Swiss Re

June 2022

Swiss Re SONAR

New emerging risk insights

10th anniversary edition

Every year, Swiss Re SONAR informs and inspires conversations about emerging risks, so the insurance industry and its clients can continue to build resilience.

Contents

Overview: Emerging risk themes & Trend spotlights 4
Foreword 5
Introduction 7
Macro trends 8
Reflections: John Dacey 13
10 years of SONAR – lessons from emerging risks 14

9 Emerging risk themes and 5 Trend spotlights

Demographic and social environment 18
Eroding trust – new worries for public health and medical science 20
Baby dreams – risks in the fertility services 22
How to better prepare for the next pandemic – Trend spotlight 24
Reflections: Cathy Desquesses 26

Political and economic environment 28
Challenges in construction – raw material shortages and price increases 30
Reflections: Jean-Claude Trichet 32
Commercial space age – coverage for satellites on collision course? 34

Technological and natural environment 36
Thawing permafrost – accelerating climate, infrastructure and health hazards 38
Reflections: Christoph Nabholz 41
New fuels to decarbonise the shipping industry – Trend spotlight 42
Quantum computing – a threat before an opportunity 44
Biotech boom drives innovation and risks – Trend spotlight 46
Underwriting crypto asset risk – what are the odds? 48
Invasive species – if climate change adaption goes wrong 52
Sustainable farming revolution – Trend spotlight 54

Competitive and business environment 58
Legal tech – is AI rendering justice? 60
Overcoming hurdles in automated underwriting – Trend spotlight 62

Appendix: Terms and definitions 64

Emerging risk themes

Potential Impact	0 – 3 years	> 3 years
High	Challenges in construction – raw material shortages and price increases	Quantum computing – a threat before an opportunity
	Thawing permafrost – accelerating climate, infrastructure and health hazards	
Medium	Eroding trust – new worries for public health and medical science	Commercial space age – coverage for satellites on collision course?
	Underwriting crypto asset risk – what are the odds?	Legal tech – is AI rendering justice?
Low	Baby dreams – risks in the fertility services	Invasive species – if climate change adaption goes wrong

Most affected business areas

- Property Lines
- Casualty
- Financial Markets incl. insurers' assets
- Specialty Lines
- Life & Health
- Operations incl. regulatory changes

Trend spotlights

- How to better prepare for the next pandemic
- New fuels to decarbonise the shipping industry
- Biotech boom drives innovation and risks
- Sustainable farming revolution
- Overcoming hurdles in automated underwriting

Foreword

This 10th anniversary edition of our SONAR publication comes at a time when the world is in a state of shock and crisis. Most immediate is the war in Ukraine and the death and destruction this is causing. The conflict is further weakening already-strained international relations, and comes in the wake of a still ongoing pandemic. The war has darkened the economic outlook considerably, for example by accentuating supply chain disruptions resulting from the pandemic, and increasing the risk of recession. At the same time, global warming remains a long-term, existential threat. The world needs to take more collaborative action now to transition to "climate-friendly" economies and away from fossil-fuel dependency.

Extreme situations arise from crises and provide an opportunity for us to evaluate our risk foresight. And SONAR is exactly that: a forward-looking view of potential turbulence, unforeseen shifts in business environments and new interactions between different risk factors. This 10th edition is a good opportunity to reflect on the purpose and value of foresight in general, and the merits of publicly sharing emerging risk insights.

"Could we have seen this coming?" is probably not the most useful question. More pertinent is "could we have been better prepared?" SONAR's aim is not to predict or forecast, but to bring risk developments and trends to the fore, with scenarios and possible (rather than likely) risk outcomes for the insurance industry and its clients. It is about raising risk awareness, dialogue, engagement and inspiration for action. Given that so many risks are shared across countries and continents, shared risk awareness might even contribute to the realization that more, not less collaboration is needed to mitigate emerging threats.

We hope you find this year's anniversary edition of SONAR a thought-provoking read.

Patrick Raaflaub
Group Chief Risk Officer

Introduction

As our world undergoes constant change, this gives rise to "emerging risks" – new or changing risks that are difficult to quantify and that can have a major impact on the insurance industry. Swiss Re identifies emerging risks by gathering input and feedback from underwriters, client managers, risk experts and others across the company, and also from external experts and research institutions. With the annual SONAR report, published since 2013, we aim to foster dialogue with all stakeholders to help insurers understand and manage emerging risks more effectively.

This year's SONAR report features nine new emerging risk themes and five emerging trend spotlights. The emerging risk themes are potential new or changing risks, with both downside risks and upside potential for the insurance industry. The "Trend spotlight" items highlight contextual developments we deem relevant for the insurance sector, without necessarily referencing a specific risk.

The emerging risk themes outlined in the SONAR report are based on early signals collected over the course of a year. They do not reflect entire industry-wide thinking with respect to emerging risks, nor do they necessarily cover the full list of associated topics currently on Swiss Re's radar screen. The themes have been categorised according to their estimated impact and our forecast for when they may materialise, and with respect to lines of business where we think the biggest exposures will lie (see page 4). For all the risk themes, we flag where there have been topic-relevant mentions in previous SONAR reports. Some emerging risks presented in this year's SONAR report may never materialise, while others may form the basis for future risk pools. Similarly, some of the trends depicted may lose importance, while others may play a growing role in shaping the future business environment.

We begin the SONAR report with an overview of the macro trends relevant to re/insurance markets and the world at large, as seen by Swiss Re. These trends and their grouping into demographic & social, political & economic, technological & natural and competitive & business themes serve as a backdrop and ordering structure for the subsequent exposition of this year's report of emerging risk themes and trend spotlights. The appendix explains all terms & definitions used in the report.

Per lines of business, the top emