-profile ransomware attack on pathology supplier Synnovis in 2024, which had an impact on thousands of procedures and appointments across six NHS trusts.[49]

Example vulnerabilities

- Lower-income individuals, older adults, and people with certain disabilities are at greater risk of cyber crime due to their increased dependence on assistance when using online platforms, making them more vulnerable to fraud and computer misuse.[50,51]
- The Government, healthcare, and hospitality sectors are prime targets for cyber attackers because of their access to sensitive personal and financial data.
- Businesses lacking adequate cyber defence investments and training are more vulnerable to cyber security breaches and their associated costs.

Example mitigations

- As the National Technical Authority for cyber security, the National Cyber Security Centre issues advice and guidance for organisations to follow to respond to the cyber threats and protect their systems.

44 Microsoft (2024) Microsoft Digital Defence Report 2024
45 NCA (2023) National Strategic Assessment 2024
46 NCSC (2024) The near-term impact of AI on the cyber threat
47 DSIT (2025) Cyber Security Breaches Survey 2025
48 Home Office (2025) The experiences and impacts of ransomware attacks on individuals and organisations
49 NHS England (2024) Synnovis cyber-attack – statement from NHS England
50 Ofcom (2022) Adults' Media Use and Attitudes report 2022
51 ONS (2022) Phishing attacks – who is most at risk?

- The Cyber Essentials certification scheme can help every organisation – from micro businesses to large corporations – guard against the most common cyber attacks whilst signalling to potential customers that they take the cyber threat seriously. The technical controls defined in the Cyber Essentials scheme continue to be the minimum standard of security that the NCSC advises for all organisations.[52]
- The UK's Product Security and Telecommunications Infrastructure Act has required consumer connected devices in the UK to have minimum security standards, which has reduced the vulnerability of devices and protected consumers and businesses. Further standards and codes of practice on apps, AI and software have given companies a framework to ensure technology is secure by design before being sold to end users.
- The Cyber Security and Resilience Bill will strengthen the UK's defences and ensure that more essential digital services than ever before are protected, for example by expanding the remit of the existing regulation, putting regulators on a stronger footing, and increasing reporting requirements to build a better picture in government of cyber threats.

Examples of additional benefits from taking action

- Training the workforce to be resilient to cyber threats can improve overall digital literacy levels and drive developments in other technology areas.
- A reduction in successful ransomware attacks can impact the financial security of serious and organised crime groups and weaken their ability to operate in other areas, for example, drugs trade and human trafficking.

What the future might hold

Short-term trajectories:

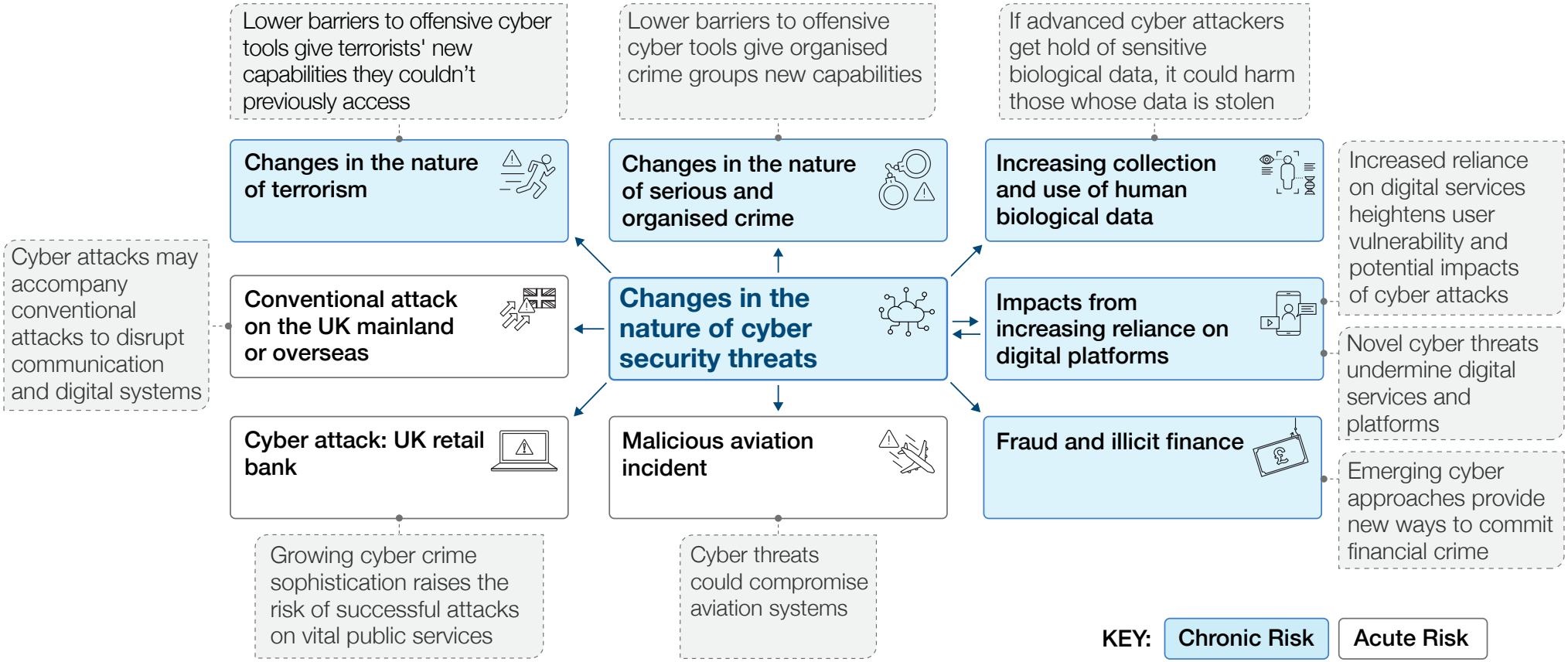
- Capability uplift, such as AI or commercially available cyber intrusion tools, could allow opportunistic actors to quickly strengthen their cyber attack capabilities, resulting in more severe and widespread impacts.
- Widespread data breaches could lead to greater exploitation of personal information, facilitate further crimes and erosion of trust in digital services.

Longer-term uncertainties:

- Governments across the world may struggle to set global cyber security standards and keep up with technological advances.
- Criminals may gain greater access to tools, data, and anonymity, allowing them to exploit poorly regulated sectors and expand cyber crime opportunities.
- AI could bolster cyber security, improving system resilience and helping to identify cyber criminals. However, adoption of AI for cyber defence could be uneven meaning some businesses could remain more vulnerable to an AI-enabled cyber attack.

52 NCSC (2024) NCSC Annual Review 2024

Example connections with other chronic and acute risks



Chronic Risk:
Impacts from increasing reliance on digital platforms

Definition

Digital platforms are online infrastructure that facilitate interactions between users, such as online marketplaces and social media platforms. Digital service providers are businesses that use these platforms to provide services. Society's growing reliance on digital platforms and service providers for daily tasks, information, services, and social connections has brought transformative changes and has enormous potential to transform productivity and drive economic growth. However, as more of our lives move online, there is a corresponding increase in vulnerabilities to cyber attacks, identity theft, misinformation, disinformation, and service disruptions, particularly for those who are already digitally excluded or mistrusting of the online world.

Current evidence

Digital platform growth stems from advancements in IT, telecommunication, and data processing. The trend is largely driven by the 'Big 5' technology giants, who have introduced and popularised various digital platforms and services, such as AI models, advanced search engines, social media, e-commerce, and cloud computing. The adoption of these services has been widespread, due to their increased affordability, accessibility, quality, and novelty.

By 2020, 92% of UK adults used the internet for digital services,[53] and 50% spent over 11 hours online daily.[54] This digital shift has been facilitated by a 33% drop in smartphone costs from 2017-2022[55] and a 266% surge in data usage,[56] making smartphones the main device to access the internet.

Global e-commerce sales reached 26.6% of all retail sales in 2022

53 ONS (2021) Internet Users UK: 2020
54 Clayton, R., & Lau Clayton, C. (2022) UK screen use in 2022: a need for guidance (Policy Brief 9)
55 OFCOM (2022) Pricing trends for communications services in the UK
56 Ibid

The shift has been particularly pronounced in the rising use of e-commerce; online sales accounted for 26.6% of UK retail sales in May 2022,[57] indicating a decline in traditional retail.

Despite this, a digital divide persists with 9% of UK families lacking essential digital tools[58] and 46% of over 75s not using the internet.[59] Extensive social media use is linked to negative effects on wellbeing, including increased depression, anxiety, and feelings of isolation.[60,61] In parallel, the rise of interconnected digital systems has increased cyber threats. In the second quarter of 2023, the percentage of organisations paying ransomware dropped from 45% to 34% but the average ransom paid more than doubled to USD $740,000.[62] In the UK, internet banking fraud cases peaked at nearly 43,000 in early 2021 before dropping to about 8,800 in early 2023.[63]

Example vulnerabilities

- Those less able to access digital platforms, such as older citizens, rural communities and lower-income groups, may lose access to important services.
- Modern infrastructure, ranging from power grids to traffic systems, are deeply reliant on and integrated with digital platforms. Disruptions can lead to catastrophic failures, endangering safety and the economy.
- Reliance on digital platforms may increase the vulnerability of government schemes, businesses, and vulnerable people to digital fraud. Lack of public awareness means many users do not know of these risks.

Example mitigations

- The Digital Markets, Competition and Consumers Act 2024 gives the Competition and Markets Authority new powers to tackle competition issues relating to the most powerful digital platforms.[64]
- The Data Protection Act 2018 and the Online Safety Act 2023 safeguard data and online interactions respectively.
- The AI Opportunities Action Plan 2025 sets out how the UK will shape the application of AI within a modern social market economy.

57 ONS (2022) How our spending has changed since the end of coronavirus (COVID-19) restrictions
58 Children's Commissioner (2020) Children without internet access during lockdown
59 ONS (2021) Internet Users UK: 2020
60 Sperling, J (2024) The Social Dilemma: Social Media and Your Mental Health
61 University of Leeds (2022) UK screen use in 2022: A need for guidance
62 Statista (2024) Ransomware - Statistics & Facts
63 Statista (2023) UK internet banking fraud H1 2023
64 CMA (2025) How the UK's digital markets competition regime works

- Initiatives like the Digital Skills Partnership enhance digital literacy,[65] allowing more people to access digital services, while the recently published Digital Inclusion Action Plan[66] sets out the first steps we are taking towards our ambition of ensuring everyone is digitally included across the UK, regardless of their circumstances.

Examples of additional benefits from taking action

- Agile regulation may facilitate innovation and allow digital platforms to stimulate economic activity by enabling e-commerce, generating tech-related employment and fostering innovation.
- Effectively addressing cyber attacks, identity theft, mis/disinformation, and service disruptions could position the UK as a global leader, attracting more investment and growth to the UK technology sector.

What the future might hold

Short-term trajectories:

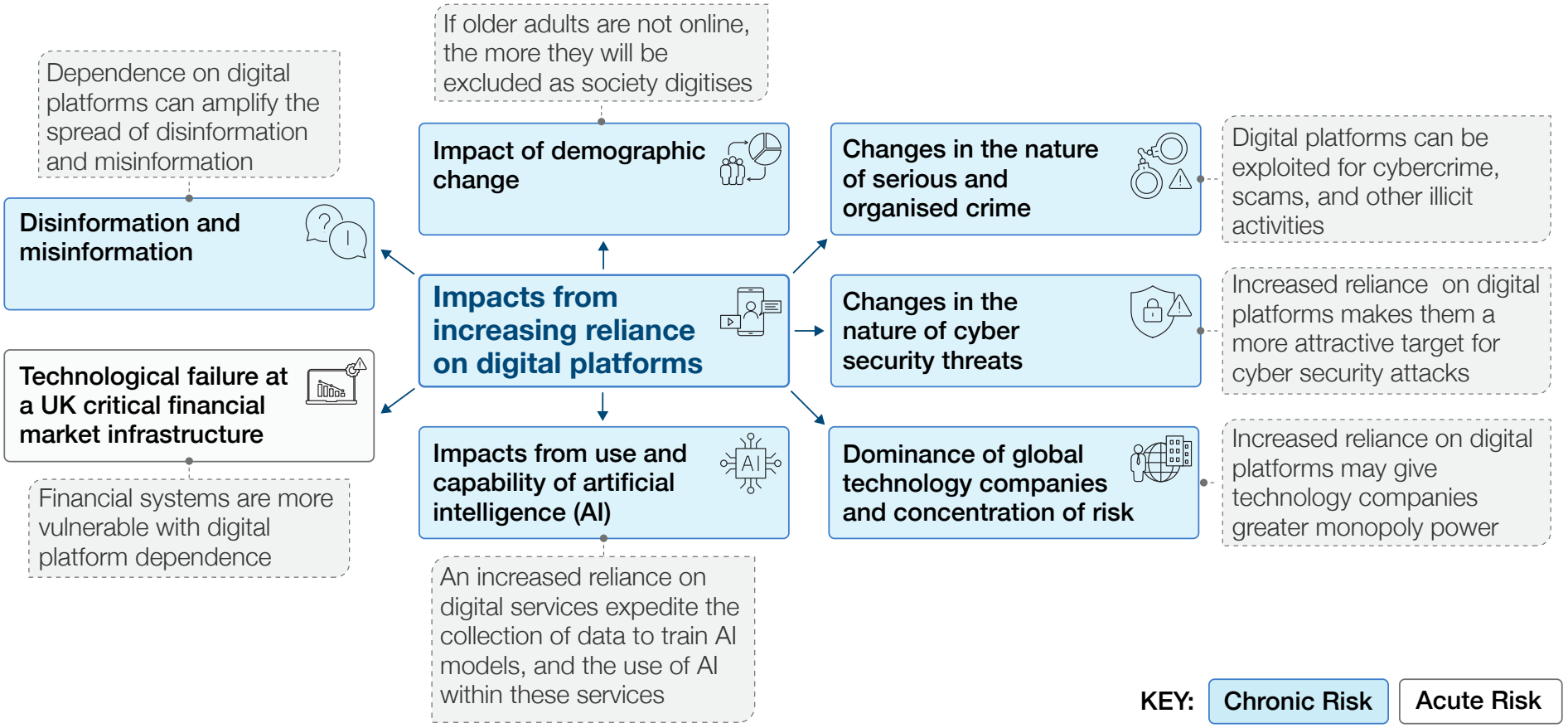
- Technological advancements, changing consumer behaviours, and evolving regulations might enable the expansion of e-commerce and digital government initiatives.
- E-commerce is expected to grow significantly,[67] aided by the internet of things,[68] which may enhance connectivity and data analysis capabilities.
- The expansion of digital services, including telemedicine, may continue, posing challenges in cyber security, energy use, and accessibility for those less equipped to use digital platforms.[69]

Longer-term uncertainties:

- The internet may fragment into 'splinternets,[70] where regional policies could isolate digital interactions and data access, creating 'digital islands'.
- This policy fragmentation may reinforce the dominance of the technology giants, centralising risk and further side-lining smaller innovators.
- The rapid, unequal adoption of technology could deepen socio-economic divides and contribute to social challenges such as human isolation and reduced social cohesion.

65 DSIT and DDCMS (2018) Digital Skills Partnerships
66 DSIT (2025) Digital Inclusion Action Plan: First steps
67 Statista (2022) Retail e-commerce sales worldwide from 2014 to 2026
68 Statista (2016) Internet of Things (IoT) connected devices installed worldwide from 2015 to 2025
69 POST (2022) Energy Consumption of ICT
70 European Parliament (2022) 'Splinternets': Addressing the renewed debate on internet fragmentation

Example connections with other chronic and acute risks



Chronic Risk:

Dominance of global technology companies and concentration of risk

Definition

The increasing size and influence of a few global technology companies complicates regulation, due to their expansion across multiple countries and into a wider range of economic and societal services. The growing dominance of a limited group of service providers is creating dependency risks, including operational, financial, and security vulnerabilities, while also restricting market innovation and customer choice.

Current evidence

Global technology firms that provide hardware, software, and digital services have become essential to a growing range of interconnected services, such as e-commerce platforms and payment systems. Whilst these firms are significant employers and investors in the UK's £1 trillion tech ecosystem,[71,72] there is a risk that powerful firms can dominate the markets in which they operate, leveraging economies of scale and significant market power. High entry barriers, including large investments and specialised expertise, further solidify their dominance. Furthermore, large major companies have developed integrated ecosystems of products and services, encouraging users to stay within their networks, making it less likely for them to switch to competitors.[73]

70-90% of the UK cloud computing market is dominated by two major players

71 GOV.UK (2025) Prime Delivery for Britain: PM Hails £40 Billion Amazon Investment Set to Create Thousands to Jobs
72 Dealroom (2025) UK Tech: A Forward Look to 2025
73 DSIT (2024) Impact Assessment - A new pro-competition regime for digital markets

Over the last few decades, a small number of global technology companies have grown to have billions of users worldwide and a combined market value of almost seven trillion US dollars,[74] dominating a range of industries including hardware, software, operating systems, and cloud computing. For example, two major companies dominate cloud computing, controlling 70-90% of the UK market in 2023.[75] This dominance reduces end user control over data and services, raising concerns over market competition. Customers may feel 'locked in' to specific providers, making it difficult to switch or use multiple services.[76]

The expanding influence of large technology companies has major market implications. As their user bases grow, the value of their services increases,[77] creating a cycle that limits competition. Smaller competitors find it difficult to keep up, while dominant firms can leverage their market power to potentially charge higher prices. Furthermore, these industry leaders collect vast amounts of personal data. This centralisation of data within individual organisations amplifies the risks associated with data breaches, reduces user control, and raises concerns around transparency and accountability in data handling.

Example vulnerabilities

- A small number of digital firms are very powerful in digital activities linked to the UK. This concentration can result in lower innovation, unfair treatment, and less choice and control for consumers in strategically important digital markets.[78,79]
- Dominance of a small number of technology companies across so many areas creates data collection, storage and privacy concerns and increases the risks associated with cyber attacks, potentially impacting consumers and critical national infrastructure.
- The global technology industry produced 2-3% of the world's carbon emissions in 2021[80] and the companies that have pledged to reduce their emissions are not doing so fast enough to mitigate their impact on the climate.[81] The semiconductor industry also produces significant amounts of toxic waste.[82]

74 Statista (2024) Google, Amazon, Meta, Apple, and Microsoft (GAMAM) - Statistics & Facts
75 CMA (2025) Cloud services market investigation
76 Ofcom (2023) Cloud services market study
77 CMA (2025) Cloud services market investigation
78 DSIT (2023) Impact Assessment - A new pro-competition regime for digital markets
79 CMA (2025) Strategic market status investigation into Google's general search services
80 UN Environment Programme (2021) With new pact, tech companies take on climate change
81 Greenpeace (2023) Supply change
82 Science Direct (2014) Semiconductor Industry

Example mitigations

- The new Industrial Strategy and Digital & Technologies Sector Plan sets out government's vision for the UK to have a globally leading and competitive technology sector. It includes an ambition to secure the UK's first trillion-dollar technology business by 2035.[83]
- The Digital Markets, Competition and Consumers Act 2024 gives the Competition and Markets Authority new powers to promote competitive digital markets and ensure powerful digital firms treat consumers and businesses fairly.[84]
- The Competition and Markets Authority is investigating cloud services to assess market competition and improve outcomes for UK consumers and businesses.[85]

Examples of additional benefits from taking action

- Enhanced competition in digital markets can foster greater innovation and growth, providing more opportunities for smaller businesses to enter and thrive.
- Stronger regulations can promote fairer corporate taxation, potentially boosting tax revenues from major technology companies whilst promoting healthy market competition.

What the future might hold

Short-term trajectory:

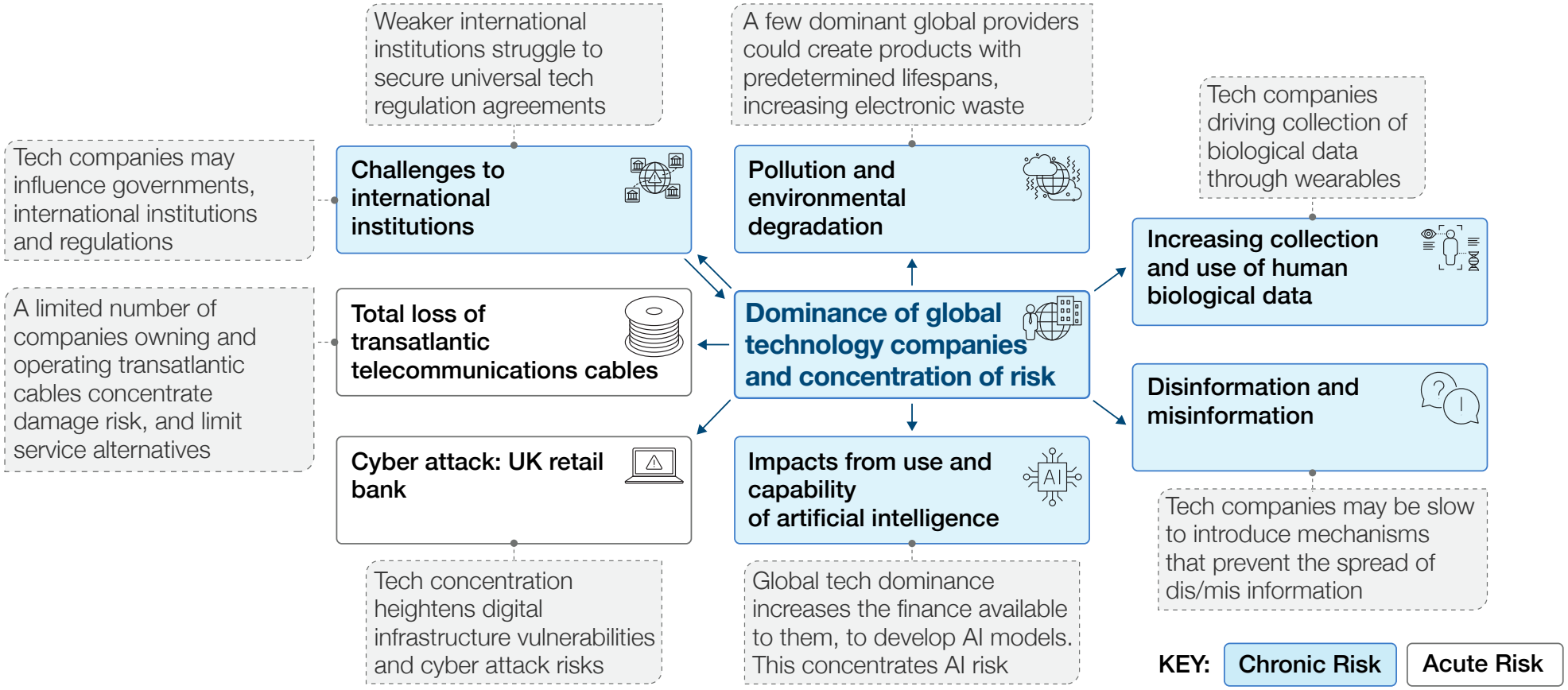
- While today's global technology leaders may retain their technological edge, emerging companies in East Asia could challenge their dominance.
- Increasing protectionism and fractured technological ecosystems might limit interoperability, potentially hindering innovation and widening the global digital divide.

Longer-term uncertainties:

- A few dominant companies could flex their influence by threatening to relocate unless governments meet their demands for low taxes and less regulation, potentially weakening governmental control.
- Distrust of large technology companies may lead to stronger regulatory measures and increased consumer resistance, creating opportunities for ethical start-ups to emerge as alternatives, driven by the demand for transparent and responsible business practices.

83 GOV.UK (2025) Digital and Technologies Sector Plan
84 CMA (2025) How the UK's digital markets competition regime works
85 Ofcom (2023) Cloud services market study

Example connections with other chronic and acute risks



Chronic Risk:

Impacts from use and capability of artificial intelligence (AI)

Definition

Artificial Intelligence (AI) refers to machines performing cognitive functions like learning, reasoning, decision-making, and problem-solving. While AI offers significant economic and societal benefits, rapid advancements pose enduring challenges, including outpacing safety measures, misuse, and potential disruptions to society and the economy. Balancing these risks and opportunities is crucial. The National Security Strategy[86] and the AI Opportunities Plan[87] highlight these huge opportunities as well as the serious and novel security risks that could emerge from AI. This assessment focuses on risks from cutting-edge frontier AI, highly capable models that can perform a wide range of tasks, although many of these risks also apply to a broader range of AI systems.

Current evidence

AI has rapidly evolved due to breakthroughs in machine learning, increased computing power (compute), and access to vast training datasets. In the 2010s, AI models began focusing on deep learning to identify patterns from large datasets to perform tasks without explicit programming. This advancement allowed a few large technology companies with significant data and computational resources to dominate the market, leading to a concentration of market power.[88]

The computational resources used to train AI models doubles every 3 – 4 months

86 HM Government (2025) National Security Strategy 2025: Security for the British People in a Dangerous World
87 DSIT (2025) AI Opportunities Action Plan
88 The Economist (2023) The race of the AI labs heats up

The computational resources used to train AI models is currently doubling every 3-4 months.[89] As compute resources have grown, so has the capability of AI systems.[90] AI systems can perform complex tasks like content generation, exam passing, and creating images from text prompts.[91]

AI's impact is multifaceted, with both positive potential and significant risks. AI is likely to bring huge gains in productivity with transformative economic impacts, as highlighted in the UK's AI Opportunities Action Plan.[92] However, AI systems can produce biased or harmful outputs due to biases in training data, leading to unfair decisions and outcomes. This issue could be exacerbated, for example, by a lack of diversity in people working on AI development, which can embed unconscious biases in the systems. Additionally, AI is vulnerable to data poisoning, where malicious actors insert harmful data to skew outputs. Privacy and copyright concerns are also rising due to the use of personal data in AI training. AI misuse presents risks, such as the creation of convincing disinformation and potential exploitation by threat actors in cyber, as well as lowering the barrier of entry to new actors. Generative AI can also be used as an enabler for criminal activities including fraud[93] and the production of child sexual abuse material (CSAM).[94] Furthermore, frontier AI could lead to more augmentation through AI and human collaboration within businesses rather than full automation. As businesses automate cognitive tasks, it could disrupt a range of industries and lower income tax yields as fewer people are in employment, affecting the tax base. Monitoring AI's influence on employment trends is crucial to understanding and mitigating these impacts. Increased use of AI could also exacerbate global inequality due to unequal access and ownership of technology and drive increased energy consumption.

Example vulnerabilities

- Biases in data availability/use around race, gender, ability and class might be perpetuated, meaning the impacts of AI could be particularly harmful for vulnerable groups.[95,96]
- Roles with repetitive tasks, such as in finance and insurance, are especially susceptible to automation from AI.[97]
- Progress in AI may heighten cyber attack risks and lower the barrier of entry to new threat actors.

89 DSIT (2023) Independent Review of The Future of Compute: Final report and recommendations
90 Kaplan, J. et al (2020) Scaling Laws for Neural Language Models
91 Government Office for Science (2023) Future Risks of Frontier AI
92 DSIT (2025) AI Opportunities Action Plan
93 Public Sector Fraud Authority (2024) Introduction to AI Guide with a focus on Counter Fraud
94 Home Office (2025) Britain's leading the way protecting children from online predators
95 O'Brien, N et al., (2023) Addressing racial and ethnic inequalities in data-driven health technologies
96 GCHQ (2023) The Ethics of Artificial Intelligence
97 DfE (2023) The impact of AI on UK jobs and training

Example mitigations

- The UK's AI Security Institute (AISI) advises governments on the scientific risks from advanced AI. Key areas of focus are testing advanced AI systems to advise policy leads on risks, fostering global collaboration across sectors and strengthening policy globally.
- The NHS AI lab was created to address challenges by bringing together government, health and care providers, academics and technology companies.
- In 2024, the UK announced the new Laboratory for AI Security Research. By partnering with world-leading experts from UK universities, the intelligence agencies and industry, this programme aims to boost Britain's cyber resilience and support growth.

Examples of additional benefits from taking action

- Safe use of AI can enhance efficiency, drive economic growth, increase tax revenues, and potentially improve work-life balance across various work settings.[98]
- AI can safely analyse complex information for diagnostics and aid in discovering new drugs and treatments for all demographics.
- Measures to assure AI can enhance efforts to mitigate the effects of an ageing population, detect illicit online materials, strengthen national security, predict hazards, aid disaster recovery, and develop new green technologies.

What the future might hold

Short-term trajectories:

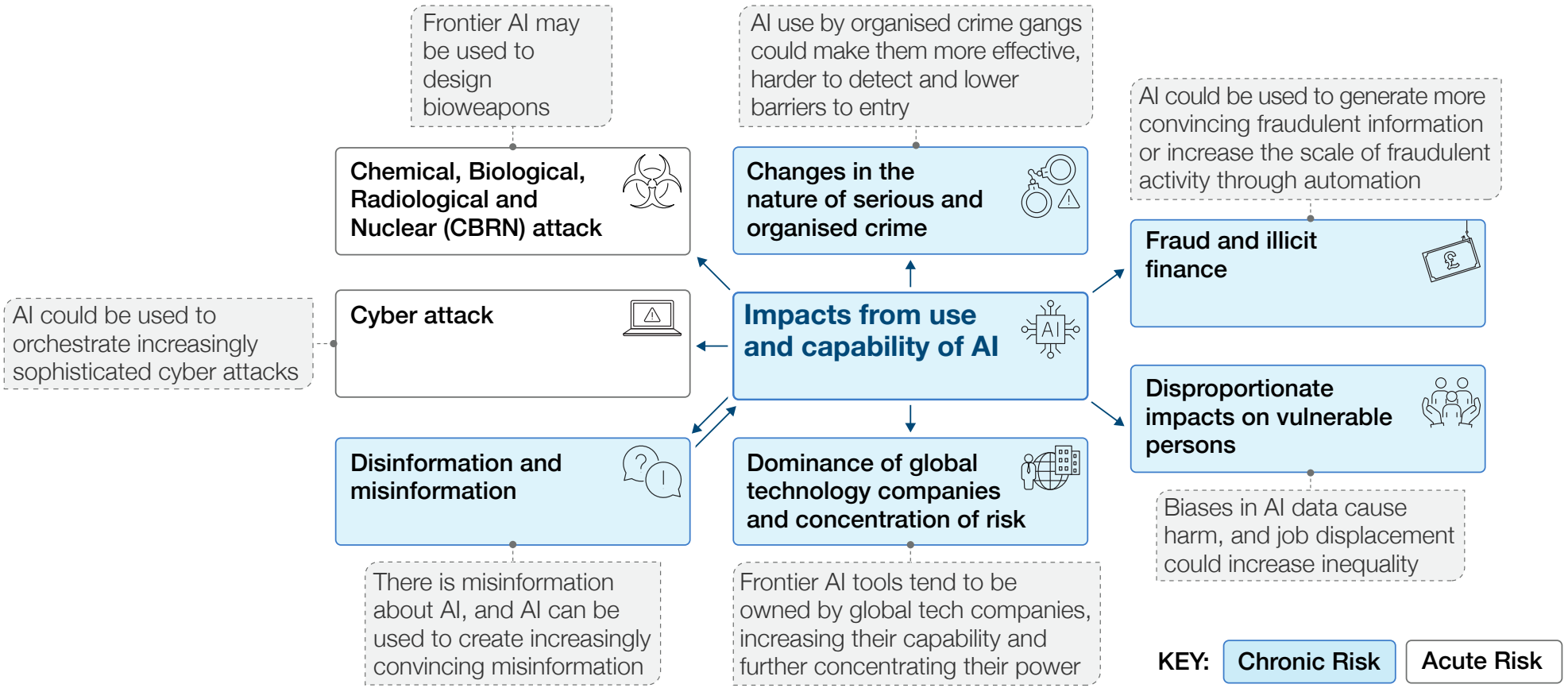
- AI enabled disinformation could increase mistrust in government, media, and technology companies, especially among those affected by job losses.
- Easier access to AI, particularly open-source models, could empower less sophisticated malicious actors, increasing security risks.

Longer-term uncertainties:

- The degree of job displacement and the creation of new roles remains uncertain. AI could significantly disrupt certain sectors, potentially leading to unemployment and a lack of training opportunities, igniting public discussions about the future of work and education. However, some roles may become more accessible through deskilling of positions by AI.
- As countries pursue both economic and military advantages, an AI arms race may ensue, making it harder to reach global consensus on long term management on its misuse.[99]

98 Brynjolfsson, E, Li, D & Raymond, L (2023) Generative AI at work
99 GOV.UK (2024) UK and its allies must stay one step ahead in new AI arms race

Example connections with other chronic and acute risks



Geopolitical

The international system has changed. Autocratic states challenge existing structures and systems. Key players including the United States, China, the European Union and Russia are wielding significant influence on global dynamics, compelling other actors to make clearer choices and intensifying competition over global norms, rules, and institutions. Persistent state threats have and will continue to manifest in various forms, such as espionage, foreign interference in political systems, sabotage, disinformation, and cyber operations, posing a heightened and escalated threat to the United Kingdom from state actors.

Chronic Risk:
Challenges to international institutions

Definition

Major international institutions, including the United Nations (UN), North Atlantic Treaty Organisation (NATO), World Trade Organisation (WTO), World Bank, and International Criminal Court (ICC), face challenges limiting their ability to promote global peace, security, wellbeing, and international cooperation effectively.

Current evidence

Many international institutions, such as key UN programmes, are hindered by funding shortages[100] and supported entirely by voluntary (and therefore unpredictable) contributions.[101] Internal bureaucracy can also paralyse international institutions, as is seen when International Criminal Court (ICC) judges fail to agree on the applications of new laws as they are all trained on their own national legislation.[102,103] Geopolitical tensions can hinder states' ability to reach agreement within international institutions, impeding their effectiveness. Tensions also arise due to disproportionate representation, with African nations in particular being underrepresented in international institutions.[104]

Only 8 people convicted by ICC over 17 years

100 UNRWA (2024) UNRWA's lifesaving aid may end due to funding suspension
101 Council on Foreign Relations (2024) Funding the United Nations, how much does the US pay?
102 Sterio (2020) The International Criminal Court: Current Challenges and Prospect of Future Success
103 Guilfoyle (2019) Lacking conviction: Is the International Criminal Court broken
104 House of Commons Library (2024) Reforming global institutions: Africa's perspective

Some funding shortages are persisting, with the UN reporting a shortfall of USD $46.4 billion to deliver the required amount of global humanitarian aid in 2024.[105] However, the picture is mixed here. Heightening geopolitical tensions have motivated more states to meet NATO's defence commitments, with 23 member states expected to invest 2% of their GDP to defence in 2024, up from just three states in 2014.[106] The UK is set to increase defence spending to 2.5% of GDP from April 2027.[107]

The influence of African states in international institutions is also rising as the African Union joined the G20 in 2024 and other institutions, such as the International Monetary Fund (IMF) and World Bank, have taken steps to address African underrepresentation.

Institutions continue to advance multilateral interests, as seen in the UN General Assembly's 2024 vote in favour of global AI governance.[108] The WTO's Enhanced Integrated Framework has helped the least developed countries reach key trading milestones,[109] yet challenges to international institutions still impact their ability to deliver. For example, rollbacks of food aid in several crisis-affected countries are undermining UN Humanitarian Aid efforts. Similarly, the ICC has struggled with case outcomes, securing only eight convictions in 17 years, largely due to weak cases and resource limitations.[110]

Example vulnerabilities

- Vetoed UN Security Council resolutions often allow conflicts to persist, obstructing critical aid and food supplies to crisis regions and further jeopardising the lives of vulnerable populations in these areas.
- A 2024 UNEP report found that full implementation of Nationally Determined Contributions (NDCs) could limit peak warming to 2.6-3.1°C, or 1.8-2.39°C in an optimistic scenario which combines NDCs with all the most stringent net-zero pledges countries have made. These are far above the 1.5°C limit that would avoid the worst impacts of climate change.[111]

Example mitigations

- In the 2023 Integrated Review Refresh, the UK committed to being a leading NATO contributor, developing its military according to NATO standards, and upholding its net-zero targets. The Prime Minister has stated his continued commitment to NATO as the cornerstone of UK security.[112]

105 UN Office for the Coordination of Humanitarian Affairs (2023) Global Humanitarian Overview 2024
106 NATO (2024) Defence expenditures and NATO's 2% guideline
107 GOV.UK (2025) Prime Minister sets out biggest sustained increase in defence spending since the Cold War
108 United States Mission to the United Nations (2024) Remarks by Ambassador Thomas-Greenfield at the UN Security Council Stakeout Following the Adoption of a UNGA Resolution on Artificial Intelligence
109 WTO (2024) EIF Phase Two Report: Delivering on Inclusive Trade for the LDS's
110 Sterio (2020) The International Criminal Court: Current Challenges and Prospect of Future Success
111 UNEP (2024) Emissions Gap Report 2024
112 HM Government (2025) PM meeting with Secretary General of NATO Mark Rutte: 27 March 2025

- As a permanent member of the UN Security Council, the UK wields significant influence, advocating for permanent African representation and permanent seats for India, Germany, Japan, and Brazil.[113] Its active participation in the UN Security Council and General Assembly helps the UK maintain its influence in multilateralism.
- The UK contributes to multilateral institutions like the UN and World Bank, pledging over £200 million at COP 29 to halt and reverse deforestation in forest-rich nations, supporting global efforts to tackle climate change.[114] The UK has also stepped up to provide additional shareholder support through a £100 million hybrid capital contribution to the World Bank, while supporting measures to stretch the International Bank for Reconstruction and Development's financial capacity by as much as USD $150 billion over 10 years.[115]

Examples of additional benefits from taking action

- Through collaboration with allies and international institutions, the UK can more effectively address state threats, terrorism, and other crimes.
- By supporting the work of organisations like the EU and UN, the UK can continue to contribute to the successful reduction of global greenhouse gas emissions. The plan to reset the UK's relationship with the EU may also help to reduce barriers to trade and encourage closer cooperation in areas like security and law enforcement.[116]

What the future might hold

Short-term trajectories:

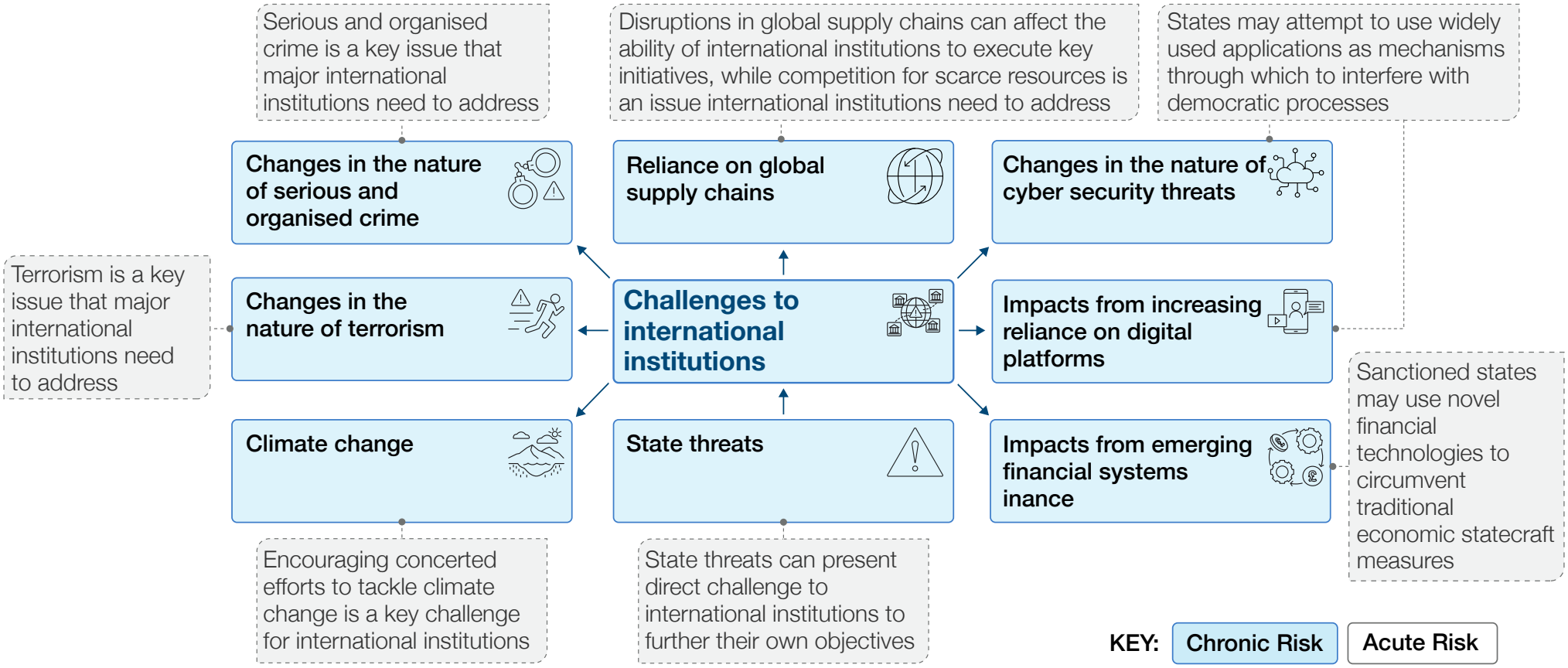
- Increasing geopolitical instability and rising tensions among major powers may destabilise regions reliant on humanitarian services and aid, making it harder to maintain diplomatic ties and potentially escalating hostilities and terrorism.

Long-term uncertainties:

- As funding priorities shift toward humanitarian crises in unstable regions, climate change mitigation may receive inadequate support, hindering international initiatives and exacerbating environmental and socio-economic challenges.
- A lack of support for global health organisations could elevate public health risks and undermine preparedness and response efforts, increasing the likelihood of widespread health crises.

113 FCDO (2023) The UK calls for Security Council expansion: UK statement at the UN General Assembly
114 DESNEZ (2023) UK unveils funding boost to help forest nations fight climate change low carbon technologies
115 HM Government (2024) World Bank 110th Development Committee meeting 2024: UK Governor's statement
116 House of Commons Library (2025) Resetting the UK's relationship with the European Union

Example connections with other chronic and acute risks



Chronic Risk:
State threats

Definition

State threats are actions by foreign governments which fall short of direct armed conflict but go beyond peaceful diplomacy and expected statecraft to harm or threaten the safety or interests of the UK or our allies.

Current evidence

The UK has always been subject to state threats, however, rapid geopolitical change across the globe is resulting in an increasingly volatile and contested world.[117,118] There is now also an increasing global cyber security threat landscape from the emergence of state-aligned actors.[119] These changes mean the international security environment may deteriorate in the coming years, with state threats increasing and diversifying.

State threats present a real and evolving risk to the UK and our allies. They can manifest in a range of forms and include: information acquisition, physical threats to people, threats to assets and services, foreign interference, and activity that undermines international freedom and stability.

States use espionage to gather intelligence

117 HM Government (2021) Global Britain in a Competitive Age: the Integrated Review
118 HM Government (2023) Integrated Review Refresh 2023
119 National Cyber Security Centre (2023) NCSC Annual Review 2023

States may seek protected data through both overt and covert means, undermining UK interests. States can also harm the UK using various methods including cyber attacks, physical actions, economic measures, and traditional espionage.

States may also seek to interfere with UK democracy and UK institutions in a manner which offers them strategic or competitive advantage. Furthermore, they may also seek to use various technical and non-technical methods to acquire our information for economic, competitive, or military advantage. These examples demonstrate the range of negative impacts foreign states can have on the UK short of direct armed conflict. Reacting to the changes in the nature and frequency of these threats is essential for national security.

Example vulnerabilities

- The UK public may be a target for state-sponsored campaigns to spread disinformation, influence public opinion or cause public harm..
- Nation states sponsor cyber attacks on UK businesses and research institutions to generate revenue through ransomware or steal sensitive information like intellectual property.[120]
- Government and citizen data are attractive targets for espionage attempts with the intent to gather confidential or otherwise sensitive information.

Example mitigations

- The National Security Act 2023 enables law enforcement and intelligence agencies to deter, detect, and disrupt the full range of modern-day threats alongside the use of specialist resources targeted towards countering sophisticated activity.
- The National Security and Investment Act 2021 upgraded the UK's investment screening powers, allowing the Government to scrutinise and intervene in business transactions to protect national security.
- The National Protective Security Authority is the UK's National Technical Authority for physical and personnel security responsible for maintaining expertise in counter-terrorism and state threats across government, police, industry and academia.
- Land, sea and air border controls protect the UK by making it difficult for foreign intelligence services to conduct operations in UK territory.

Examples of additional benefits from taking action

- A reduced influence and impact of state threats improves the safety and security of UK digital and physical assets, creating a safer environment for UK nationals and UK-based individuals against the threats from criminal or terrorist activity.
- Mitigating cyber attacks, intellectual property theft, and espionage helps protect businesses, ensuring economic stability and safeguarding innovation, trade, and investments.

120 NCSC (2022) NCSC Annual Review 2022

What the future might hold

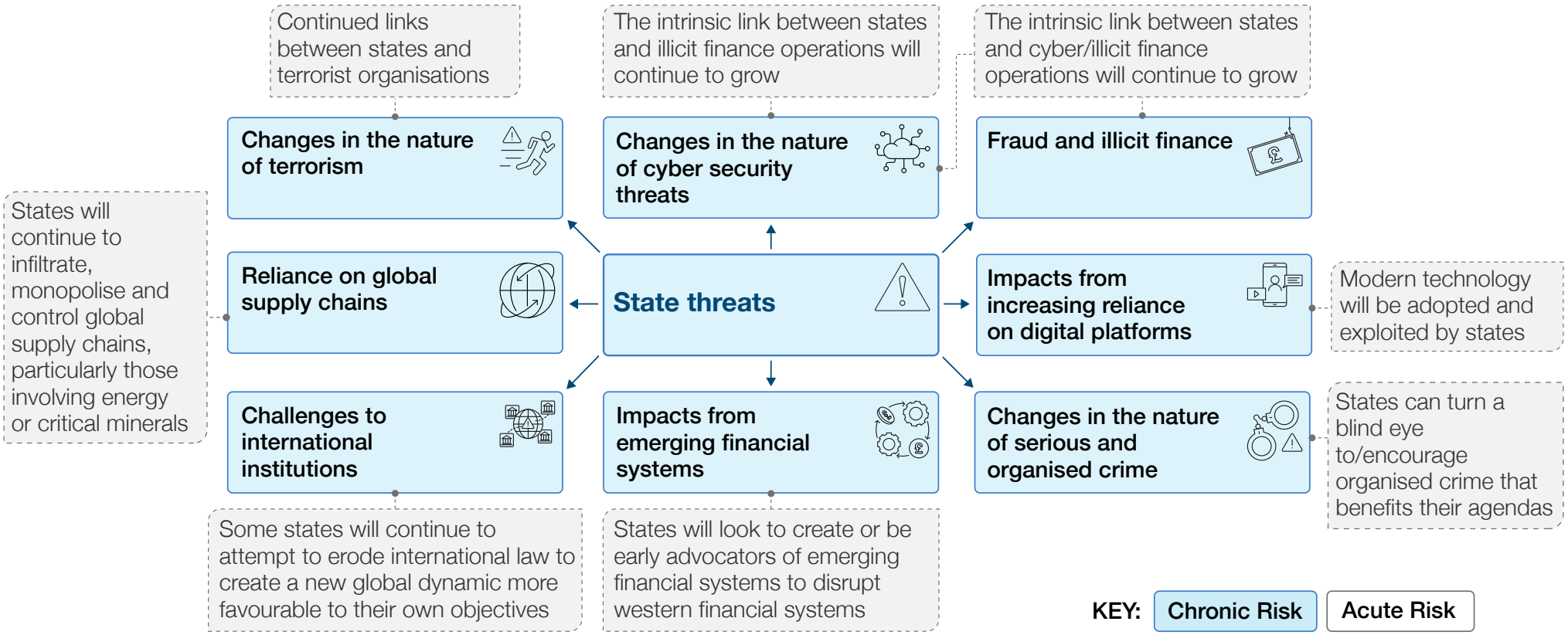
Short-term trajectories:

- Increasing global tensions could trigger a rise in state activity. This could include growing adversary alliances, proxy use of criminal organisations, shifts in adversary intent calculations and lower barriers to entry through technological advancements, leading to a potentially wider pool of challenger actors.
- States could utilise artificial intelligence (AI) to conduct effective information operations seeking to undermine social cohesion.

Longer-term uncertainties:

- Advances in AI could be used by state-linked threat actors to develop new surveillance technologies, and/or for creating disinformation campaigns.
- Increased competition for critical minerals could lead to heightened geopolitical tensions.
- The risk of future conflict may increase the use of offensive cyber pre-positioning against sites of critical interest in the UK.

Example connections with other chronic and acute risks



Environmental

Accelerating climate change, biodiversity loss, and pollution will have cascading, compounding impacts, which will amplify threats to national and international security. Impacts, though unevenly distributed, are likely to increase resource competition (including over water, food, energy, land and critical minerals), intensifying conflict, political instability and displacement.

Chronic Risk:
Climate change

Definition

Climate change refers to long-term shifts in temperatures and weather patterns. It is caused by increasing concentrations of greenhouse gases in the atmosphere caused by human activity. These gases stop heat from escaping into space, and act as a warming blanket around the Earth. Even if global net zero emissions are reached and global temperatures stabilise, further climate impacts like rising sea levels will continue.

Current evidence

Human activities, such as burning coal, oil, and gas, along with land-use changes, generate greenhouse gases (GHGs). These actions have dramatically increased atmospheric concentrations of carbon dioxide, methane, and other greenhouse gases, driving a rise in global temperatures. Since the early 20th century, carbon dioxide levels have surged by 40%,[121] reaching levels not observed in at least 2 million years.[122]

The global average surface temperature has increased by approximately 1.3°C since pre-industrial times[123] and the past ten years (2015-2024) are the ten warmest years on record. Rising temperatures have led to more frequent and severe extreme weather events, including heavy rainfall and heatwaves.

5.5 million homes and businesses are at risk of flooding in the UK

121 NASA (2023) Carbon Dioxide
122 DESNZ (2023) Climate change explained
123 Betts et al. (2023) Approaching 1.5 °C: how will we know we've reached this crucial warming mark?

These changes have also contributed to a global sea-level rise of about 21cm since 1900,[124] caused by melting polar ice and thermal expansion. Unless we rapidly reduce emissions, global warming of 1.5°C (calculated as the average temperature over decades) is likely to be reached in the early 2030s.[125] The Climate Change Committee[126] and House of Lords[127] have highlighted that inadequate planning and maladaptation to climate change in the UK could worsen these outcomes.

Every increment of warming brings more frequent hazards, such as flooding, heatwaves, and droughts. These impact public health and threaten lives, infrastructure, and ecosystems. In the UK, 5.5 million homes and businesses face flooding risks, for example, Storm Babet (October 2023) affected 2,100 properties.[128] Additionally, unplanned recovery and repair costs are higher than from planned adaptation.[129] Agriculture and fisheries also face challenges, such as increased soil erosion which is reducing crop yields and algal blooms, costing fisheries £224 million annually.[130] Coastal erosion and increased flooding make it harder to insure properties, leaving many vulnerable. Adaptation in the built and natural environments is needed to address these challenges.

Example vulnerabilities

- Vulnerable groups, including older adults, children, low-income individuals and those in poor health, face disproportionate impacts from temperature changes and climate-related diseases.
- Rural and coastal areas are disproportionately affected by climate change as farms and fisheries become less viable. Urban areas with limited green spaces also face increased risks related to heat and flooding due to poor rainwater absorption, overwhelming drainage systems.
- Businesses are vulnerable to climate-related supply chain disruption, damage to buildings, and absences from work due to transport disruption or climate-related illness.

124 European Environment Agency (2022). Global and European sea level rise
125 IPCC (2023) Climate Change 2023 Synthesis Report
126 Climate Change Committee (2023) Progress in adapting to climate change: 2023 report to Parliament
127 House of Lords Library (2023) Preparing for climate change
128 Environment Agency (2023) Flood Action Week: Households need to know their flood risk after 2023's record breaking weather
129 UN (2019) For Every Dollar Invested in Climate-Resilient Infrastructure Six Dollars Are Saved
130 LSE (2022) What will climate change cost the UK?

Example mitigations

- Building on the Climate Change Act 2008,[131] the UK aims to achieve net zero emissions by 2050, with the Government's mission to transform Britain into a Clean Energy Superpower as central to this commitment.
- The Third National Adaptation programme (2023-2028) includes a £15 million research fund and a Local Authority Climate Service pilot.[132]
- The UK has invested £5.2 billion in flood defences[133] and contributes up to £60 million internationally for climate related loss and damage.[134]

Examples of additional benefits from taking action

- Mitigating climate change and implementing adaptation measures enhances economic resilience by reducing vulnerability to extreme weather and enabling faster disaster recovery.
- Climate adaptation actions can support vulnerable communities, promote social equity, reduce poverty, and improve wellbeing by building resilience to climate impacts.
- Climate action can also improve public health, reduce NHS costs, enhance energy security, and help to preserve and promote biodiversity.

What the future might hold

Short-term trajectories:

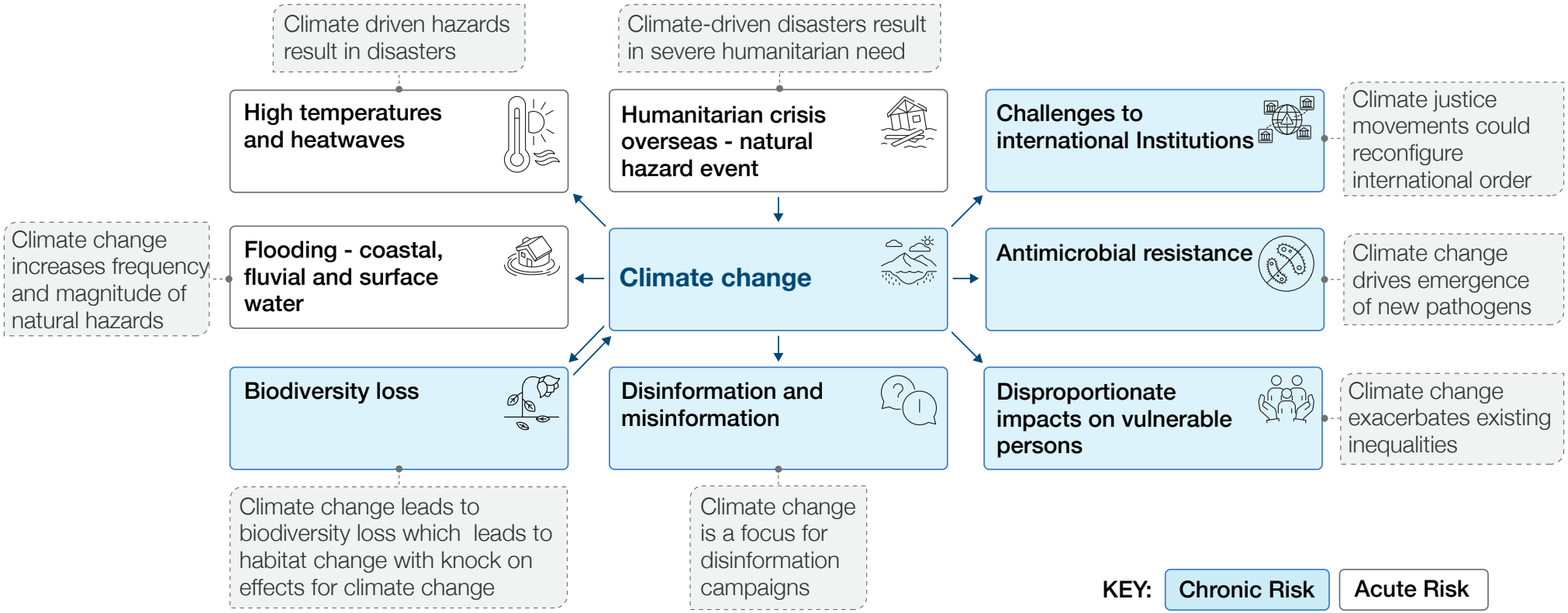
- People may increasingly need to remain at home to stay safe from extreme weather, which could have wider implications for the economy.
- Hotter, drier summers might lead to more heat-related morbidity and mortality, transport disruptions, droughts, water shortages and increased wildfire incidents.
- Animal welfare issues may emerge as livestock perish in heatwaves, affecting farming livelihoods. Failures in the global agriculture supply chain could lead to food shortages, which would impact health, inflation, social cohesion, and farmers' incomes.

Longer-term uncertainties:

- Rising sea levels could disrupt UK sea ports and impact food imports, while overheating data centres caused by hotter climates may disrupt public and emergency services.
- Urban planning could prioritise green spaces and farmers may choose to diversify crops, making livelihoods more resilient to climate change.

131 HM Government (2024) Climate Change Act 2008
132 DEFRA (2023) The third National adaptation Programme (NAP3) and the fourth strategy for climate adaptation reporting
133 Defra and National Audit Office (2023) Resilience to flooding
134 PM Office (2023) PM to call for 'era of action' at COP28 climate summit

Example connections with other chronic and acute risks



Chronic Risk:
Biodiversity loss

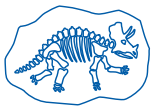
Definition

Biodiversity is the variety of all life on Earth. It includes all species of flora, fauna and fungi. Biodiversity loss describes the decline in the number, genetic variability, and variety of species. It undermines ecosystems' ability to function effectively and efficiently, which directly impacts the economy and human wellbeing.

Current evidence

Researchers have identified five important drivers of biodiversity loss at both global and local levels: climate change, habitat loss and degradation, pollution, invasive species, and overexploitation—including the illegal wildlife trade.[135] For example, the ongoing use of non-selective herbicides and pesticides is resulting in declining plant and invertebrate populations.[136] Invasive Non-Native Species (INNS) can exacerbate biodiversity loss by outcompeting native species and spreading diseases to new areas.

Since 1970 at least 75% of the world's land surface and 66% of the ocean have been significantly altered and degraded by human activity.[137] Globally, 420 million hectares of forest—an area larger than India—have been lost to land conversion since 1990.[138]



42,100 species face extinction

135 UNEP (2023) Five drivers of the nature crisis
136 Ibid
137 IPBES (2019) The global assessment report on biodiversity and ecosystem services
138 FOA and UNEP (2020) The State of the World's Forests 2020

The UK has a direct and indirect role in this land use change; in 2021 the UK was responsible for an estimated 30,656 hectares of tropical deforestation globally, through the consumption of crop, cattle and timber commodities.[139] In 2023, an estimated 42,100 species were at risk of extinction worldwide,[140] with monitored populations of mammals, fish, birds, reptiles, and amphibians having decreased by over 69% between 1970 and 2018.[141] Of the 10,008 British species assessed in the 2023 State of Nature report, nearly one in six species are threatened with extinction from Great Britain.[142]

The World Economic Forum estimates that USD $44 trillion in economic value—over half of the world's total GDP—relies moderately or heavily on nature and its services, making it vulnerable to the impacts of biodiversity loss.[143] This loss affects the availability of raw materials (such as food, timber, cotton, and plant-based pharmaceutical compounds) as well as essential ecosystem functions like water and air purification, pollination, nutrient cycling and homeostasis. In the UK, biodiversity loss can have a significant impact on the economy, environment, and culture by disrupting global supply chains and causing direct domestic effects.

With approximately 69% of the UK's land area dedicated to agriculture,[144] the decline in pollinators and other beneficial invertebrates that control crop pests (such as beetles, wasps, and spiders) can reduce crop yields. This is especially concerning for nutrient-rich fruits and vegetables, which are vital for preventing non-communicable diseases.[145]

Example vulnerabilities

- Biodiversity decline increases the risk of disease and may limit potential medical discoveries, with around 70% of cancer drugs being found in nature or being nature-inspired.[146]
- Overfishing is negatively impacting food supplies and livelihoods in coastal communities in the UK and beyond.
- Food security is at risk from declining pollinators, pest-controlling species, and reduced agrobiodiversity, with crop diversity shrinking by 75% in the 20th century.[147]

139 DEFRA (2023) K1: Global environmental impacts of UK consumption of key commodities
140 IUCN (2023) IUCN SSC statement on World Wildlife Day
141 WWF (2022) Living Planet Report 2022 – Building a nature positive society
142 State of Nature (2023) The most comprehensive report on the UK's current biodiversity
143 WEF (2020) Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy
144 DEFRA (2022) Agricultural Land Use in United Kingdom at 1 June 2022
145 The Lancet Planetary Health (2022) The lost opportunity from insufficient pollinators for global food supplies and human health
146 WEF (2020) Nature Risk Rising: Why the crisis engulfing nature matters for business and the economy
147 FAO (2010) Crop biodiversity: use it or lose it

Examples of additional benefits from taking action

- Access to green and blue spaces enhances physical and mental health, potentially saving the NHS £2.1 billion annually.[148]
- Protecting and improving nature can boost the economy through job creation, tourism, and local community investment.
- Harnessing natural processes and rehabilitating ecosystems, such as restoring mangroves, can tackle environmental challenges and help avoid significant damage costs. For example, nature based solutions are estimated to save USD $57 billion in flooding damages in China, India, Mexico, Vietnam and the US each year.[149]

Example mitigations

- The Global Biodiversity Framework (Kunming-Montreal) aims to restore 30% of degraded land and ocean by 2030,[150] with the UK's £100 million Biodiverse Landscapes and Blue Planet funds supporting this target.[151]
- The Environment Act (2021) and the 2023 Environmental Improvement Plan (EIP) set legal and actionable targets to halt nature and biodiversity decline, including significant investments in habitat restoration and marine protection.[152] A revised EIP is due to be published in 2025.
- The 3rd National Adaptation Programme sets out the actions that the UK government and others will take for reducing biodiversity loss under a changing climate.

What the future might hold

Short-term trajectories:

- Climate change, population growth, and natural resource overconsumption, including land use change, may accelerate biodiversity loss and may increase other risks including threats to human and animal health.[153]
- Pollution from industrial waste and fertilizers could become a major driver of biodiversity loss, creating 'dead zones' in coastal ecosystems.[154]
- The undervaluation of nature in markets and the collapse of sensitive ecosystems could be very costly to the global economy.

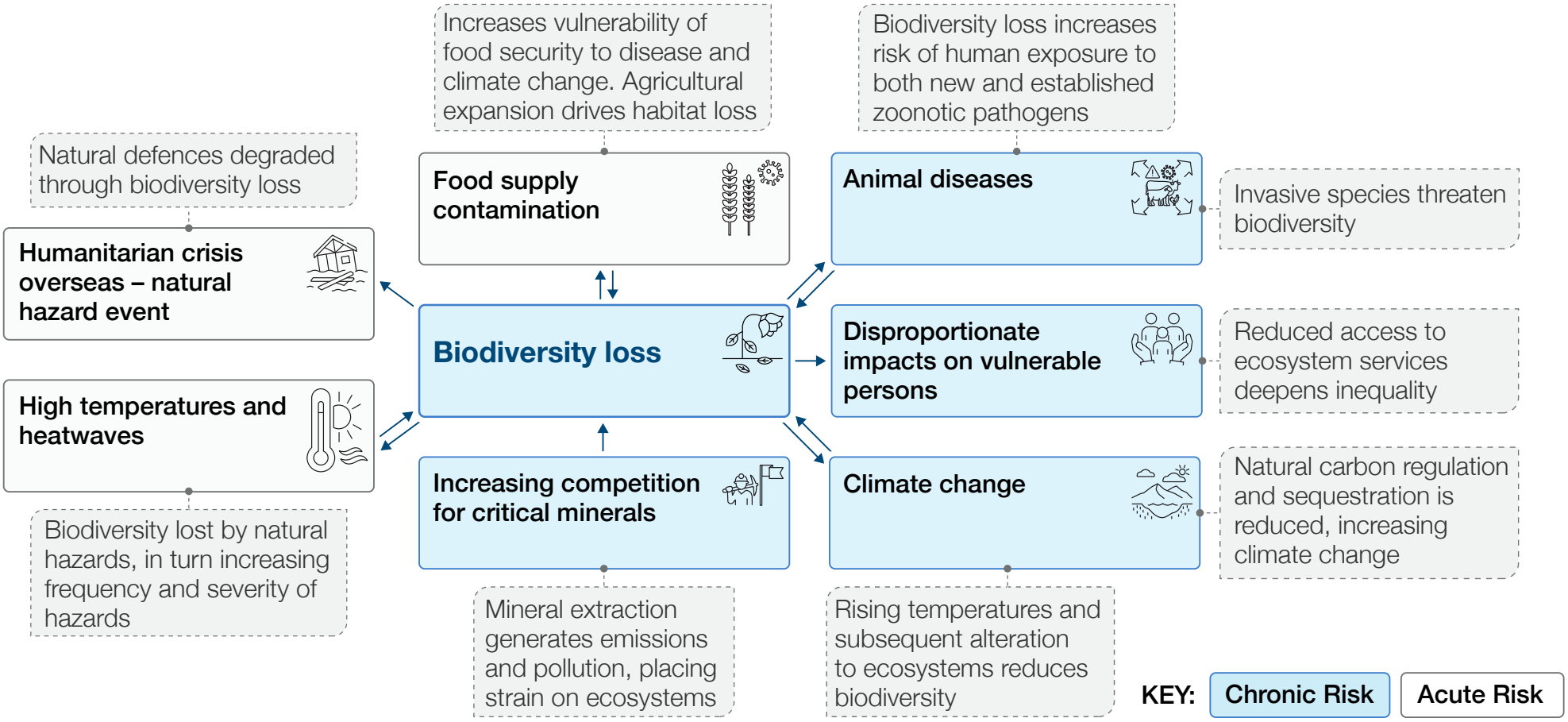
148 PHE (2020) Improving access to greenspace: A new review for 2020
149 ICUN International Union for Conservation of Nature
150 CBD (2022) COP15: final text of the historic Kunming-Montreal Global Biodiversity Framework
151 DESNZ, DEFRA and FCDO (2023) 2030 Strategic Framework for International Climate and Nature Action
152 DEFRA (2023) Environmental Improvement Plan 2023
153 CO (2023) Integrated Review Refresh 2023: Responding to a more contested and volatile world
154 IPBES (2019) The global assessment report on biodiversity and ecosystem services

Longer-term uncertainties:

- Worsening climate change could lead to species extinction, ecosystem degradation, and reduced ability of nature to buffer climate effects,[155] increasing habitat destruction and endangering human lives.
- Rising temperatures may push species out of their natural habitats, allowing invasive non-native species to outcompete native wildlife. In parallel, ocean acidification and algal blooms may disrupt marine food chains, resulting in food and livelihood losses, increased migration, and heightened poverty.
- The economic and health consequences of biodiversity loss could lead to legal actions against corporations and governments that fail to address the issue, resulting in costly compensations and prompting swift reforms to prevent further litigation.

155 DESNZ, DEFRA and FCDO (2023) 2030 Strategic Framework for International Climate and Nature Action

Example connections with other chronic and acute risks



Chronic Risk:
Increasing competition for critical minerals

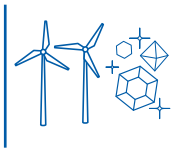
Definition

Minerals are considered critical if they are vitally important to the economy and are also experiencing major risks to their security of supply. These risks can be caused by combinations of factors including, but not limited to, rapid demand growth, high concentration of supply chains in particular countries, or elevated levels of price volatility. Many of these critical minerals are produced in comparatively small volumes or as companion metals (i.e., produced as by-products financially dependent on other mining activities), are non-substitutable in their applications, and have low recycling rates.

Current evidence

Global consumption of raw materials is rising due to growing living standards[156] and a shift to clean energy technologies.[157] Furthermore, critical minerals are often by-products or co-products of mining for other commodities. This can lead to challenges in ensuring sufficient resources as supply and demand are disconnected.[158]

To reach global climate targets, the International Energy Agency (IEA) assessments show the world's total mineral demand for clean energy technologies will double between 2023 and 2030 in a scenario that reflects the 2023 policy settings, almost triple by 2030 under an Announced Pledges Scenario, and quadruple by 2040 in the Net Zero Emissions by 2050 Scenario.[159]



The world's total mineral demand will triple by 2030 if 2023 clean energy pledges are to be kept per annum

156 UNEP (2024) Global Resource Outlook 2024
157 IEA (2023) Critical minerals market sees unprecedented growth as clean energy demand drives strong increase in investment
158 DBT & BEIS (2023) Resilience for the Future: The UK's Critical Minerals Strategy
159 IEA (2024) Global critical minerals outlook 2024

This introduces a potential vulnerability in our energy systems as we shift from fuel-intensive to material-intensive technologies,[160] since the production and processing of many critical minerals are more geographically concentrated than oil or natural gas and, as a result of by-product status and long lead-times for new production, have lower supply elasticity in response to demand shocks. This leads to an overdependence on certain countries, further destabilising already volatile supply chains.

Increased demand for critical minerals, aligned to supply chain disruptions and rising mineral prices, threaten to increase the cost of clean energy technologies[161] and slow their deployment. For example, lithium supply is estimated to fulfil only half of projected requirements to meet 2035 Announced Pledges Scenario goals.[162] Industries heavily dependent on critical minerals, such as the next generation telecoms sector, could suffer during shortages leading to reduced economic growth and potential job losses.

Example vulnerabilities

- Net Zero businesses could struggle to develop and scale-up clean energy technologies due to supply chain disruption and associated price shocks.
- The UK defence sector's ability to deploy cutting-edge military capability is dependent on critical minerals. Sustained supply chain disruption could reduce the UK's freedom of action.[163]
- Without strong regulation, mining and downstream processing can also lead to localised environmental and humanitarian concerns such as increased emissions, water stress, biodiversity loss, human rights violations and corruption.[164]

Example mitigations

- The UK Critical Minerals Intelligence Centre (CMIC) has been established to deliver up-to-date data and analysis to define an evolving list of critical minerals that are essential to the UK economy.[165]
- Building on the UK Critical Minerals Intelligence Centre's updated criticality assessment, government will work with industry to publish a new Critical Minerals Strategy in 2025 to help secure supply chains in the long term and drive forward green industries.

160 IEA (2021) The Role of Critical Minerals in Clean Energy Transitions
161 IEA (2022) World Energy Outlook 2022
162 IEA (2024) Global critical minerals outlook 2024
163 DBT & BEIS (2023) Resilience for the Future: The UK's Critical Minerals Strategy
164 UK Parliament (2019) Access to critical materials
165 Critical Minerals Intelligence Centre (2025) CMIC Interactive Map

- Funding has been deployed to develop and strengthen domestic critical mineral supply chains by boosting the circular economy,[166] and Defra is preparing a Circular Economy Strategy.
- The International Organisation for Standardisation (ISO) has enabled collaboration between UK experts and the British Standards institution to develop global technical and sustainable supply chain standards.

Examples of additional benefits from taking action

- More reliable supply chains will reduce costs and delays, helping to accelerate projects supporting the transition to net zero.
- By supporting a transition to a circular economy, including through advanced R&D to alleviate pressure on primary mineral supply, it will also reduce waste and energy use.
- Reduced standards-related friction in international critical minerals trade worldwide.

What the future might hold

Short-term trajectories:

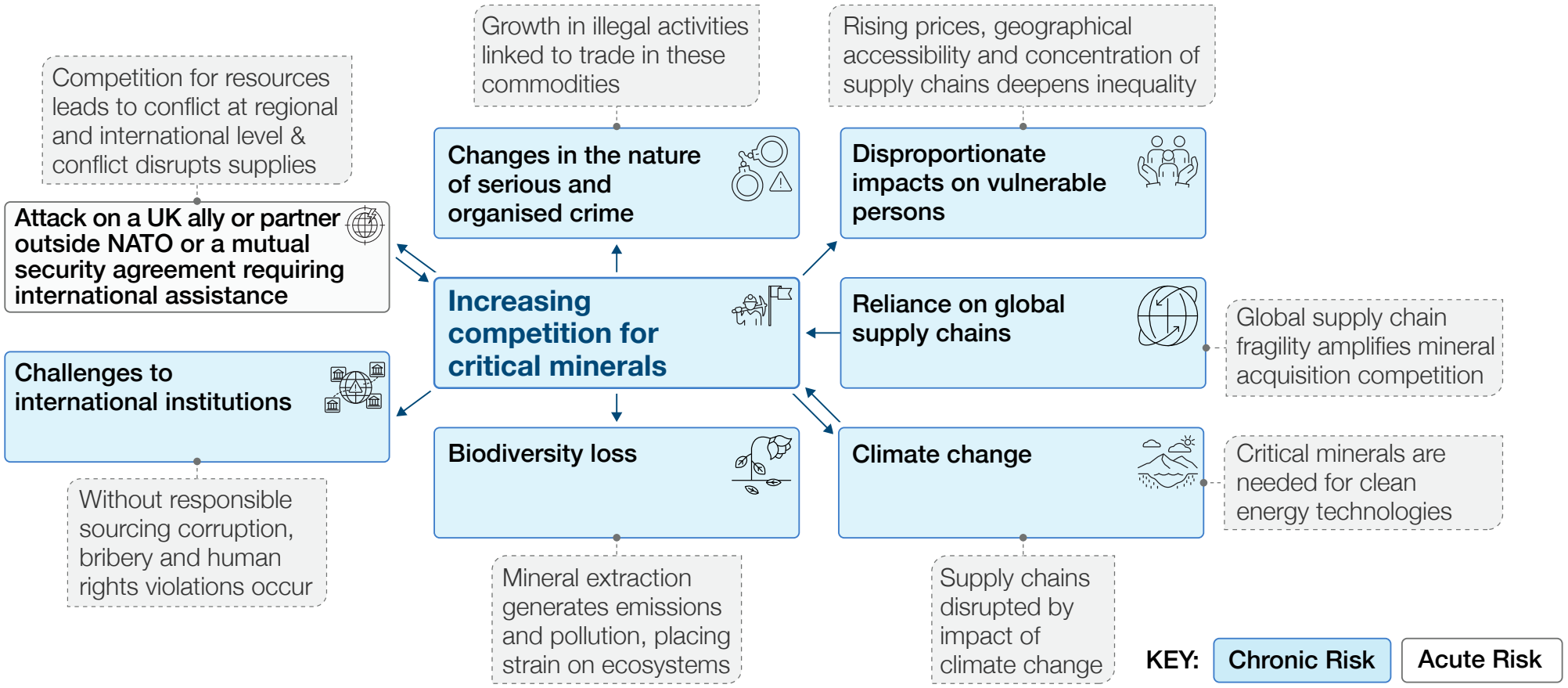
- High-risk minerals, such as tellurium and rare earth elements, needed for solar power and offshore wind turbines, may become harder to source, increasing already high rates of price volatility which has knock-on effects for both investors and consumers.
- Countries with large reserves as well as processing and refining capabilities of critical minerals could gain further geopolitical influence by controlling their supply.
- Emerging economic powers may form additional new trade agreements with current UK trade partners, undercutting UK partnerships and disrupting supply chains.[167,168]

Longer-term uncertainties:

- Disrupted supply chains could create shortages of essential minerals needed for the transition to net zero, escalating geopolitical tensions.
- The pressure on primary supply could be alleviated if the UK transitioned to a circular economy, for example, by increasing material re-use and end-of-life recycling rates.

166 DBT, Innovate UK, Nusrat Ghani (2023) £15 million funding boost to strengthen supply of critical minerals
167 IEA (2022) Africa Energy Outlook 2022
168 IEA (2023) Latin America's opportunity in critical minerals for the clean energy transition

Example connections with other chronic and acute risks



Chronic Risk:
Pollution and environmental degradation

Definition

Pollution refers to contaminants that are offensive or negatively impact human, animal, plant and environmental health. It can come in various forms, such as physical (including light, heat, and noise), biological, chemical, and emerging contaminants (for example, pharmaceuticals, industrial pollutants, nanomaterials, and per- and polyfluoroalkyl substances (PFAS), each with distinct sources, impacts on biological systems, and characteristics.

Current evidence

Industrialisation, urbanisation and agricultural development have harmed the environment with successive waves of pollutants. In parallel, population growth, rising incomes and changing consumption patterns have led to an increased demand for resources, energy, and transportation, which creates pollutants like nitrogen oxides (NOx) and particulate matter (PM).[169] More recently, thermal, noise, light and pharmaceutical pollution have been recognised as an increasing concern.[170,171,172] Wider environments like space are also at risk of pollution and degradation, with 3,000 decommissioned satellites already littering space, putting live satellites at risk.

Soil Pollution costs the UK £1.2 billion per annum

169 Defra (2019) Air quality: explaining air pollution – at a glance
170 Clark, C. et al. (2020) Evidence for Environmental Noise Effects on Health for the United Kingdom Policy Context
171 Azman, M. I. (2018) A brief overview on light pollution
172 Wilkinson, J. et al. (2021) Pharmaceutical pollution of the world's rivers

Agricultural runoff and the discharge of untreated sewage are the leading causes of river pollution in the UK,[173] with a significant portion eventually making its way into the seas. Additionally, 60–80% of litter is plastic, of which almost 10% ends up in the ocean directly or indirectly (as microplastics), highlighting the transboundary nature of pollution.[174,175] Recently, microplastics have been detected near Mount Everest's peak,[176] persistent organic pollutants (POPs) and mercury have been identified in animals in the North American Arctic,[177] and many PFAS have been found in the blood of people and animals globally.[178] Air pollution levels in urban regions of the UK, specifically nitrogen dioxide and particulate matter levels, have decreased since the 1990s.[179] However, there are still instances where legal thresholds are surpassed, with ozone levels increasing in recent years.[180]

Pollution contributes to societal inequalities and constitutes an ongoing threat to human and planetary health.[181] Chronic exposure to pollutants, even at low doses, can lead to bioaccumulation and is a significant risk factor for a number of diseases.[182] For example, in 2020 Public Health England stated that air pollution was the greatest UK environmental public health threat.[183] Pollutants can also contaminate food and pose a risk to human health. For instance, exposure to cadmium from fertilisers has been linked to an increased incidence of osteoporosis in a number of EU countries.[184] At an environmental level, soil pollution impacts soil fertility and crop yields,[185] costing the UK £1.2 billion a year.[186] Whilst our understanding of the impacts of pollution is improving, it is likely that there are still many unknown consequences for planetary and human health from long-term exposure to complex mixtures of pollutants.

173 House of Commons (2022) Water Quality in Rivers, Fourth Report of Session 2021-22
174 Rellán, A.C. et al (2023) Sources, sinks and transformations of plastics in our oceans
175 Napper, I. and Thompson, R. (2019) Marine Plastic Pollution: Other than microplastics
176 Napper, I. E. et al. (2020) Reaching New Heights in Plastic Pollution—Preliminary Findings of Microplastics on Mount Everest
177 Arctic Council (2023) Contaminant issues: POPS and Mercury
178 US Environmental Protection Agency (2023) PFAS Explained
179 POST (2023) Urban outdoor air quality
180 Ibid
181 Fuller, R. (2022) Pollution and health: a progress update
182 K. Chojnacka, M. Mikulewicz (2014) Bioaccumulation
183 Public Health England (2023) Improving outdoor air quality and health: review of interventions
184 Ougier, E. et al. (2021) Burden of osteoporosis and costs associated with human bio monitored cadmium exposure in three European countries: France, Spain and Belgium
185 European Environment Agency (2022) Soil pollution and health
186 Environment Agency (2023) Summary of the state of the environment: soil

Furthermore, should a pollution tipping point be breached, where gradual accumulation of pollutants results in a significant change, it would have a significant knock-on effect for other globally important systems including freshwater, biodiversity, and nitrogen and phosphorus dynamics.[187]

Example vulnerabilities

- Younger children, older adults, and those with underlying health conditions, are most vulnerable to pollution.
- Air and water pollution pose a threat to species such as lichen, frogs, and otters, while light pollution affects insect and songbird populations. Meanwhile, marine species are harmed by pollutants entering the oceans.

Example mitigations

- The Government's clean energy mission promotes investment in renewable energy sources, electric vehicles, and carbon capture technologies, which are essential for reducing overall pollution levels.
- The Environment Act 2021 provides legislative support by setting specific targets for air and water quality, waste management, and biodiversity conservation.[188]
- The Clean Air Strategy 2019 outlines initiatives to cut emissions in sectors such as transport, agriculture, and industry, with the aim of enhancing air quality and safeguarding ecosystems.[189]
- The Circular Economy Package focuses on reducing waste and optimising resource use, supported by specific bans and taxes on plastic waste.[190]

Examples of additional benefits from taking action

- Enhancing the quality of local spaces for residents and visitors will improve community wellbeing and may boost tourism.
- Removing or preventing pollutants from entering the environment will have a positive effect on plant and animal health.
- Reduced pollution and environmental degradation can help mitigate climate change and improve public health, reducing burden on the health system.

187 Rockström et al. (2009) Planetary Boundaries: Exploring the Safe Operating Space for Humanity
188 UK Parliament (2024) Environment Act 2021
189 UK Government (2019) Clean air strategy 2019
190 Defra (2020) Circular Economy Package policy statement

What the future might hold

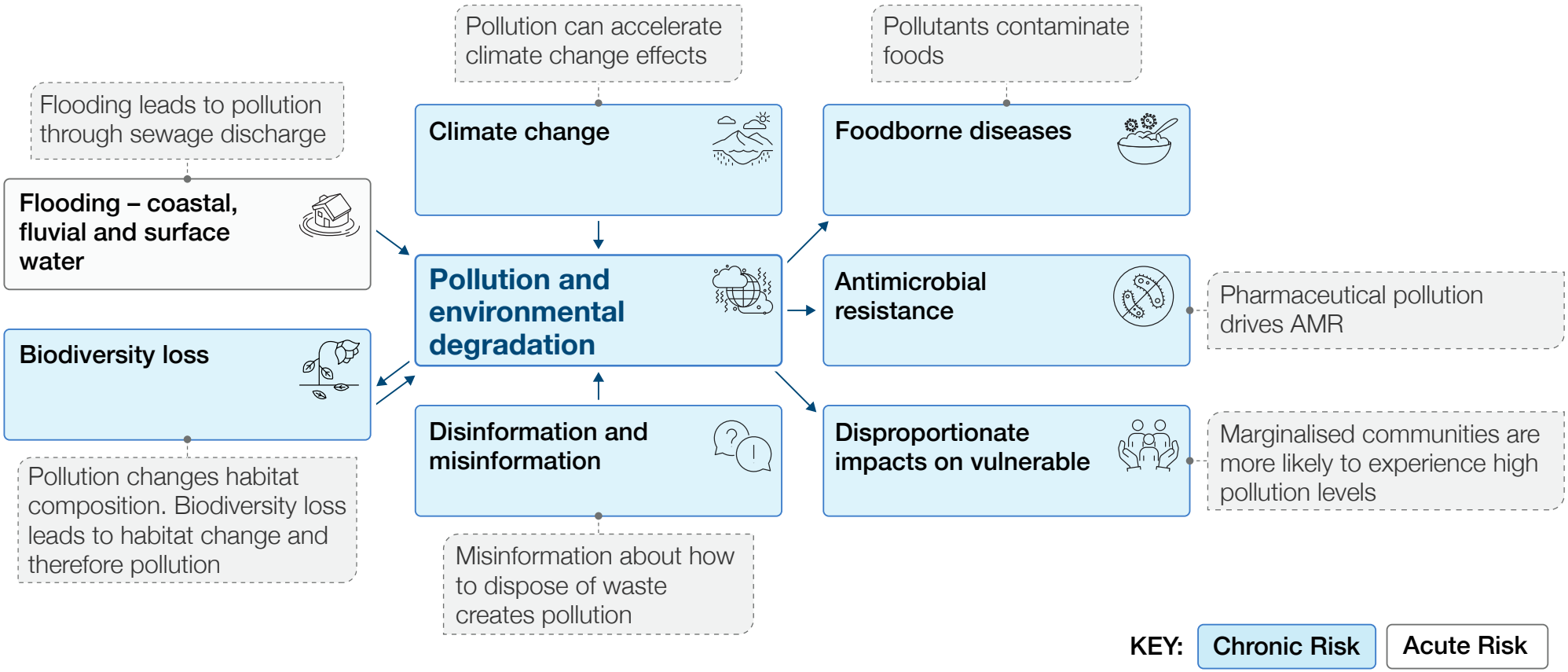
Short-term trajectory:

- To reduce water pollution, water companies will need to upgrade their infrastructure, existing regulations must be enforced, and the effects of climate change on flooding must be managed.
- Globally, exposure to metal pollutants including copper, aluminium, zinc and lead may remain a particular challenge.

Longer-term uncertainties:

- Ambient air pollution may exacerbate the prevalence of non-communicable diseases, imposing substantial burdens on the older adults within our populations and their health.
- Ecosystem degradation could create disparities in access to clean environments, potentially leading to widespread legal action against polluters and governments over health impacts.
- Significant strides could be made in managing UK air, water and soil pollution for legacy and recently emerged pollutants, allowing people to reconnect with nature.
- Novel chemical mixtures, including endocrine disruptors, affect a range of hormone functions and may present new health challenges.

Example connections with other chronic and acute risks



Societal

The expanding and ageing population in the UK exerts stress on communities, the economy, and various services, notably health and social care. Ongoing income and wealth disparities persist and grow, rendering specific demographic groups disproportionately susceptible to crises and their enduring consequences. The rise of an online landscape marked by fragmentation, lack of verification, and susceptibility to information manipulation enables the production and spread of misinformation and disinformation by diverse malicious actors. This, in turn, exposes the fractures within communities and states, eroding civic nationalism and heightening volatility.

Chronic Risk:
Impact of demographic change

Definition

Demographic change describes the effects of birth rates, death rates, and migration on population size and structure. Demographic change brings opportunities as well as risks. This assessment focuses primarily on those risks arising from an increasingly ageing population, particularly concerning the potential impact on welfare and health systems, the economy, infrastructure, housing and public finances.

Current evidence

There are four major components of the UK's current demographic shift: (1) rising life expectancy is increasing the number of elderly people as a percentage of the population; (2) migration, i.e. the increased movement of people driving population growth; (3) life milestones – like getting married or buying a property - moving to later ages compared to historical trends in the UK; (4) falling fertility rates as people have fewer children. This contrasts the high fertility rates of the post-war era, with the children born during this time now entering retirement.

The UK population has steadily grown and by mid-2021 was estimated to be 67 million, an increase of 3.7 million (5.9%) on the population in mid-2011. However, the UK fertility rate has been declining. In 2020, the total fertility rate fell to 1.58 children per woman, the lowest since records began in 1938.[191]

Falling fertility rates as people are having fewer children

191 ONS (2021) Births in England and Wales: 2021

It rose slightly to 1.61 in 2021. Migration has steadily increased over the last few decades, with an annual average net migration of 200,000 between 2011-2021. Yet despite migration, low fertility and rising life expectancy have caused the population to age.

Assuming age-related health and working patterns don't change, demographic change results in an increased dependency ratio – a measure that compares the working-age to the non-working-age populations. With a higher dependency ratio, the working-age population provide more support to the non-working population, either directly or via the tax system.[192] A higher dependency ratio can decrease economic productivity[193] and can require higher taxes or increased government spending to maintain social welfare programs.[194]

Example vulnerabilities

- The rising demand for informal care, mainly provided by women and older individuals who may also need care, could impact economic activity. With declining fertility rates reducing the number of potential caregivers, more people may face increased loneliness and lack of support.
- With an ageing population, the health and social care sectors will see increased demand, potentially accompanied by a drop in workforce if there are fewer people of working age.
- Outward migration of working age people and inward migration of retirees exacerbates the ageing population of rural and coastal areas[195] while some regions (for example, Scotland and Wales) may experience population decline without future net migration.[196]

192 OBR (2022) Fiscal risks and sustainability – July 2022
193 United Nations Dependency Ratio
194 Gonzalez-Eiras, M. & Niepelt, D. (2012). Ageing, government budgets, retirement, and growth
195 House of Lords (2019) Select committee on regenerating seaside towns and communities: The future of seaside towns
196 The Migration Observatory (2023) The Impact of Migration on UK Population Growth

Example mitigations

- Reforms in the Get Britain Working White Paper 2024 aim to address the trend of rising inactivity rates and ensure the UK has a labour market fit for the future.
- Health initiatives, such as screening programmes, help to delay or stop the onset of serious disease and prevent ill health in later life,[197] further improving quality of life.
- The UK has a points-based migration system to attract and retain skilled workers,[198] which can mitigate the effects of ageing populations.

Examples of additional benefits from taking action

- Greater wellbeing in later life (both physical and mental) reduces the burden on the healthcare and welfare systems.
- Growth of a 'silver economy', specifically catering for older adults, could drive innovation, export opportunities to other ageing economies, and generate employment opportunities.

What the future might hold

Short-term trajectories:

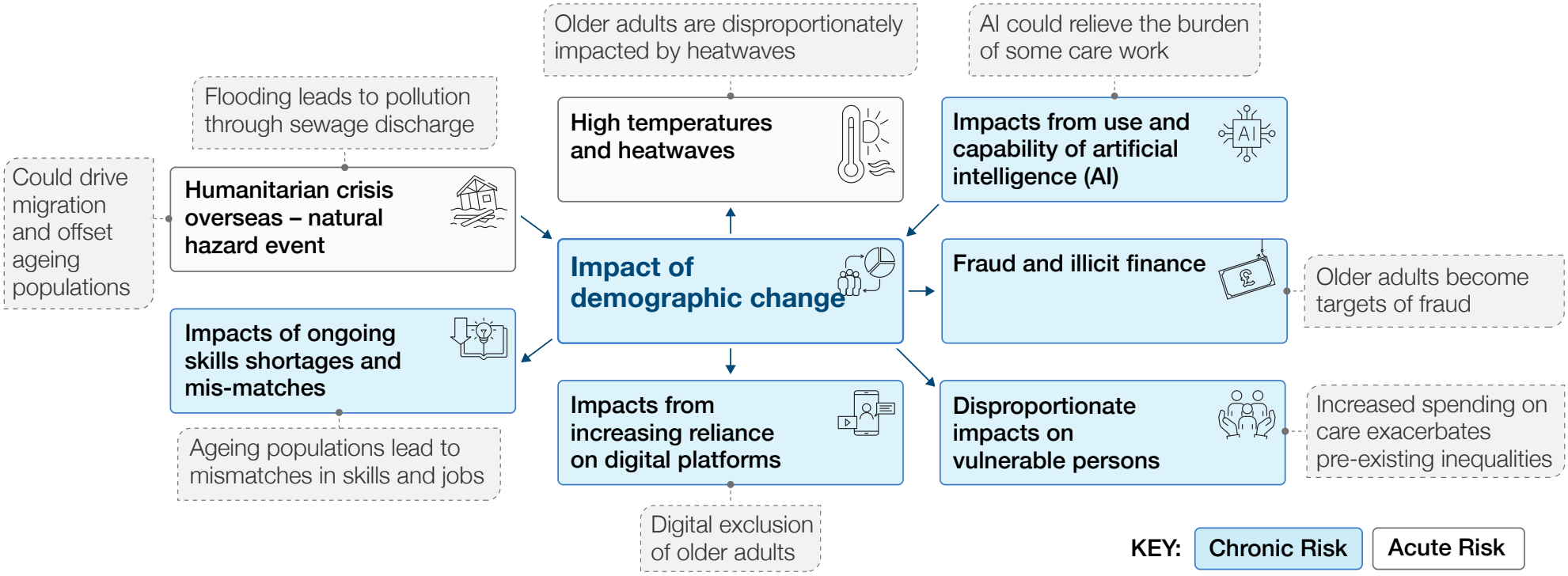
- The percentage of people aged over 65 is projected to rise from 19% in 2022 to 22% in 2032.[199] This would increase the dependency ratio. Changes to immigration may only partially offset this, with inward migration mostly concentrated in cities such as London and Manchester.[200]
- Many schools may become financially unviable and need to close as pupil numbers decline in specific locations, impacting the education sector.

Longer-term uncertainties:

- Healthy life expectancy may not improve if progress in early treatment and detection of conditions like dementia is low and investment in preventative healthcare is lacking. This could increase demands for healthcare, putting increasing pressure on health service budgets.

197 DHSC (2023) Chief Medical officer's annual report
198 HM Government (2022) New immigration system: what you need to know
199 ONS (2022) Voices of our ageing population: Living longer lives
200 Ibid

Example connections with other chronic and acute risks



Chronic Risk:
Disproportionate impact on vulnerable persons

Definition

One definition of being vulnerable is being in need of special care, support, or protection because of age, disability, risk of abuse or neglect.[201] Some individuals face heightened risks and have limited access to resources or opportunities. Vulnerable groups may vary depending on the context but can include children, older adults, ethnic minorities, disabled people and LGBTQIA+ individuals. These categories often overlap, and individuals may fall into several vulnerable groups at once.[202,203]

Current evidence

The UK is faced with a wide range of risks that can have a disproportionate impact on vulnerable and at-risk groups and communities. For example, vulnerable people may be more likely to suffer financial hardship either as a direct or indirect consequence of a risk materialising.[204] Health and socioeconomic disparities are also linked and impact on people's ability to reduce their risk and respond in emergencies. This means these communities and places may have fewer resources and less capacity to proactively take steps to build their resilience.[205]

The wealthiest 10% hold 43% of wealth in Britian

201 HM Government (2022) Vulnerabilities: applying All Our Health
202 Social Protection & Human Rights (2015) Disadvantaged and vulnerable groups
203 WMA (2024) WMA Declaration of Helsinki – Ethical Principles For Medical Research Involving Human Subjects
204 ONS (2023) Impact of increased cost of living on adults across Great Britain: June to October 2023
205 Cabinet Office (2023) The UK Government Resilience Framework

Poverty in the UK is linked to income inequality,[206] which has remained stable for over a decade, ranking 7th highest based on equivalised disposable income among OECD countries in 2021.[207] Between April 2018 and March 2020, the wealthiest 10% of households in Great Britain held 43% of the wealth, while the bottom 50% held just 9%.[208] Geographically, London has the greatest wealth inequality.[209] In the UK, 14.3 million people (21%) were living in relative poverty after housing costs in 2022/23, a decrease of 0.1 million from the previous year.[210] Childhood poverty is linked to poorer health, education, and job prospects, while groups like ethnic minorities and disabled people are especially prone to economic vulnerability.[211,212]

Multiple vulnerabilities can overlap, compounding their effects. For example, economic disparities are closely linked to health inequalities.[213,214] In 2021, 33% of smokers in England were from the two most deprived deciles, up from 30% in 2017, while only 11% were from the least deprived deciles, down from 12%.[215] Between 2018 and 2020, life expectancy dropped most for those in the most deprived areas.[216]

More recently, the COVID-19 pandemic and cost of living impacted everyone, but the most vulnerable – ethnic minorities, those in deprived areas,[217] single parents, young people, individuals with mental health issues,[218] and disabled people[219] – faced the worst financial, health, and social impacts.

206 LSE (2017) Double Trouble, A review of the relationship between UK poverty and economic inequality
207 HM Government (2024) Income inequality in the UK
208 ONS (2022) Household total wealth in Great Britain: April 2018 to March 2020
209 ONS (2022) Household total wealth in Great Britain: April 2018 to March 2020
210 DWP (2024) Households Below Average Income: an analysis of the UK income distribution: FYE 1995 to FYE 2023
211 The Health Foundation (2024) Inequalities in poverty
212 HM Government (2023) Ethnicity facts and figures
213 DHSC (2021) Chief Medical Officer's annual report: health in coastal communities
214 UCL (2022) Growing social and economic inequalities across north-west England are directly impacting health
215 ONS (2023) Deprivation and the impact on smoking prevalence, England and Wales: 2017 to 2021
216 ONS (2022) Health state life expectancies by national deprivation deciles, England: 2018 to 2020
217 HM Government (2019) English indices of deprivation, 2019
218 ONS (2023) Dataset: The impact of winter pressures on different population groups in Great Britain
219 Scope (2023) Disability Price Tag 2023: the extra cost of disability

Example vulnerabilities

- Critical data gaps, particularly for the most vulnerable and disadvantaged, hinder the ability to assess diverse experiences and intersecting vulnerabilities in the UK, potentially exacerbating their vulnerability.
- Individuals disproportionately impacted by certain risks often face heightened recovery challenges. For instance, those who have experienced adverse childhood events are less likely to pursue higher education, which can impact job opportunities available to them.
- Regional disparities exacerbate the challenges for vulnerable groups, as urban and rural communities face distinct barriers to accessing healthcare, education, and employment.

Example mitigations

- The Government's Missions aim to reduce regional disparities by promoting economic growth, education, and healthcare in underdeveloped regions. This includes boosting manufacturing, green technologies, and innovation, along with devolving employment support and improving infrastructure to attract businesses and talent.
- The Equality Act 2010 provides individuals with the means for protection from discrimination in employment, education, and other sectors, including based on race, disability, gender, age, and sexual orientation. As part of this, the Public Sector Equality Duty requires public authorities in Great Britain to have due regard to certain equality considerations when exercising their functions, like making decisions.[220]
- In the Spring Statement of 2025, the Government announced an additional £2 billion of funding for the Affordable Home Programme to deliver up to 18,000 new social and affordable homes, helping hardworking families get safe and secure homes.
- The Employment Rights Bill 2024-25 as part of the 'Plan to Make Work Pay' will protect vulnerable people from exploitation with changes such as strengthened redundancy rights and sick pay, banning zero hours contracts, and removing qualifying periods for claiming paternal leave or unfair dismissal.[221]

Examples of additional benefits from taking action

- Addressing disparities and disadvantages promotes social equality, enhances resilience to crises.
- Reducing inequality can lead to a fairer society and a stronger economy. A key reason for this is that individuals from lower-income backgrounds often struggle to invest in their education.

220 HM Government (2023) Public Sector Equality Duty: guidance for public authorities
221 DBT (2024) Employment Rights Bill: factsheets

What the future might hold

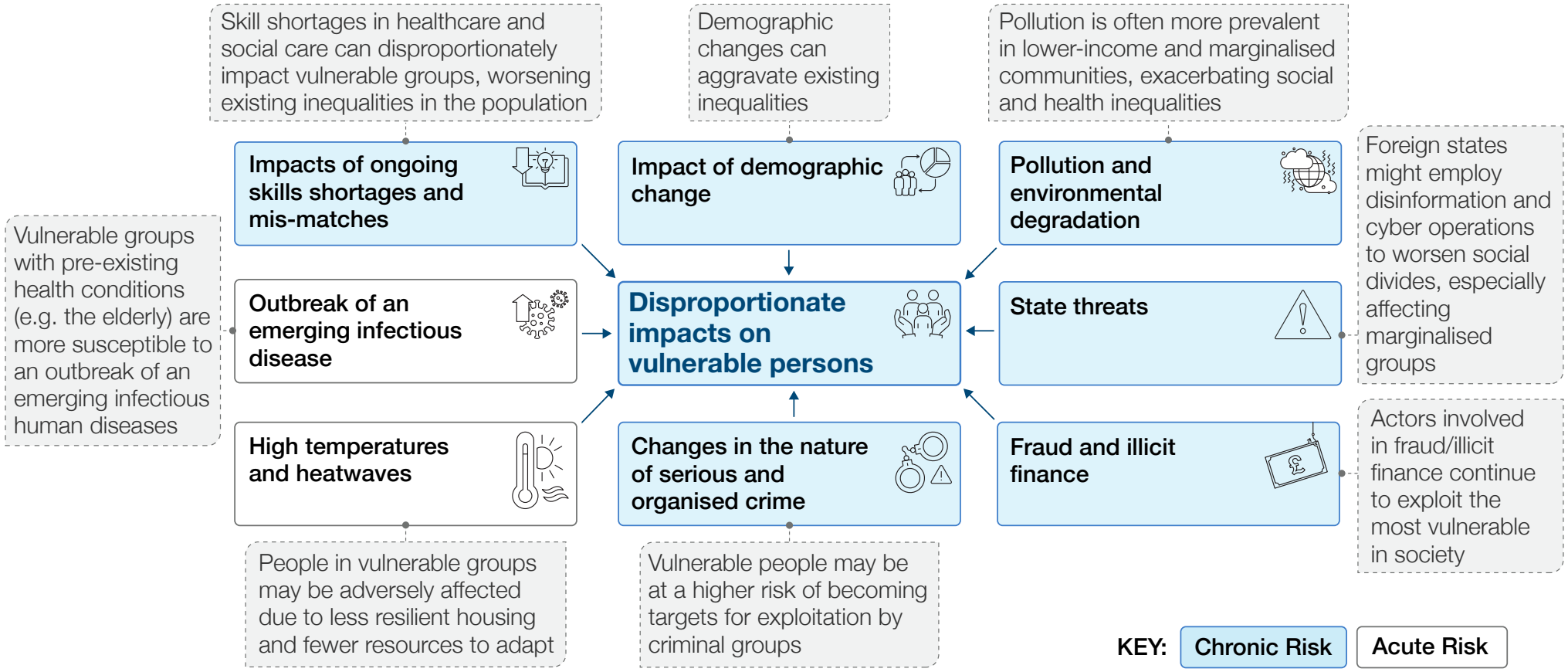
Short-term trajectories:

- Persistently high mortgage rates and rental prices may hinder renters from purchasing their first homes, resulting in a decline in homeownership and widening intergenerational wealth gaps.
- The long-term effects of the COVID-19 pandemic on education may exacerbate child poverty and disproportionately impact the educational achievements of children from low-income households.
- An ageing population and rising major illnesses are straining healthcare services, particularly for older adults and those with chronic conditions. This increased demand may expand the private healthcare sector, creating significant disparities in waiting times between NHS and private treatments, and worsening health vulnerabilities among older and disabled individuals.

Longer-term uncertainties:

- Technology has the potential to support vulnerable groups by mitigating economic and health challenges. For example, artificial intelligence (AI) may deliver personalised education through tutoring services for children and providing quality health advice. However, it may also take work away from lower income families.
- Climate change could disproportionately impact lower-income households through rising food costs, increased food insecurity, and unaffordable insurance in storm and flood prone areas.

Example connections with other chronic and acute risks



Chronic Risk:
Disinformation and misinformation

Definition

Disinformation is the deliberate creation and dissemination of false or manipulated information intended to deceive and mislead. Misinformation refers to inadvertently spreading such false information. Both pose risks to society, particularly marginalised groups, the economy, and national security. Disinformation campaigns for example, can undermine social cohesion or inflame pre-existing tensions.

Current evidence

Disinformation has always been spread by malign actors, including foreign state-backed actors, as a tactic to promote their agendas or weaken another country. Political polarisation, stemming from perceived disenfranchisement and inequalities,[222,223] exacerbates the spread of misinformation, particularly in the context of digital and social media, where a lack of digital literacy skills can hinder people's ability to critically assess sources.[224] The shift from traditional news sources like TV and print media to digital platforms has contributed to this issue. Younger audiences increasingly consume news online or through social media, where editorial standards are less rigorous, and algorithms prioritise engagement over accuracy.[225]

Trust in news dropped from 51% in 2015 to 33% in 2023

222 European Commission (2021) Conspiracy theories and right-wing extremism – Insights and recommendations for P/CVE
223 Jaiswal, J et al. (2020) Disinformation, misinformation and inequality-driven mistrust in the time of COVID-19
224 Harvard Kennedy School (2021) Digital literacy is associated with more discerning accuracy judgments but not sharing intentions
225 Reuters Institute (2023) Reuters Institute Digital News Report 2023

This has led to a proliferation of dis/misinformation, with posts that generate more likes and shares being more visible, as opposed to those that are most accurate.[226]

From 2015 to 2023, trust in news among UK citizens dropped from 51% to 33%.[227] The rapidly evolving media landscape, including the rise of artificial intelligence (AI) and social media, has increased the spread of dis/misinformation.[228] This has led to growing public mistrust in technology, vaccines, and institutions. Some states have capitalised on this by attempting to use disinformation as a tool to damage social cohesion, and weaken institutions[229] by trying to interfere in democratic processes. For example, foreign actors almost certainly sought to interfere in the 2019 UK general election.[230]

Dis/misinformation has the potential to polarise public debates, reduce trust in institutions, and endanger environmental and public health. A 2022 review found health misinformation prevalent in over half of vaccine-related social media posts,[231] further eroding trust in public health responses.

Example vulnerabilities

- Children, older adults,[232] the unemployed, and marginalised groups[233] are more susceptible to dis/misinformation, which can have ramifications for their mental and physical health.[234]
- Dis/misinformation targets outgroups, potentially leading to increased harms online and offline.[235,236,237]
- Dis/misinformation can undermine the confidence in the democratic process and can affect businesses market value[238] and infrastructure, like 5G masts.

226 Smith, A (2018) Public Attitudes to Computer Algorithms
227 Reuters Institute (2023) Reuters Institute Digital News Report 2023
228 United Nations General Assembly (2022) Countering Disinformation for the Promotion and Protection of Human Rights and Fundamental Freedoms
229 Fletcher et al, (2020) Trust in UK Government and News Media COVID-19 information down, concerns over misinformation from Government and Politicians Up
230 UK Parliament (2020) Cyber Security: Update
231 André. et al. (2022) Infodemics and health misinformation
232 DCMS (2021) Minister launches new strategy to fight online disinformation
233 Cox, K. et al., RAND Europe. (2021) Covid-19, Disinformation and Hateful Extremism
234 Verma et al. (2022) Examining the impact of sharing COVID-19 misinformation online on mental health
235 Cox, K. et al., RAND Europe. (2021) Covid-19, Disinformation and Hateful Extremism
236 Thakur, D. and Hankerson, D. (2021) Facts and their discontents: A research agenda for online disinformation, race and gender
237 Europol (2021) European Union Terrorism Situation and Trend Report (TE-SAT) 2020
238 Pew Research Centre (2017) The Future of Trust and Misinformation Online

Example mitigations

- The Online Safety Act requires companies to remove illegal dis/misinformation, and the Foreign Interference Offence requires them to address state sponsored disinformation.
- The Defending Democracy Taskforce[239] works to reduce interference in UK democratic processes, with cross departmental and interagency collaboration.
- The Government provides additional funding to the BBC world service, a platform which plays a crucial role in shaping the global landscape by delivering impartial and accurate news to an audience of 320 million.

Examples of additional benefits from taking action

- Policies are easier to implement without dis/misinformation around them.
- Greater resilience and trust of existing democratic institutions and authoritative information sources.

What the future might hold

Short-term trajectories:

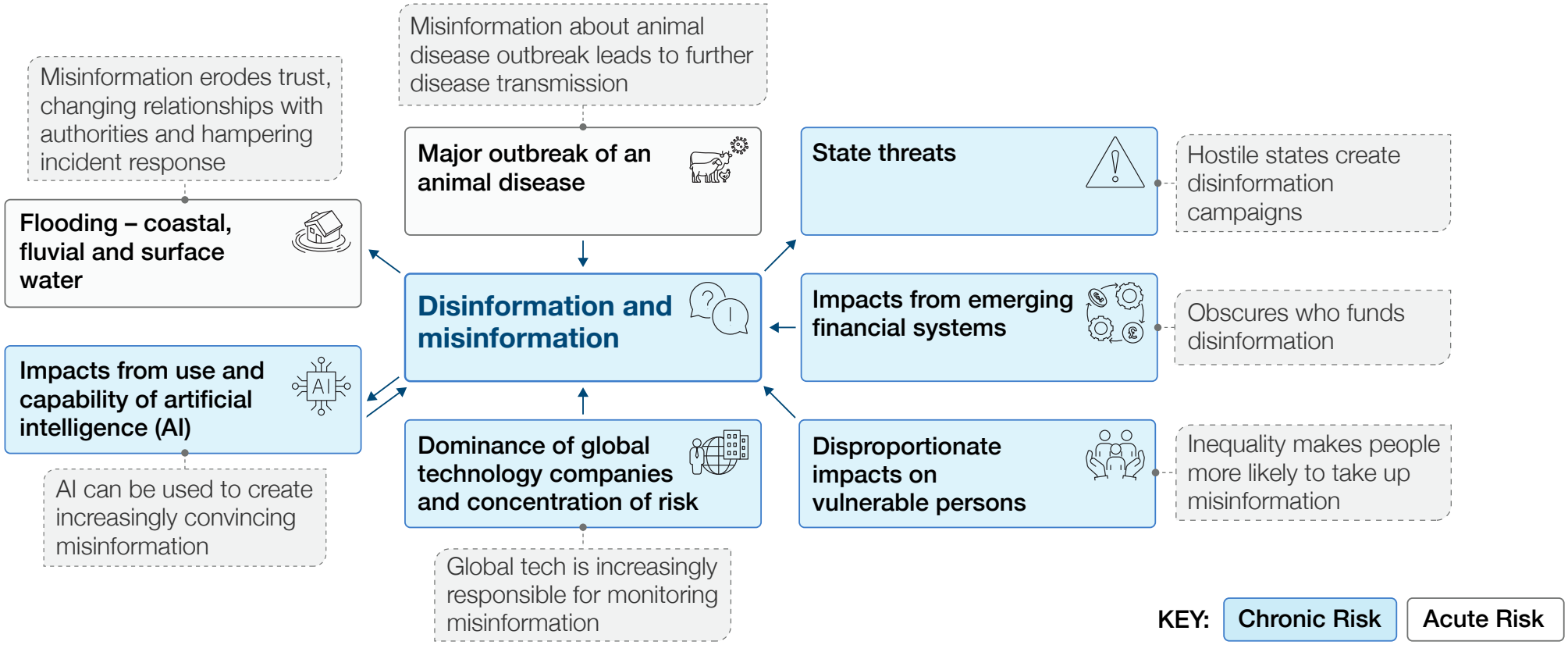
- AI may lower the barrier to entry for creating convincing dis/misinformation, for example, using deepfakes, potentially accelerating its spread.
- People may increasingly rely on trusted sources, like legacy news organisations or influencers, as information becomes less reliable.
- Dis/misinformation could continue to target the most polarised issues in order to potentially deepen social divides on issues like climate change and immigration.

Longer-term uncertainties:

- The spread of dis/misinformation may erode public trust, potentially leading to disengagement from democratic processes.
- Mistrust in experts may drive people to believe dis/misinformation, potentially resulting in reduced vaccine uptake for example, posing threats to public health.
- Improved media literacy and digital skills could make users more critical of information, enhancing trust in fact-based news sources.
- Some may view digital environments as preventing open debate, pushing groups to more fringe platforms, complicating monitoring.

239 UK Parliament (2023) Defending Democracy Taskforce

Example connections with other chronic and acute risks



Biosecurity

Biosecurity encompasses a broad spectrum of concerns. The convergence of technological progress, environmental decline, and the growing interconnectivity of our global society means that it is likely that there could be an escalation in the number of threats we face. The expanding availability of biological data, coupled with advancements in technologies and genetic modification techniques, holds the promise of innovative solutions across various sectors. However, the widespread adoption and accessibility of these technologies also raise the potential for dual-use scenarios with harmful consequences. Simultaneously, antimicrobial resistance persists as an enduring menace to public health, food security, environmental stability, and the overall economy. In addition, the rise in global mobility, evolving trade patterns, and the impacts of climate change collectively elevate the risk of introducing novel animal, plant, or foodborne diseases into the United Kingdom.

Chronic Risk:
Antimicrobial resistance (AMR)

Definition

Antimicrobial resistance (AMR) occurs when microorganisms (for example, fungi, bacteria, viruses and parasites) evolve to resist the effects of treatment, increasing the risk of severe illness and mortality. AMR is a rapidly growing, global threat to public health, animal health, plant health, and food security.

Current evidence

Antimicrobials are used to treat infectious diseases and have profound benefits for human and animal health. AMR evolves naturally but has been exacerbated by indiscriminate use of antibiotics and antifungals, inadequate infection, prevention and control (IPC), and poor water, sanitation and hygiene (WASH) practices. AMR has resulted in a rise in infection incidence, importation of resistant strains and transmission of drug-resistant strains and genes between humans and animals, as well as through the environment.

While human antibiotic use in the UK has declined in recent years, global antibiotic consumption in humans rose by 46%[240] between 2000 to 2018. In the UK, antimicrobial use in livestock has dropped by 59% since 2014.[241]

Global antibiotic consumption up 46% (2000-2018)

240 Browne, A.J. et al. (2021) Global antibiotic consumption and usage in humans, 2000–18: a spatial modelling study
241 VMD (2023) UK Veterinary Antibiotic Resistance and Sales Surveillance Report, (UK-VARSS 2022)

However, worldwide antimicrobial use in livestock is estimated to have increased by 58% from 2010 to 2020,[242] contributing to the rise of antimicrobial resistance.[243] The limited range of antifungals along with their extensive use in both medicine and agriculture risks a combined "One Health" challenge to both respiratory medicine food supply.[244]

In 2019, bacterial AMR was responsible for an estimated 1.3 million deaths globally,[245] double the toll of malaria.[246] In England, following a decline during the COVID-19 pandemic, severe antibiotic-resistant infections rose by 6.6% between 2020 and 2022, reaching nearly 58,000 cases and approaching pre-pandemic levels.[247] Beyond the direct health impacts, the economic consequences of unchecked AMR could surpass the disruptions of the 2008-2009 global financial crisis.[248] Some estimates suggest the cumulative cost could reach USD $100 trillion by 2050, driven by rising healthcare costs, disruptions to food and feed production, trade, livelihoods, and worsened poverty and inequality.[249]

Example vulnerabilities

- High-risk groups (babies, children, older adults, immunocompromised, or those with comorbidities), could become vulnerable to the infection's consequences (ill health, and death) and will have their quality of life reduced as they try to avoid previously simple-to-treat infections that may become lethal.
- The healthcare sector may face increased pressure, with more AMR infections, a higher workload from additional treatments and their potential side effects (since there may be limited antimicrobials that still work), and fewer beds available due to longer hospital stays.[250]
- The agricultural sector could see yields dramatically reduced by resistant fungal crop infections, diminished livestock welfare and productivity, and increased cost of those antimicrobial treatments that still work.

242 Mulchandani, R. et al. (2023) Global trends in antimicrobial use in food-producing animals: 2020 to 2030
243 WHO (2023) Antimicrobial resistance factsheet
244 Fisher, M.C. et al. (2022) Tackling the emerging threat of antifungal resistance to human health
245 Murray, C.J.L. et al. (2022) Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis
246 FAO (2023) Why should policymakers act on antimicrobial resistance in agrifood systems?
247 UKHSA (2023) English surveillance programme for antimicrobial utilisation and resistance (ESPAUR), Report 2022 to 2023
248 Green Finance Institute (2024) Assessing the Materiality of Nature-Related Financial Risks for the UK
249 WHO (2019) No time to Wait: Securing the future from drug-resistant infections
250 Touat, M. et al. (2021) Costs and Outcomes of 1-year post-discharge care trajectories of patients admitted with infection due to antibiotic-resistant bacteria

Example mitigations

- The UK's 20 year "vision" aims for a multi-department, One Health approach[251] which recognises the interconnectedness of human, animal and environmental health.
- In 2024, the UK's second 5-year National Action Plan[252] to tackle AMR across humans, animals and the environment was launched. The plan focuses on reducing the need and unintentional exposure to antimicrobials, optimising their use, and investing in innovation, supply and access.[253]
- AMR is identified as a high consequence risk in the 2023 Biological Security Strategy, which pledged to make it part of a real-time Biothreats Radar.
- AMR is an international issue that cannot be solved in isolation, and the UK supports global action via grants and funding for low- and middle-income countries through the Fleming Fund and the Global AMR Innovation Fund.

Examples of additional benefits from taking action

- Better IPC and farm management in agriculture results in improved animal health and welfare.
- Reducing antimicrobial overuse and regulating clinical and industrial discharge results in lower levels of antimicrobials secreted in wastewater, resulting in a less polluted environment.

What the future might hold

Short-term trajectories:

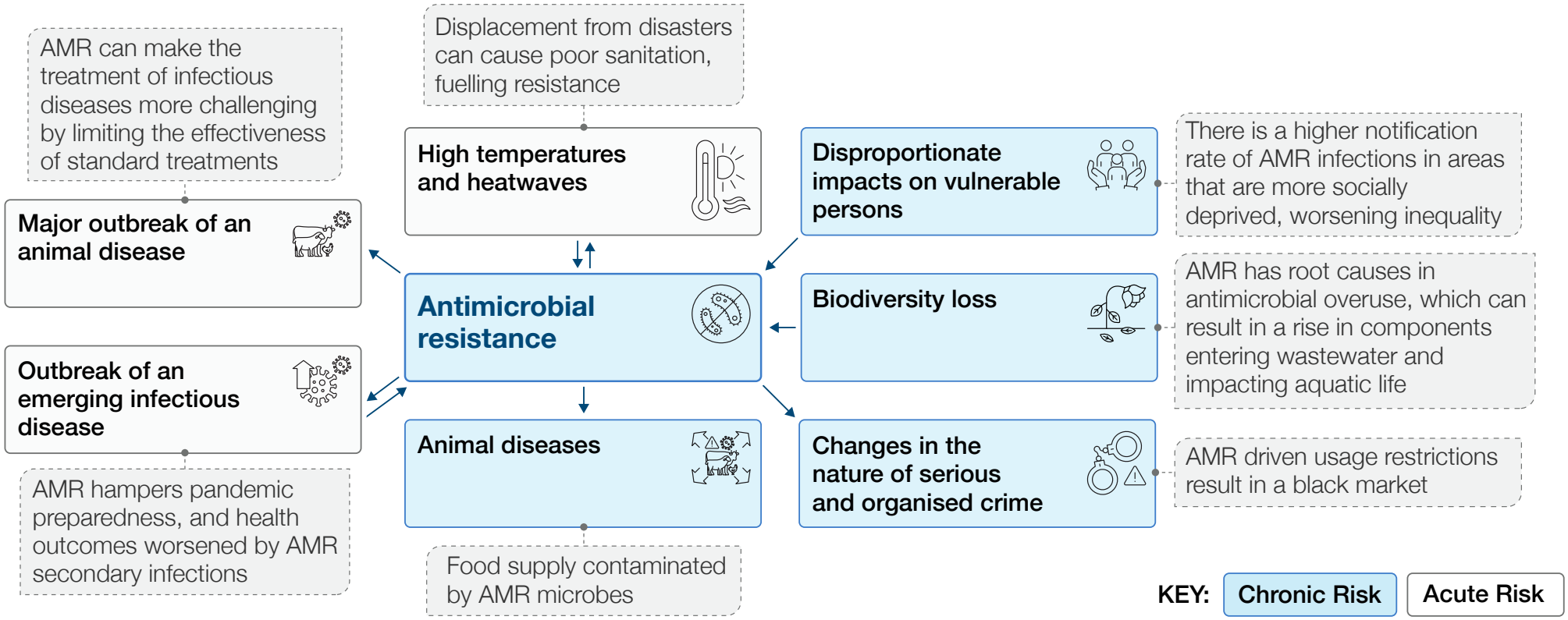
- AMR may cause treatments in animals to fail and crop protection to become more difficult. Reductions in veterinary antimicrobial use in the UK could level-off as further reductions become harder to achieve and require more fundamental management changes.
- There may be increased environmental AMR microbe transmission, particularly via humans being exposed to untreated wastewater.

Longer-term uncertainties:

- The global rise in antimicrobials may be stemmed, as has happened in the UK, curbing the evolution of AMR.
- A rapid rise of antimicrobial resistance (AMR) could lead to multi-drug-resistant microbes dominating healthcare, making routine procedures like hip replacements and caesarean sections more dangerous.
- The farming and aquaculture industries could be severely impacted, as common infectious diseases of livestock may become untreatable.
- The extensive use of antifungals in agriculture, combined with warming climate, may increase the range and severity of fungal infections in people and crops, while diminishing our ability to treat them.

251 HM Government (2023) Third UK One Health Report - Joint report on antibiotic use, antibiotic sales, and antibiotic resistance
252 HM Government (2024) UK 5-year action plan for antimicrobial resistance 2024 to 2029
253 Ibid

Example connections with other chronic and acute risks



Chronic Risk:
Animal diseases

Definition

Animal disease disrupts an animal's health due to infections, genetic defects, toxins or nutritional deficiencies altering its normal functions. While often appearing as acute outbreaks, animal disease can also be a chronic burden on environmental and human health, as well as the economy, trade, and food security.

Current evidence

Animal diseases arise from various pathogens including bacteria, viruses, parasites, fungi, misfolded proteins, or genetic abnormalities. Transmission occurs through contact with infected tissues or fluids, airborne droplets, vectors like insects, contact with contaminated objects, sexual transmission, or ingestion of contaminated food or water. The spread of these diseases depends on the pathogen, susceptible hosts, and environmental factors. Factors such as an intensification of global trade, increased interaction of livestock with wildlife, poor biosecurity for farmed livestock, and poor farming practices can exacerbate disease risks.

Despite advances in detection, prevention, and treatment, the global emergence and recurrence of animal diseases have risen in recent decades.[254]

116 listed diseases

254 WOAH The Global Burden of Animal Diseases

The World Organisation for Animal Health (WOAH) lists 116 terrestrial and aquatic infectious animal diseases that have spread between countries and naturally infect humans, resulting in severe health impacts.[255] Over 1.3 billion people worldwide depend on livestock for their livelihoods,[256] with production animals accounting for 40% of global agricultural value.[257] Since 1940, agricultural intensification has been linked to a significant portion of new infectious diseases, particularly zoonotic diseases that cross over to humans.[258]

Approximately 60% of emerging human infectious diseases originate in animals.[259] The effects range from mild, such as food poisoning, to severe illnesses and fatalities, such as those caused by rabies. Economically, animal diseases can also be devastating; for example, the 2001 foot and mouth disease outbreak in the UK cost over £8 billion in total.[260] Endemic diseases, like bovine tuberculosis, cost the UK government £70 million annually.[261] Disease outbreaks can lead to import bans, as seen with the 10-year EU ban on British beef following the BSE outbreak.[262] These outbreaks impact public trust, consumer behaviour, and can cause significant mental health issues among those directly affected, such as farmers and veterinarians.[263]

255 WOAH Animal Diseases
256 WOAH Animal health through an economic lens
257 WOAH The Global Burden of Animal Diseases
258 UN Environment Programme (2020) Preventing the next pandemic - Zoonotic diseases and how to break the chain of transmission
259 Jones, K. et al. (2008) Global trends in emerging infectious diseases
260 NAO (2002) The 2001 Outbreak of Foot and Mouth Disease
261 DEFRA (2018) Bovine TB Strategy Review
262 EC (2006) BSE: UK beef embargo to be lifted
263 Mort, M., Convery, I., Baxter, J. and Bailey, C. (2005) Psychosocial effects of the 2001 UK foot and mouth disease epidemic in a rural population: qualitative diary-based study

Example vulnerabilities

- Agricultural workers are at higher risk for many zoonotic diseases, impacting their health and livelihoods.
- Trade and agriculture are vulnerable to animal disease outbreaks, potentially causing economic losses and shortages of food.
- Disease threats to biodiversity and agriculture disproportionately impact rural areas.

Example mitigations

- The Animal and Plant Health Agency published an overarching UK contingency plan for exotic animal diseases in 2021.[264] Wales, Scotland, and England published their respective contingency plans (updated in 2018,[265] 2022[266] and 2023[267]) that detail processes, departmental responsibilities, and specific disease control strategies.
- The 2023 Animal Health and Welfare Pathway offers financial support to farmers to improve biosecurity, manage endemic risks and eradicate bovine tuberculosis.
- The UK's Biological Security and Official Development Assistance strategies enhance resilience through a One Health approach and global investments in veterinary infrastructure and disease surveillance.

Examples of additional benefits from taking action

- Animal diseases are not confined to livestock, with wildlife diseases threatening species with extinction, causing cascading impacts on other dependent animal and plant species. Better animal health may result in a healthier ecosystem.
- Fewer disease-impacted animals means more efficient livestock production.
- Controlling the spread of animal diseases can result in improved animal welfare, better trade reputation, reduced impact on human health, decreased antimicrobial resistance (AMR), and better food security.

264 APHA (2021) United Kingdom contingency plan for exotic notifiable diseases of animals
265 Welsh Government (2018) Welsh Government Contingency Plan for Exotic Notifiable Diseases of Animals 2018
266 Scottish Government (2022) Exotic Diseases of Animals Contingency Framework Plan v 7.0
267 APHA (2023) Contingency plan for exotic notifiable diseases of animals in England: including foot and mouth disease, avian influenza, Newcastle disease and all other exotic notifiable diseases of animals

What the future might hold

Short-term trajectories:

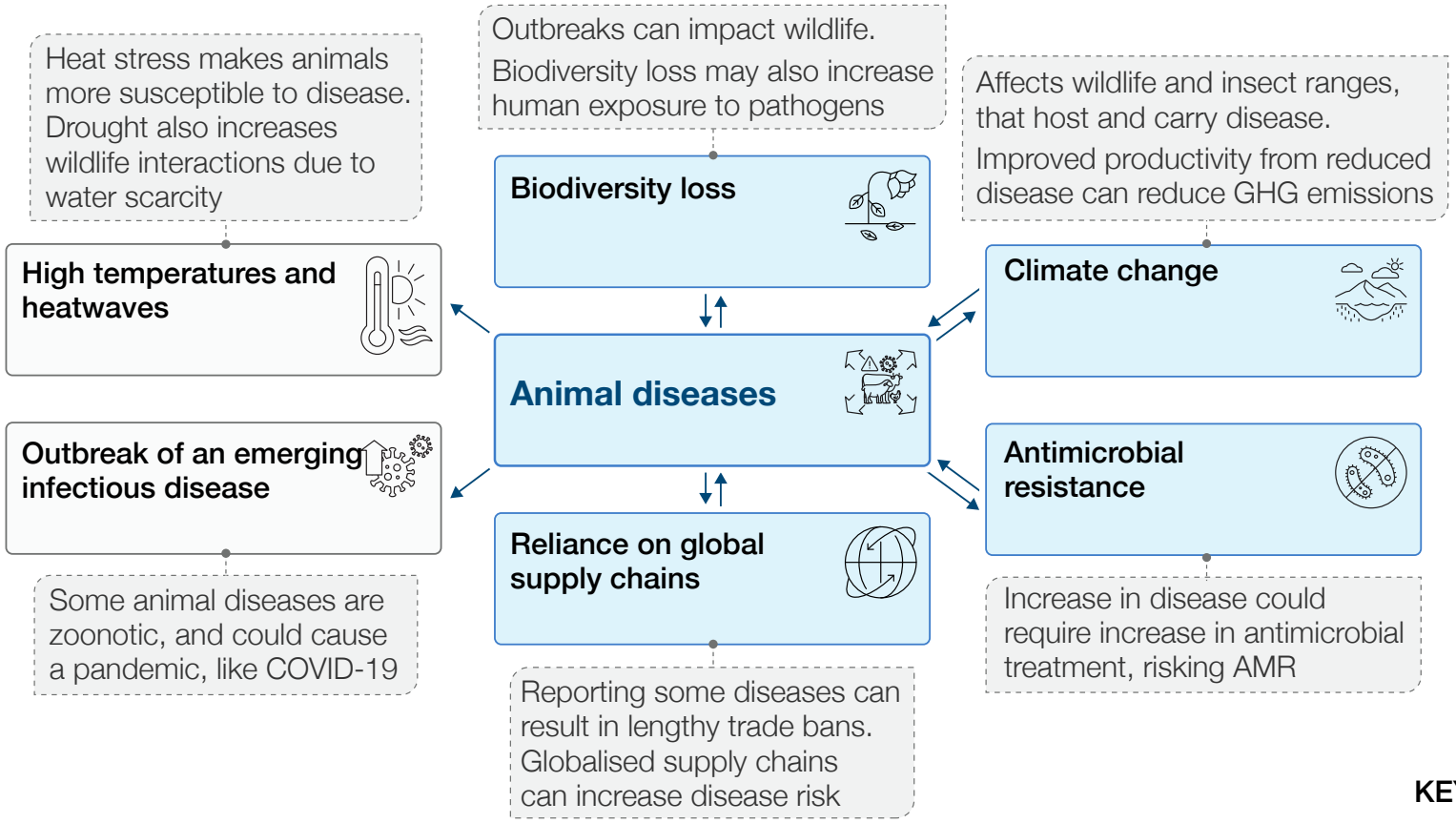
- Shifts in international trade may expose the UK to new diseases and antimicrobial-resistant organisms, heightening the risk of outbreaks.
- The UK climate will change further, which could expand the range and active season[268] of insects that carry livestock diseases, like bluetongue and Schmallenberg virus, pet diseases like heartworm, and other zoonotic diseases like Lyme disease.

Longer-term uncertainties:

- Warmer winters may lead to increased numbers of disease-transmitting ticks, which, coupled with rising AMR infections, may increase livestock mortality, potentially impacting UK farmers and the UK food supply.
- Increasing global meat consumption may drive increased livestock trade which could exacerbate zoonotic disease outbreaks, possibly leading to a major human pandemic in the UK.
- Artificial intelligence (AI) technologies may help predict, monitor, detect and treat animal diseases, potentially benefiting larger farms while smallholders may struggle to compete.
- People shifting towards plant-based diets and lab-grown meat could reduce the demand for animal agriculture, thus reducing disease burden.

268 Sanders, C.J. et al. (2019) Long-term shifts in the seasonal abundance of adult Culicoides biting midges and their impact on potential arbovirus outbreaks

Example connections with other chronic and acute risks



KEY: **Chronic Risk** | **Acute Risk**

Chronic Risk:
Foodborne diseases

Definition

Foodborne disease (FBD) is caused by the consumption of food contaminated with microorganisms including bacteria, viruses, parasites, or their toxins. Disease caused by this contamination is a large and ongoing economic and health burden on society.

Current evidence

Contamination of food by microbes and their toxins can occur at any stage in the food chain – on the farm (animals and plants), during processing, preparation and distribution, storage or via mishandling (i.e. cross contamination in the kitchen) pre or post cooking. Pathogens can come from the environment, from people, pets and livestock, or be inherent in the food product itself. Some foods are more likely to carry pathogenic microbes, such as undercooked or raw foods. Certain conditions (such as higher temperatures, possibly worsened by climate change) can accelerate growth of foodborne microbes. Additionally, some foodborne microbes may be resistant to antimicrobials, making the resulting illness harder to treat.

FBD related pain, grief and suffering is estimated to cost £7.1 billion

Despite ongoing preventive measures, foodborne illness remains a persistent public health concern in the UK, with the number of cases linked to causative contaminants consistently high between 2015 and 2019.[269] In 2018 there were an estimated 2.4 million cases related to FBD in the UK,[270] with approximately 16,000 hospitalisations and over 180 deaths.[271] Norovirus, an enteric or gastrointestinal tract virus, accounts for the highest number of cases linked to food, with an estimated 380,000 cases per annum.[272] The most significant bacterial pathogen contaminants in the UK are Salmonella, Campylobacter, Shiga toxin-producing Escherichia coli O157 (STEC), and Listeria monocytogenes.[273] In 2022, there was an increase in STEC cases to the highest rate per 100,000 population since 2015. This was driven by two large national outbreaks investigated in summer 2022.[274] There is a cross-border component to FBD, one example of which was associated with 241 cases of Salmonella infection in travellers returning from holidays to Türkiye during the first half of 2023.[275]

The estimated cost of FBD to UK society in 2018 was £9.1 billion annually.[276] Of this, 20% was down to financial costs, including lost earnings, medical costs, school absences and disturbances to businesses as people take sickness leave.[277] £7.1 billion of the total burden was related to the human cost of pain, grief and suffering of individuals and their carers from illness, their long-term complications, and fatalities.[278] Norovirus had the greatest economic and societal burden, with an estimated annual cost of £1.7 billion, followed by Campylobacter and Salmonella.[279]

269 DEFRA (2023) United Kingdom Food Security Report 2021: Theme 5: Food Safety and Consumer Confidence
270 FSA (2020) The Burden of Foodborne Disease in the UK 2018
271 Holland, D., Thomson, L., Mahmoudzadeh, N. and Khaled, A. (2020) Estimating deaths from foodborne disease in the UK for 11 key pathogens
272 FSA (2019) Technical Report: Review of Quantitative Risk Assessment of foodborne norovirus transmission
273 DEFRA (2023) United Kingdom Food Security Report 2021: Theme 5: Food Safety and Consumer Confidence
274 FSA (2023) Performance and Resources report quarter 4 2022 to 2023: Foodborne disease - gastrointestinal (GI) pathogen reporting
275 UKHSA (2023) HPR volume 17 issue 8: news (20 July 2023), Multi-cluster investigation of Salmonella Enteritidis in travellers returning from Turkey
276 FSA (2020) The Burden of Foodborne Disease in the UK 2018
277 Ibid
278 Ibid
279 Ibid

Example vulnerabilities

- Certain vulnerable groups, including babies and children under 5, pregnant individuals, immunocompromised individuals, and older adults, face increased susceptibility to foodborne diseases.
- Foodborne illnesses and employee absence disrupt business operations, necessitating resource reallocation. In 2018, these issues cost businesses an estimated £157.5 million.[280]
- The UK's NHS, as the primary healthcare provider, faced an estimated annual resource cost of £60.5 million due to FBD cases, as of 2018.[281] These costs include GP visits and hospital patient care.

Example mitigations

- The Food Standards Agency (FSA) and Food Standards Scotland (FSS) focus on tackling detrimental pathogens through policies and strategies.
- The Food Hygiene Rating Scheme (FHRS) rates food businesses based on hygiene standards and helps consumers make informed choices about where to eat or buy food.
- National control programs, research initiatives, consumer advice initiatives and cross-departmental teams focus on preventing foodborne diseases and promoting knowledge exchange.

Examples of additional benefits from taking action

- Better understanding of ecosystem microbiome due to increased surveillance.
- Widespread messaging around benefits of hygiene and handwashing to prevent FBD has positive knock-on effects, with fewer non-foodborne pathogen reports.
- Actions to control foodborne disease can improve animal welfare and reduce environmental contamination.

280 Ibid
281 Ibid

What the future might hold

Short-term trajectories:

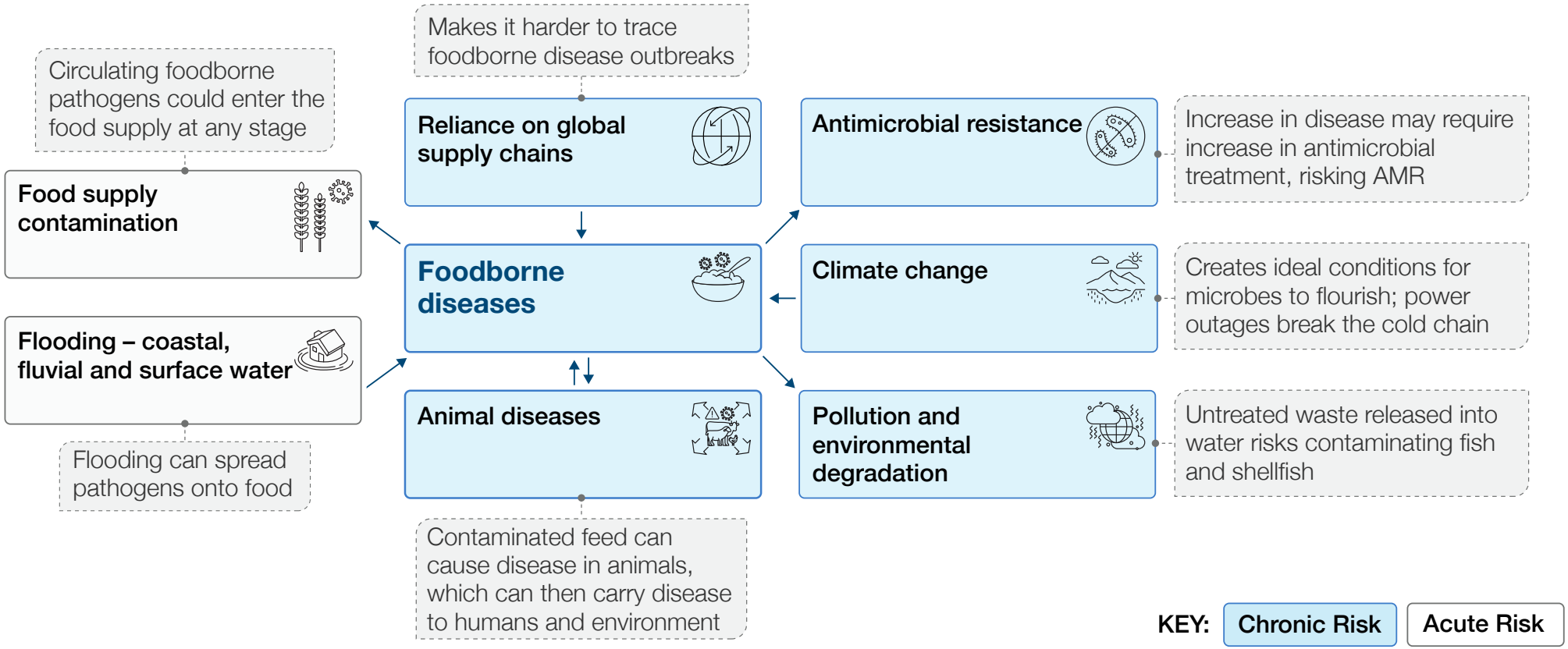
- While antimicrobial use in UK livestock is declining, global use is increasing. This means that trade deals with novel partners may raise the risk of importing foodborne antimicrobial-resistant (AMR) strains.
- Changing climate and increasing frequency of extreme weather events could result in a greater frequency of contamination of food in the UK, including salad crops and shellfish.
- Economic changes may influence consumers to opt for cheaper food options, increasing their risk of exposure to food fraud. This includes items: made without proper oversight, from unsafe goods, or prepared in unhygienic conditions.[282]

Longer-term uncertainties:

- Climate change may drive food production to new regions with less familiar threats and weaker tracing protocols. This could lead to frequent contaminated food imports and deadly disease outbreaks in the UK, which may undermine public trust in food systems.
- There may be a rise in the number of online marketplaces and unregulated distribution chains. This could complicate traceability and management of foodborne disease outbreaks.
- Blockchain, internet of things (IoT), and artificial intelligence (AI) technologies could enable faster tracing and certification of food ingredients, streamlining investigations and reducing food waste. However, the increased costs of implementing these technologies may be passed on to consumers, potentially widening inequalities in access to safe food.

282 National Food Crime Unit and Scottish Food Crime & Incidents Unit (2020) Food Crime Strategic Assessment 2020: Section 6 - The Future of Food Crime

Example connections with other chronic and acute risks



Chronic Risk:
Plant pests

Definition

A plant pest is any organism (including insects, other invertebrates, bacteria, fungi, viruses and other pathogens) that affects plant health by feeding on them, causing disease, or interfering with their normal growth and development.[283] Due to changing consumer demands, increased global trade into the UK and changing weather patterns, there is a significant likelihood of new acute events such as non-native plant pests emerging in the UK. The gradual spread of both native and non-native plant pests could have detrimental effects on plant health, crop yields, the environment, natural capital, and trade.

Current evidence

International trade[284] and travel act as pathways for plant pests, resulting in persistent threats to plant health. Additionally, abiotic stresses in the environment such as drought, flooding, and pollution can also increase plant vulnerability to pests, and can alter disease development and impact.[285] Ongoing environmental changes linked to climate change intensify these stressors, resulting in more frequent and severe outbreaks of plant diseases.[286] Furthermore, they may enable new plant pests to establish themselves in the UK.[287]

Plant diseases cost the global economy 220 billion USD

283 DEFRA (Accessed 2024) Defra's approach to pest risk analysis (PRA)
284 Hulme, P.E. (2021) Unwelcome exchange: International trade as a direct and indirect driver of biological invasions worldwide
285 Velásquez, A.C., Castroverde, C.D.M. and He S.Y. (2018) Plant and pathogen warfare under changing climate conditions
286 Singh, B.K., et al (2023) Climate change impacts on plant pathogens, food security and paths forward
287 IPPC Secretariat (2021) Scientific review of the impact of climate change on plant pests: A global challenge to prevent and mitigate plant-pest risks in agriculture, forestry and ecosystems

The top five crops in the UK by production volume are wheat, barley, sugar beet, potatoes, and oilseed.[288] However, their yields are susceptible to plant pests. Recently, fungal cereal pathogens that were previously eradicated in the UK have re-emerged. For example, in 2013, wheat stem rust was detected for the first time in 60 years.[289] Quarantine pests are non-native species subject to control measures.[290] There are currently over 200 listed quarantine pests already identified globally, with this number growing annually as new threats are identified.[291] Six quarantine pests are already established within Great Britain.[292]

The UN Food and Agriculture Organization (FAO) predicts that, globally, up to 40% of food crops are lost due to plant pests annually (with regional variations in losses). Plant diseases cost USD $220 billion to the global economy, and invasive insects cost USD $70 billion.[293] UK potato farmers spend on average £55 million a year to keep potato blight under control. Furthermore, native pests like peach potato aphids can transmit the pathogen causing virus yellows, which caused the loss of up to 25% of the UK's national sugar beet yield in 2020.[294] Additionally, plant diseases and pests can weaken or kill plants that play a key role in supporting wider UK biodiversity.

For example, over 950 UK species are associated with ash trees,[295] which are threatened by ash dieback.

Example vulnerabilities

- Plant pests can increase commodity prices, disproportionately affecting low-income groups and potentially impacting the job security of 471,000 agricultural workers in the UK.
- Pest infestations can erode consumer confidence, decrease demand for crops, affect the commercial viability of UK producers, and impact tourism and forestry sectors.
- Trees provide essential services like shade, carbon capture, and flood alleviation, but pests could significantly reduce their value, impacting urban environments and construction materials.

288 DEFRA (2024) Agriculture in the UK Dashboard: Crops and Livestock, Production by Volume
289 Lewis, C.M., Persoons, A., Bebber, D.P. et al. (2018) Potential for re-emergence of wheat stem rust in the United Kingdom
290 DEFRA (2023) High profile pests and diseases
291 The National Archives (2025) Commission Implementing Regulation (EU) 2019/2072
292 Ibid
293 FAO (2022) FAO's Plant Production and Protection Division
294 DEFRA (2023) Defra economic analysis report explaining adjustments to the breakeven threshold and impacts of virus yellows on sugar beet production in 2023
295 Mitchell, R.J., et al. (2014) The potential ecological impact of ash dieback in the UK

Example mitigations

- Defra, Scottish Government, Welsh Government, and the Forestry Commission developed the Plant Biosecurity Strategy for Great Britain (2023-2028), linking it to the UK Biological Security Strategy.
- The UK Plant Health Risk Register (established 2013) helps prioritise and manage risks from pests and disease.
- The UK international action plan for plant health aims to strengthen global biosecurity, monitoring non-native plant pests to protect UK plant diversity.

Examples of additional benefits from taking action

- Disease-resistant varieties require less land to achieve the same yields, which would also decrease the time and money farmers spend on pest and disease management.
- Preventing pests could improve crop quality and therefore harvest value.
- Preventing plant pests can increase food security and conserve biodiversity.

What the future might hold

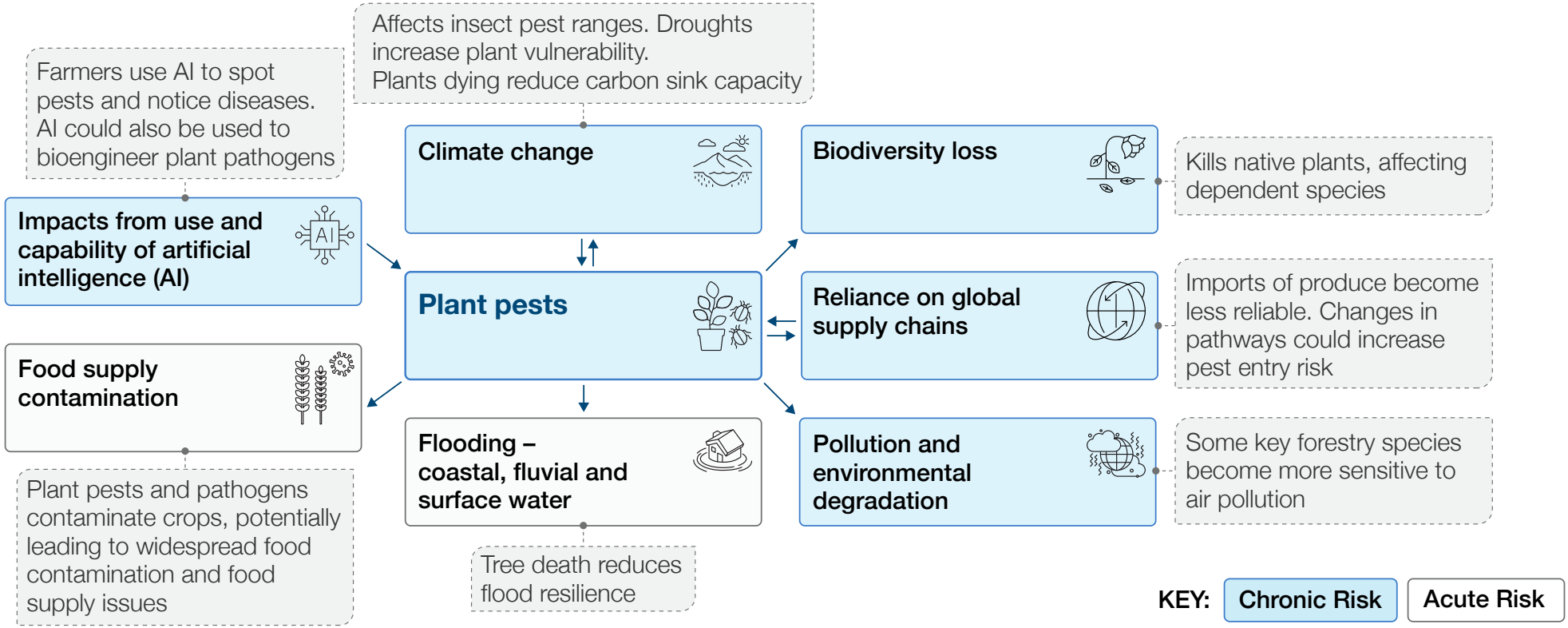
Short-term trajectory:

- Climate change may facilitate the emergence of new plant pathogens and invasive species, with drought-stressed trees and crops becoming more vulnerable to diseases.
- Increasing imports of trees and outdoor plants could heighten the risk of introducing pests similar to ash dieback and oak processionary moth.

Longer-term uncertainties:

- Multi-year droughts and plant pathogens could lead to repeated harvest failures, causing food insecurity, increased reliance on imports, heightening socioeconomic inequalities in the UK.
- Changing climate patterns may allow imported plant pests to flourish, which would alter forest conditions, deplete biodiversity, and reduce carbon storage capacity in stressed woodlands.
- The UK may adopt a stricter approach to trade imports to protect agriculture, forestry, and biodiversity, but this would limit trading partnerships.
- Farmers may diversify crops and expand the market for genetically engineered varieties to improve resilience and food security.

Example connections with other chronic and acute risks



Chronic Risk:
Impacts from the expansion of engineering biology

Definition

Engineering biology (EB)/Synthetic Biology applies engineering principles to design and construct biological parts, devices, and systems, such as cells or proteins. Applications range from medicine, agriculture, energy, to environmental remediation. Advancements and wider accessibility of these technologies could increase the likelihood of misuse, such as accidental or intentional release of engineered organisms, resulting in harms to human, animal or plant health, and/or disruption of ecosystems.

Current evidence

The growth in engineering biology can be attributed to a combination of scientific, technological, and societal factors, and has been propelled by a series of breakthroughs including the sequencing of the human genome (completed in 2003[296]), which provided fundamental information about human biology. This has been furthered by advancements in the scalability and speed of DNA sequencing, synthesis and cost reductions.[297]

In 2023, the global biotechnology market was valued at USD $1.55 trillion,[298] with governments and businesses recognising EB's transformative potential across fields like health, agriculture, manufacturing, energy, and the environment.

EB has facilitated the development of alternative food sources

296 NIH (2023) The Human Genome Project
297 NIH (2017) Synthetic DNA Synthesis and Assembly: Putting the Synthetic in Synthetic Biology
298 Grand View Research (2023) Biotechnology Market Size, Share & Trend Analysis by Technology

Therefore, the UK and other nations have made EB a strategic priority. EB has had positive impacts on food security through advanced breeding techniques for plants and animals,[299] for example, increasing crop resilience to pests, diseases and changing climate.[300] Alternative food sources, like lab-cultivated proteins with fewer resource inputs and reduced greenhouse gas emissions, are also possible using EB.[301] Furthermore, EB has promoted sustainable manufacturing practices, such as biomanufacturing from waste materials, to support a circular economy and improve supply chain resilience.[302]

However, recent advancements, such as open-source resources, more affordable tools, large language models, and support from platforms like DIYbio,[303] have lowered the barriers to accessing these technologies, increasing the risk of misuse. Additionally, international competition could catalyse EB innovation, with regulations struggling to keep pace with technological progress. Although this is less likely in the UK, where strong regulations exist,[304] globally, it could exacerbate the negative consequences of EB's misuse.[305]

Example vulnerabilities

- Malign actors could engineer pathogens to use as biological weapons to target humans. Engineered pathogens could also threaten keystone species, livestock, and crops, jeopardising UK food security.
- The release of engineered organisms (intentional or not) could have unforeseen cascading effects across an entire ecosystem.

Example mitigations

- Under the UK Biological Security Strategy, the Government is committed to fostering responsible innovation in EB.
- The Department for Science, Innovation and Technology has published guidance on nucleic acid synthesis,[306] contributing towards the UK's efforts in addressing biosecurity concerns associated with the deliberate or accidental misuse of synthetic nucleic acids, whilst enabling and championing legitimate use.

299 Roell, M.S, Zurbrigge, M.D. (2020) The impact of synthetic biology for future agriculture and nutrition
300 Zaidi, S.SeA., et al. (2020) Engineering crops of the future: CRISPR approaches to develop climate-resilient and disease-resistant plants
301 NIH (2023) An Overview of Recent Progress in Engineering Three-Dimensional Scaffolds for Cultured Meat Production
302 DSIT (2023) National vision for engineering biology
303 DIY BIO An Institution for the Do-It-Yourself Biologist
304 Global Gene Editing Regulation Tracker (2020) Human and Agriculture Gene Editing Regulations and Index
305 The Centre for Arms Control and Non-Proliferation (2023) Fact Sheet: Biotechnology
306 DSIT (2024) UK screening guidance on synthetic nucleic acids for users and providers

- The Government is investing over £1.5 billion annually in biological security, launching new initiatives like the National Biosurveillance Network and Biothreats Radar.[307] Through the National Security and Investment Act, it has increased oversight of controlling interests in UK EB entities, providing an additional safeguard against acquisition by adversarial actors.
- Internationally the UK is committed to strengthening the Biological and Toxin Weapons Convention (BTWC)[308] and the capability of bio-surveillance measures across the UK in relation to the International Pathogen Surveillance Network (ISPN).[309]

Examples of additional benefits from taking action

- Enhanced R&D in EB, supported by improved public engagement and education on its benefits, is driving growth in the UK's agri-food, health tech, and biotech sectors, and safely unlocking the social benefits of EB.

What the future might hold

Short-term trajectories:

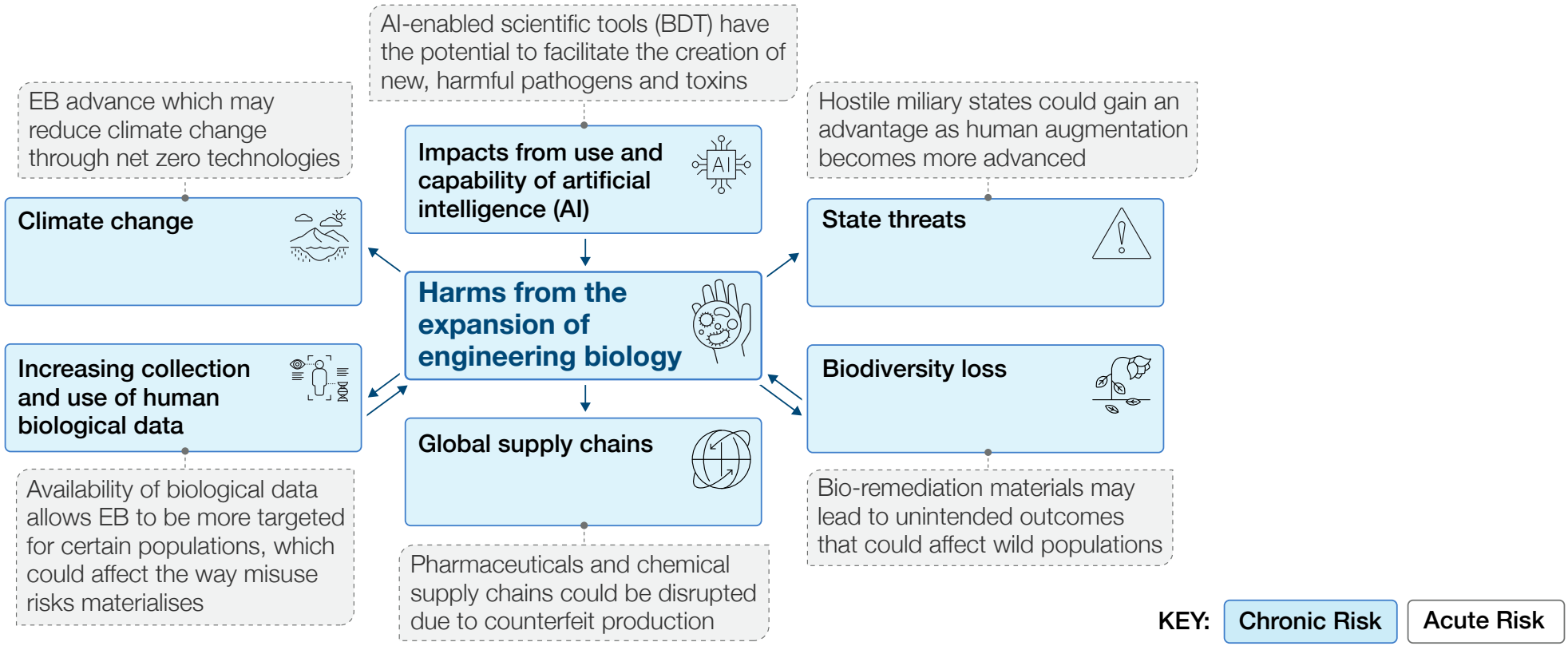
- Researchers may continue to develop engineered cells to create functional systems for drug development, disease treatment, and personalised cancer therapies.
- In industry, EB could enable sustainable bio-manufacturing using waste materials like sugarcane and wheat straw for biofuels and high-value chemicals.
- Malicious actors could seek to circumvent regulations and guardrails, combining artificial intelligence and EB to create engineered biological weapons,[310] which are illegal under international law.

Longer-term uncertainties:

- By employing machine learning systems to predict protein structures and pharmacological effects from DNA sequences, home fermentation kits and engineering biology tools could enable individuals to produce bioengineered products at home.
- Decentralised chemical production could pose enforcement challenges, leading to substandard or fake medications and synthetic opioids, potentially disrupting traditional pharmaceutical supply chains.
- Genetic tools may become routine in health, agriculture and manufacturing, with initial consumer acceptance in the food supply chain driving wider adoption across more sectors.

307 Cabinet Office (2023) World-class crisis capabilities deployed to defeat biological threats of tomorrow
308 UN United Nations Office for Disarmament Affairs
309 WHO International Pathogen Surveillance Network
310 MoD (2021) Human Augmentation – The Dawn of a New Paradigm

Example connections with other chronic and acute risks



Chronic Risk:
Increasing collection and use of human biological data

Definition

Acquisition of and access to human biological data, such as human genetic information, biometrics, and personal health and fitness data, is increasing. Whilst this has many benefits for healthcare, wellbeing and improved personalisation of services, it presents risks associated with deliberate misuse. This could affect individual rights to privacy and could be used by threat actors for strategic advantage.

Current evidence

There is a significant amount of human biological data that can now be collected, from the genetic information that codes how a person is constructed, to their heart rate and blood pressure. Scientists, healthcare professionals, and citizens are increasingly interested in this data to answer questions about people's health and ancestry. Technological advances have made sequencing the human genome much cheaper, with the first full genome sequencing costing USD $300 million in 2003, dropping to only USD $525 in 2022. These rapid cost reductions have allowed an increasing number of private companies to offer consumers access to their biological data.

Over 500 million
DNA kits sold since 2006

Fully and part state-funded enterprises, such as the UK Biobank, now hold detailed genetic and health information from half a million anonymised UK participants. This data is globally accessible to approved researchers,[311] enabling wide-scale, public research. With tools like Artificial Intelligence (AI), these publicly funded datasets can now be processed and analysed more efficiently.[312] In contrast, private companies like 23&Me operate on a for-profit basis. Since 2006,[313] 23&Me has sold over 12 million DNA kits, and by 2019, about 21% of U.S. adults regularly used smartwatches or fitness trackers—contributing to a growing pool of privately collected health data.[314] In 2025 23&Me filed for bankruptcy, with some warning customers to delete their data from the company's website.[315]

The divide between public and private ownership of genetic data presents challenges in accessibility, diversity, and oversight. While regulations protect personal data, collectors must continuously enhance security to counter cyber threats. Ethical concerns include biometric surveillance,[316] targeting individuals based on genomic profiles,[317] and insurers accessing shared biological data,[318] which is increasingly viewed as a valuable strategic resource[319] for economic competitiveness at both business and state levels.

Example vulnerabilities

- Privacy risks and potential exposure of sensitive health information.
- Underrepresentation of non-European ancestry in genomic data, risking reinforced inequalities in healthcare development.
- Increased risk of hacks and information asymmetry in healthcare and biotechnology sectors, leading to higher insurance prices.

Example mitigations

- Biological data is protected under GDPR and the Data Protection Act 2018, with rights like the "right to be forgotten" and the national data opt-out for NHS patients.
- The 2018 Code on Genetic Testing and Insurance limits the use of genomic information for insurance.

311 UK Biobank (2024) Enable your research
312 Bhardwaj, A., Kishore, S. and Pandey, D.K. (2022) Artificial Intelligence in Biological Sciences
313 23andMe (2024) About: "By the numbers"
314 Vogels, E.A. (2020) About one-in-five Americans use a smart watch or fitness tracker
315 NYTimes (2025) 23andMe Just Filed for Bankruptcy. You Should Delete Your Data Now.
316 Cyranoski, D. (2017) China expands DNA data grab in troubled western region
317 Lentzos, F. (2020) How to protect the world from ultra-targeted biological weapons
318 Ipsos MORI (2019) A public dialogue on genomic medicine: time for a new social contract?
319 Liang, Z., Chu, X., Zeng, Y., Zhou, J. and Ma, J. (2019) Big Data and Application of Strategic Biological Resources in China (Chinese Version)

Examples of additional benefits from taking action

- Ability to utilise the secure application of precision medicine that uses an individual's genome/fitness data to tailor clinical care to their health needs.
- Ethical inclusion of populations that are historically underrepresented in research, would enable the closure of harmful data gaps. This would be aided by improvements in public engagement and an increase in the number of people opting-in, due to improved data holding security.

What the future might hold

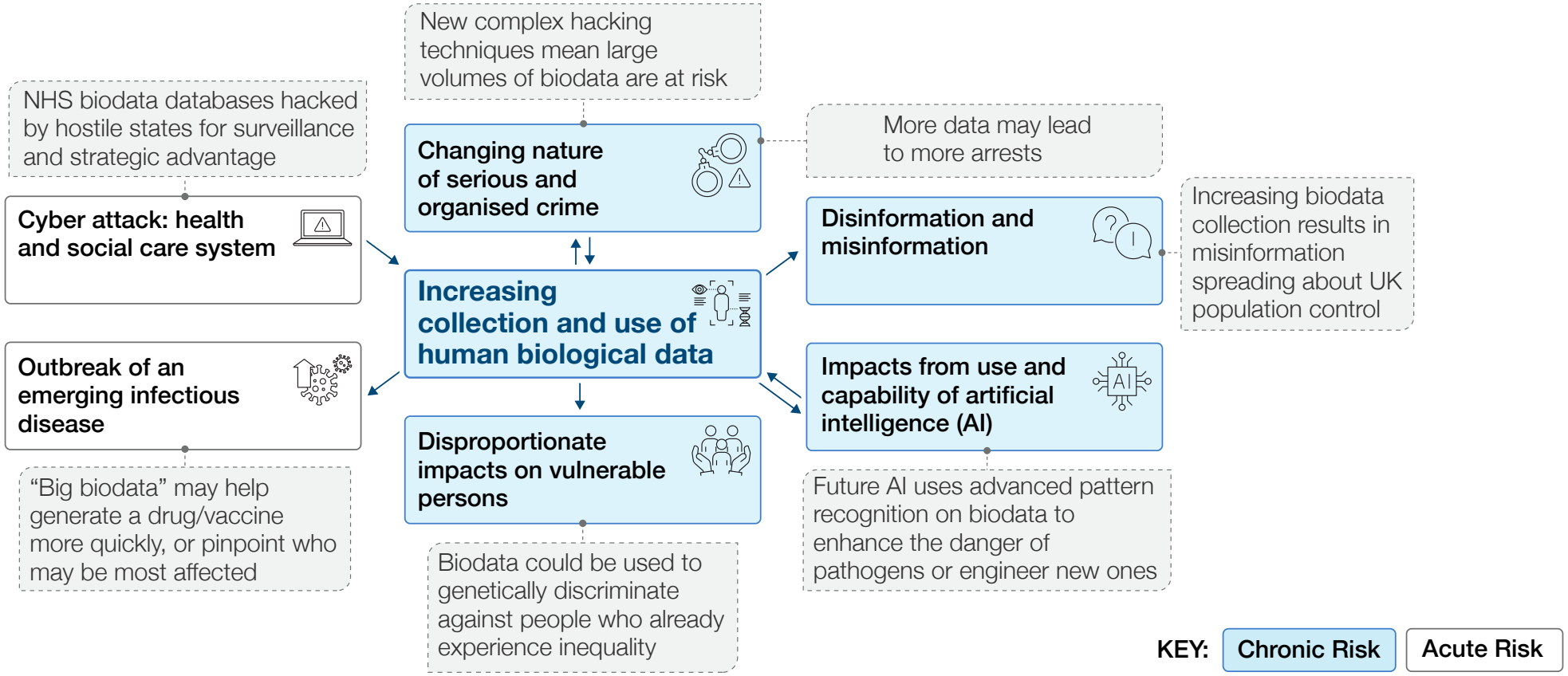
Short-term trajectories:

- Genomic and biometric data collection may become more common for personalised care and authentication, driven by declining DNA sequencing costs and technological advancements.
- Incentives from healthcare providers and insurers could drive greater integration of wearable technology with fitness trackers, increasing data collection but also raising privacy and data ownership concerns.

Longer-term uncertainties:

- Countries could engage in biological data "arms races" for strategic and economic advantages, with some states conducting data hacks for their own gain.
- The routine use of biological data, such as using genetic screenings for health insurance purposes, could lead to ethical concerns and heighten the risk of genetic discrimination and stigmatisation.
- In the UK, genome sequencing at birth and integration with NHS records, along with fitness tracker data, may facilitate personalised healthcare and early disease detection.

Example connections with other chronic and acute risks



Economic

Global economic trends are shaping conditions within and between states. Key sectors and public services lack skilled people in the numbers required, with demographic trends and migration patterns feeding into this. In parallel, rapid changes in the make-up and direction of the economy, driven by trends including digitisation, artificial intelligence (AI), and the shift to net zero, mean that the skills of some workers become redundant, with retraining needed to enable them to participate in the labour market. In addition, changes in the global economy, geopolitical environment, and climate increase the frequency and magnitude of shocks to supply chains, on which the UK relies for many goods needed for our critical national infrastructure. At the same time, the use of distributed ledger technology in finance (for example, cryptocurrencies) makes it harder to track financial activity and manage stability. The complexity and interconnectedness of global financial systems and products increases the impacts of bank failures, potentially causing industry or economy-wide instability or collapse, with long-lasting effects.

Chronic Risk:
Reliance on global supply chains

Definition

The UK relies on a complex network of companies and people globally to produce and deliver products and services. These supply chains include many critical goods needed for our economy and the functioning of essential public services, such as our health system.

Current evidence

Globalisation has resulted in economies becoming more interconnected through a complex set of trading relationships. This allows the UK to benefit from greater access to goods and services at lower prices. However, global supply chains can be complex, opaque, and fragile systems. Supply chains are being placed under significant strain from a range of factors including the emergence of new technologies and changing trading relationships, with increased protectionism and market distorting practices.

Trade is increasingly pivotal to the UK economy, representing 43% of GDP in 1970, rising to 70% in 2022.[320] However, geopolitical tensions are resulting in the fragmentation of trading relations.

Economies are becoming more interconnected with increased international trade

320 World Bank (2024) World Bank Development Indicators

For example, the war in Ukraine has resulted in a range of impacts including high and volatile prices for food, fuel, fertiliser and other commodities, such as nickel, which rose in price by 270% and caused the London Metal Exchange to suspend trading.[321] Many organisations are attempting to source materials and services from within their country's borders to reduce the potential impact from geopolitical risks and support domestic industry. Climate change is also disrupting trade routes, as increased severe weather can reduce agricultural yields and damage infrastructure.

Supply chain disruptions can trigger widespread impacts, as demonstrated during the COVID-19 pandemic. National lockdowns, shipping delays, and production slowdowns led to significant supply shocks and price spikes. This was also evident when Russia cut European energy supplies following the invasion of Ukraine. A resulting increase in UK wholesale gas prices caused an increase in the energy price cap by over £2,800 for a typical household (from £1,216 in winter 2021/22 to £4,059 in winter 2022/23). The Energy Price Guarantee (EPG), however, limited typical household bills to £2,500 during this period.[322] Supply chain disruptions are particular concerns for critical sectors such as health and defence.

Example vulnerabilities

- The UK's medical supply chains are global and complex, with roughly 20-25% of generic medicines prescribed in England being manufactured in the UK, whilst around a third are manufactured in India.[323]
- The high interconnectivity of supply chains, especially in key logistic hubs like the Suez and Panama canals, allows disruptions to spread across the network, increasing risks throughout the entire system.

Example mitigations

- The Global Supply Chains and Economic Security Directorate was established in the Department for Business and Trade (DBT) to drive action across government on strengthening critical supply chains.
- In January 2024, DBT published the Critical Imports and Supply Chains Strategy, focusing on five priorities: enhancing government expertise, removing import barriers, responding to global supply chain shocks, fostering international collaboration, and strengthening partnerships between government, business, and academia to build resilient and strategically important supply chains.
- The National Semiconductor Strategy outlines the steps that the UK government will take to help high-tech sectors ensure they are better prepared for potential supply shocks.

321 London Metal Exchange (2023) Independent Review of Events in the Nickel Market in March 2022
322 Office for National Statistics (2022) Inflation and Price Indices
323 British Generic Manufacturers Association (2020) Strengthening the resilience of the global supply chain

Examples of additional benefits from taking action

- New trading relations established to reduce the dependencies on unstable nations may also open access to new markets, potentially decreasing costs.
- Sourcing materials and services from within the UK and moving towards a circular economy would reduce dependence on finite resources, reduce costs and create jobs, whilst making the UK less dependent on international markets.

What the future might hold

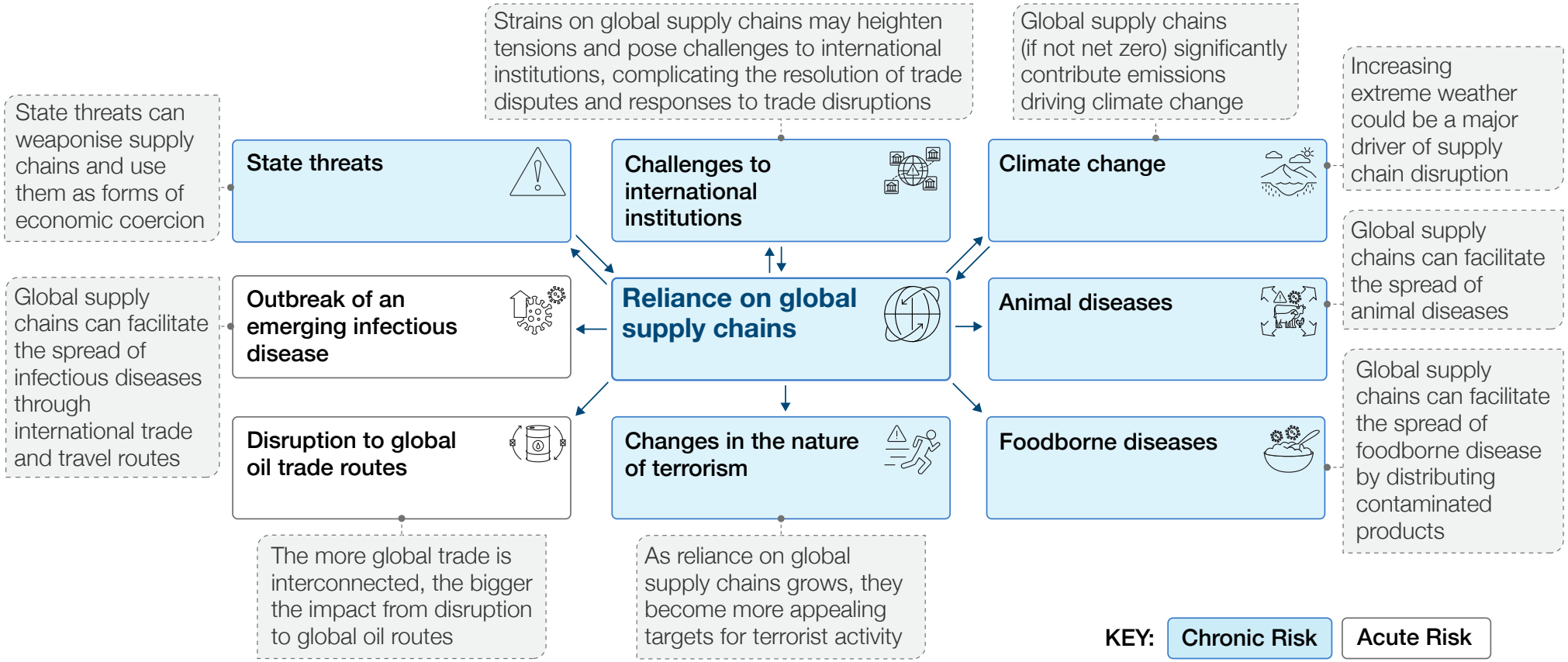
Short-term trajectories:

- New and improved technology may improve product traceability, monitoring and efficiency in supply chains. However, the technology is likely to be dependent on a few key companies and regions.
- As countries decarbonise, prices of minerals for clean energy technologies may rise.
- Protectionism and sanctions could add pressure to supply chains, undermining economic performance, threatening employment and worsening living standards.
- Increasing competition for natural resources may provide opportunities for organised criminals to disrupt trade routes, create black markets, and exploit labour through illegal mining and counterfeiting.

Longer-term uncertainties:

- Due to the global efforts to decarbonise, it may become increasingly difficult to meet demand for lithium, cobalt and other rare earth metals. States may use private military companies, investments, bribes and political interference to gain access to these minerals, increasing conflict, corruption and criminality in mineral-rich countries.
- Global trade routes may change as sea levels rise and melting ice caps open new shipping routes through the Arctic, while some trade routes may become less viable due to climate change, geopolitical tensions and piracy.

Example connections with other chronic and acute risks



Chronic Risk:
Impacts from emerging financial systems

Definition

New technologies are enabling emerging financial systems which can offer higher efficiency, accessibility and security than current systems. However, these new systems make it more difficult to track and regulate financial activities and may be more vulnerable to cyber attacks. The complexity and increasing interconnectedness of global financial systems and products amplify the effects of bank failures and insolvencies, potentially leading to industry-wide or economic instability with lasting consequences.

Current evidence

In the past decade, numerous digital and decentralised systems have been developed to enhance financial processes. Distributed ledger technology (DLT) allows for secure, transparent and decentralised finance, offering increased efficiency and lower costs, as intermediaries are not required to participate in exchanges. The most common DLT is the blockchain structure, which underpins cryptoassets such as Bitcoin, Ether, and Tether. Decentralised Finance (DeFi) is a digital ecosystem built on DLT that emerged in July 2020, which eliminates the need for traditional centralised intermediaries (for example, banks, pension funds, stockbrokers). Central bank digital currencies (CBDCs) are similar to cryptocurrencies, except they are issued by the central bank and their value is fixed to the country's fiat currency (for example, US dollar, the euro, and the British pound).

500 million crypto asset users across the globe

The market for cryptoassets began to establish itself in around late 2013, and has since seen its total market capitalisation increase, standing at c.USD $3.1 trillion in May 2025.[324] Globally there are now at least 500 million crypto asset users.[325] Big financial firms have even begun to adopt blockchain technology and cryptoassets.[326] Globally the DeFi market is still relatively small, with its market capitalisation peaking at c.USD $170 million in 2021. CBDCs have become increasingly popular over the last few years, with 100 jurisdictions exploring their use.[327]

Although DLTs offer advantages, they can also have negative impacts. The complex nature, increased anonymity of transactions, and limited regulation[328] of cryptoassets has also opened new avenues for illicit finance, such as money laundering and sanction evasion, and funding serious organised crime, terrorism and fraud.[329] Some blockchain processes are also very energy-intensive, resulting in high carbon emissions.[330]

Example vulnerabilities

- Consumer cryptoassets are not yet legally protected in the same way as in the traditional banking system,[331] meaning that consumer funds are much more vulnerable to hacks and bankruptcies.
- Blockchain technology requires a high level of expertise to implement and maintain. Insufficient digital literacy in businesses and regulators could impede the UK's ability to take advantage of this technology.[332]

Example mitigations

- In October 2023, financial promotions requirements for cryptoassets came into effect: cryptoassets now fall within scope of the UK financial promotions regime, requiring them to be fair, clear, and not misleading.
- In November 2024, the Treasury confirmed it is proceeding with proposals to create a new financial services regulatory regime for cryptoassets.[333]

324 CoinGecko Global Cryptocurrency Market Cap Charts
325 Statista (2023) Number of identity-verified cryptoasset users from 2016 to June 2023
326 Forbes (2023) Big Financial Institutions are adopting Crypto and Blockchain – What does the technology offer SMBs?
327 IOSCO (2023) Policy Recommendations for Decentralised Finance (DeFi)
328 Bains et al. (2022) Regulating the Crypto Ecosystem: The Case of Unbacked Crypto Assets
329 OECD (2022) Why Decentralised Finance (DeFi) matters and the policy implications
330 European Environment Agency (2023) Blockchain and the environment
331 Forbes (2023) Are Crypto Exchange Accounts Insured?
332 ITBrief United Kingdom (2023) UK's trust in emerging tech lagging
333 HMT (2023) Future financial services regulatory regime for cryptoassets

- HM Treasury also published its National Payments Vision in November 2024, outlining the Government's ambition to enable a trusted, world-leading payments ecosystem delivered on next generation technology, within a clear regulatory framework and with more choice for consumers and businesses.[334]

Examples of additional benefits from taking action

- The safe adoption of blockchain technology and digital currency in the West would allow it to influence global standards in the implementation and usage of these technologies.
- New policing powers to seize digital assets identified and linked to criminal activity can enable the UK to more effectively deter and mitigate against economic crime and crime financed through cryptoassets.

Looking to the future

Short-term trajectories:

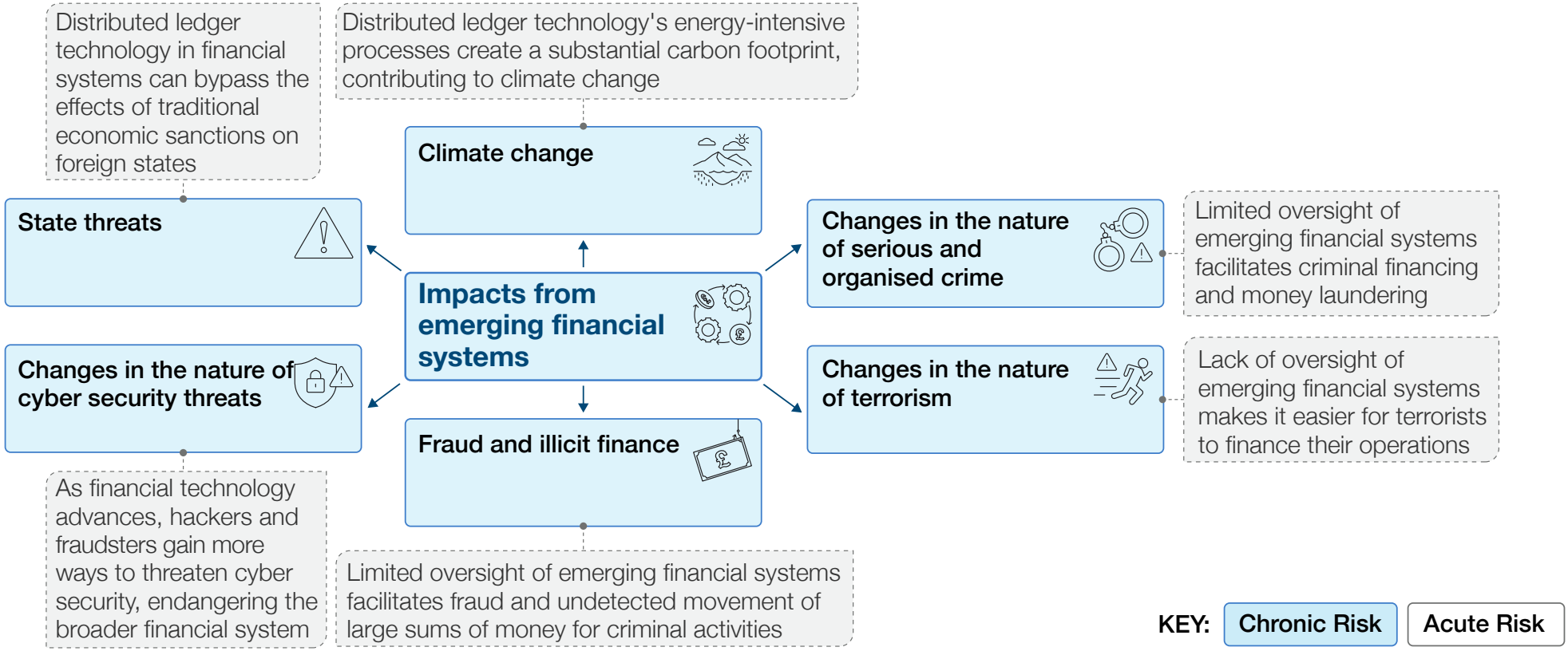
- DLT and programmable smart contracts could improve efficiency and resilience in the financial system, thanks to their straightforward structure, provided there is effective governance in place.[335]
- Blockchain based assets and payment systems encourage financial inclusion, which may foster entrepreneurship and growth in underserved communities,[336] However, they may also lend themselves to financial risk taking and individual liability, particularly if consumer protection is not implemented.
- Cryptoassets and DeFi could pose a threat to the stability of the financial system, especially if the risks are not adequately understood and proper regulations are not implemented.

Longer-term uncertainties:

- Cryptocurrencies, in their current form, transcend borders and regulations, and are not controlled or influenced by central banks like fiat currencies. Should they become universal, the Government's ability to influence inflation and employment through interest rates and open market operations could be limited.
- Without appropriate regulation, cryptoassets may facilitate a rise in organised criminal activities, such as fraud, illicit finance, and the illegal trade of drugs and weapons. Increased levels of crime would put pressure on public services, such as policing and the health service, and reduce social cohesion.

334 HMT (2024) National Payments Vision
335 Bank of England (2022) If a blockchain became more critical to the financial system, how should it be governed?
336 Cointelegraph (2024) Banking the unbanked: How DeFi can help the low-income population

Example connections with other chronic and acute risks



Chronic Risk:
Impacts of ongoing skills shortages and mis-matches

Definition

Skills shortages occur when employers are unable to find candidates with the necessary skills for specific jobs. Skills mis-matches occur when there is a misalignment between the skills possessed by workers and the skills needed for a particular role. Technological, social and economic changes are driving an increase in skill shortages and mis-matches in the UK.

Current evidence

Rapid changes in the make-up and direction of the economy, driven by trends such as digitisation, artificial intelligence (AI), and the shift to net zero, are making the skills of some workers redundant. Retraining is needed to enable these workers to continue participating in the labour market. Skills shortages are partly driven by the UK's ageing population, which is increasing the demand for health and social care and reducing the proportion of the population at working age.

Over 100,000 staff shortages and 122,000 vacancies in the adult social care sector

The UK unemployment rate for people aged 16 years and over was estimated at 4.4% in December 2024 to February 2025, higher than before the COVID-19 pandemic. The estimated number of vacancies in the UK fell by 26,000 on the quarter, to 781,000 in January to March 2025. This is the first time since March to May 2021 that vacancies were below pre-pandemic levels.[337] In March 2025, 6% of UK businesses reported experiencing recruitment difficulties.[338] Digital literacy is a key issue, with 7.5 million people, or 18% of UK adults, lacking essential digital skills needed for the workplace.[339] Overall, the latest Employer Skills Survey shows there has been a decrease in training and development, with 60% of employers providing training for their staff in the last 12 months compared to consistent levels of 65-66% between 2011-2017.[340] Additionally, AI is evolving rapidly and is likely to have significant effects on the labour market. Automation alone is forecast to impact up to a third of UK jobs. While job displacement does not necessarily lead to higher unemployment rates, workers may need to upskill to move into technical occupations.[341]

Skills shortages and mismatches reduce productivity, limiting growth.[342] Essential public services are also impacted, reporting a shortage of over 100,000 staff and 122,000 vacancies in the adult social care sector, equating to a vacancy rate of 8% (compared to just under 3% for jobs across the wider economy).[343] Staff shortages in this sector can have wide-ranging consequences, hindering efforts to tackle care backlogs, reducing care quality and impacting staff wellbeing and sickness rates.[344,345]

Example vulnerabilities

- Areas outside of London, particularly rural and coastal areas, struggle to attract and retain highly qualified workers.[346] However, the increased remote working may lead to high-skilled workers from the South-East moving to other areas where property is more affordable.[347]

337 ONS (2025) Labour market overview, UK: April 2025
338 ONS (2025) Business Insights and Conditions Survey - wave 130
339 House of Commons Library (2024) Digital skills and careers
340 DfE (2023) Employer Skills Survey 2022: research report
341 ONS (2023) Vacancies and jobs in the UK: September 2023
342 Government Office for Science (2017) Future of Skills & Lifelong Learning
343 House of Commons Library (2020) The health and social care workforce gap
344 Hospital Times (2022) NHS workforce shortage has “serious and detrimental” impact on services
345 Care Quality Commission (2023) State of Care 2022/23
346 ONS (2023) How workforce qualification levels differ across England & Wales
347 Economics Observatory (2022) What does remote working mean for regional economies in the UK?

Example mitigations

- The Government's mission to 'Break down the barriers of opportunity' will ensure enhanced early years services, increased access to high-quality childcare, and greater recruitment of skilled teachers, supporting young people to be equipped with the essential skills needed for future employment.
- The Get Britain Working White Paper 2024 set out significant reforms to employment support, bringing together work, health and skills support to get more people into work and to get on in work.
- The UK has launched T Levels, which are equivalent to 3 A levels and focus on vocational skills, including an industry placement of at least 45 days, to help students into skilled employment.[348]
- In 2020 the UK launched the skilled work visa, which has relaxed eligibility criteria for those seeking roles that are in short supply in the UK labour market.[349,350,351]

Examples of additional benefits from taking action

- A higher level of matching skills with demands of the economy can lead to lower unemployment and higher pay for workers.
- Addressing skills shortages in the NHS would improve the quality of healthcare in the UK.[352]
- Redistribution of both workers and businesses across the UK could reduce the disparity between high/low income and urban/rural areas.

348 HM Government T-levels
349 HM Government (2024) Skilled Worker visa: Overview
350 HM Government (2023) Skilled Worker visa: shortage occupations
351 Davidson Morris (2023) Shortage Occupation List 2023
352 House of Lords Library (2024) Importance of skills: Economic and social benefits

What the future might hold

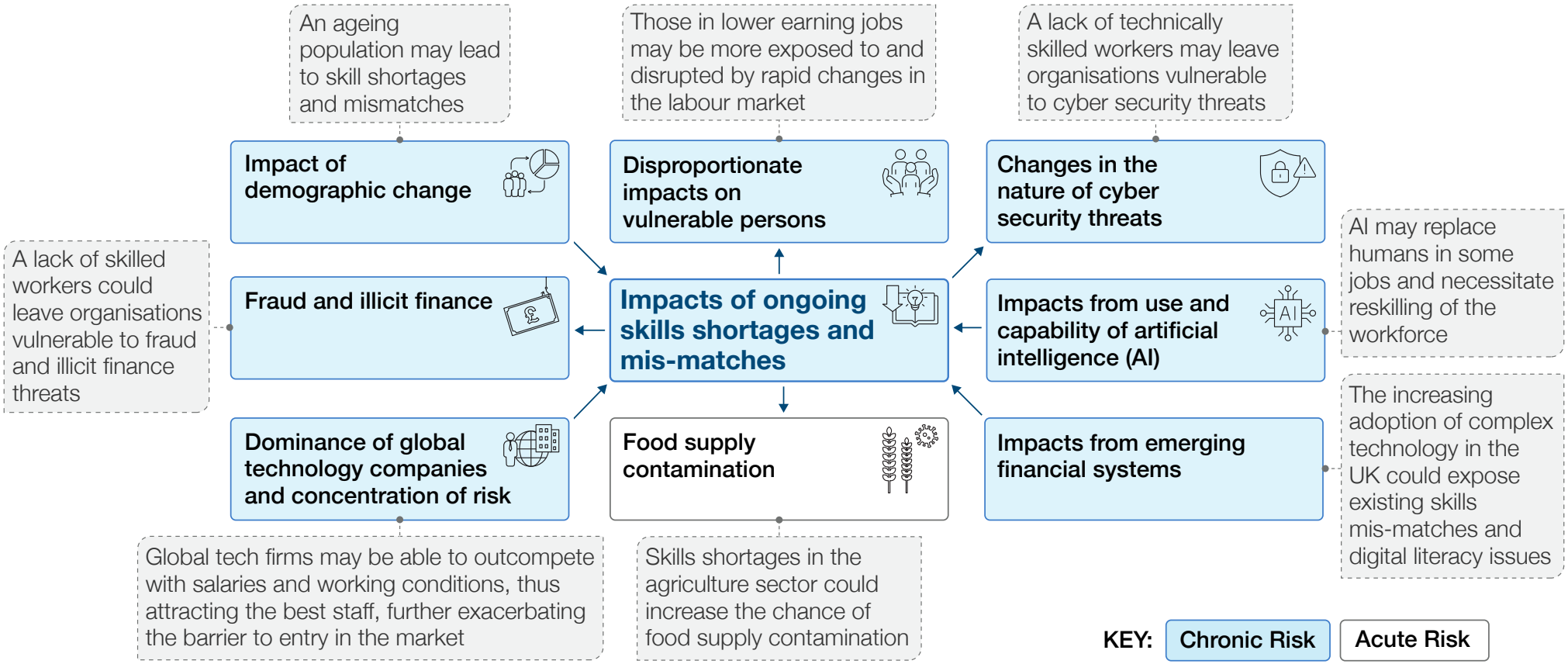
Short-term trajectories:

- A shortage of skilled nursing staff may collide with an increasingly sick and ageing population, affecting quality of and access to care and decreasing job and patient satisfaction.
- Professions in fields like electrical engineering, bioengineering, and applied AI may emerge and expand, while others, such as accountants, software coders, and analysts, could gradually be replaced by AI.
- AI may augment and enhance productivity rather than entirely replace human input in fields such as customer service, accountancy, and graphic design.
- AI could have an outsized impact on education, supporting all ages, designing tailored lesson plans, marking and providing real time feedback. This could help people retrain and improve opportunity, as private tutoring is no longer the preserve of the wealthy.

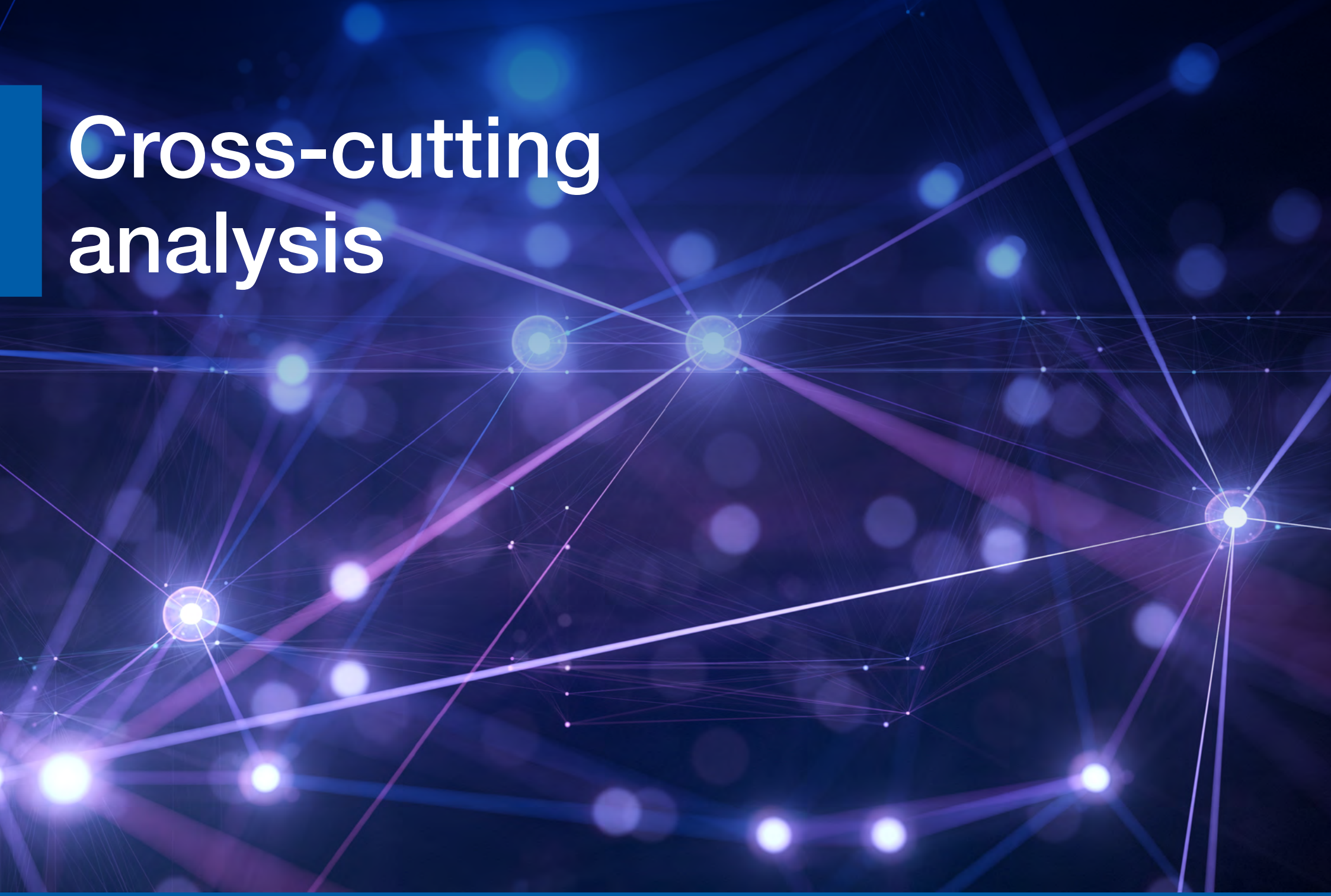
Longer-term uncertainties:

- Universities may struggle to attract students as online courses may provide an alternative, cheaper pathway for higher education, with AI designing curriculums and providing instant feedback on submissions.
- Workers may retrain and move away from dying professions. For example, software engineers may move into new (related) roles, such as “AI Prompt Engineers” or “AI ethicists”.

Example connections with other chronic and acute risks



Cross-cutting analysis



Chronic risks do not operate in a vacuum and are instead interlinked with other chronic and acute risks. Chronic risks can therefore have both direct and indirect cascading impacts on vulnerabilities that gradually erode our economy, environment, way of life, and/or national security. Mitigating the negative effects of these risks will therefore require coordination across government departments and for the wider resilience community across industry and academia.

Each chronic risk assessment includes a review of the interactions between risks. This holistic approach highlights the most systemically important chronic risks in the network to inform the design of effective evidence-based policies that mitigate multiple risks together.

Most interconnected

Challenges to international institutions has the largest number of direct impacts on other risks and vulnerabilities, highlighting this as a key risk to tackle to mitigate many risks together. This is because a lack of international coordination inhibits the ability to tackle global environmental issues such as climate change, biodiversity loss and pollution, as well as issues of international security related to state threats, terrorism, serious and organised crime (SOC), and regulation of new technologies.

Terrorism, SOC and vulnerable persons have the largest number of chronic risks directly impacting them highlighting these as being most vulnerable to exacerbation by other chronic risks.

State threats has the largest total number of direct impacts, i.e., both incoming and outgoing impacts. This is largely driven by many direct impacts on acute risks, 11 in total, including biological and conventional military attacks on the UK. There are also less obvious connections with other chronic risks, such as the adoption of emerging financial systems to avoid economic sanctions. Terrorism, cyber security and climate change are tied with the second largest total number of connections. It is now well established that combatting the effects of climate change requires a holistic systems approach; this analysis indicates that similar approaches are required to tackle a range of other chronic risks.

Fewest direct connections

Risks with fewer direct connections can highlight risks at the edge of the network which may require more targeted mitigation methods. For example, although concentration of risk through dominance of global technology impacts 19 risks and vulnerabilities, and increasing competition for critical minerals impacts 14, each is only impacted by two chronic risks. Therefore, addressing other risks in the network are unlikely to have large impacts on these issues. Instead, measures to specifically target these risks will be required to mitigate their adverse direct and indirect impacts.

At the other end, risks affected by numerous other risks but with minimal direct impacts themselves may signify the final stage in a cascade. These include vulnerable persons and biological data. Tackling these risks necessitates a more holistic approach to reduce risks higher up the chain.

Overall, this analysis emphasises the need for coordination in addressing the underlying trends that drive these risks. Most notably, various vulnerable groups of people are impacted by many chronic risks spanning all 7 themes: security, societal change, technology and cyber security, geopolitics, environment, biosecurity and economics.

Furthermore, this analysis also highlights potential conflicting interests. For example, reliance on digital platforms makes businesses and public services more vulnerable to outages and cyber attacks, but also connects geographically isolated locations.

In parallel, other technologies such as AI and engineering biology are also associated with many benefits as well as risks, for example, together these technologies can reduce the risks of human disease by designing novel vaccines. These results highlight the need for a whole of society conversation surrounding the use and regulation of these technologies to balance their positive and negative effects.

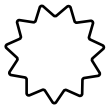
The figure on the following page shows an example section of a full impact map which displays chronic risks with direct impacts on the groups of people vulnerability.

The visualisation on the next page shows how groups of people might be affected by a representative selection of chronic risks.

Chronic risks, or long-term risks, do not operate in a vacuum and are instead interlinked with other chronic and acute risks.[353] Chronic risks can therefore have both reinforcing and diminishing cascading impacts on a range of vulnerabilities that gradually erode our economy, environment, way of life, and/or national security.

How to read

Vulnerability and Risks



Each vulnerability is represented by this unique shape.

Each risk is represented by a circle.

Risk Categories

The macro categories are represented by colours

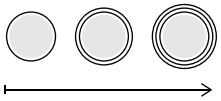
- Security
- Geopolitical
- Economic
- Societal
- Biosecurity
- Environmental
- Technology and cybersecurity

Scoring system

Diminishing

The risk weakens or lessens the impacts of the other risk or lessens the negative impacts on the vulnerability.

Reinforcing



The risk exacerbates or increases the impacts of the other risk or increases the negative impacts on the vulnerability.

Risk Relationship

The arrows on connections represent the direction of the relationship.

353 To ensure that images are not too crowded we have only chosen to show Chronic Risks in these visualisations.

A representative selection of chronic risks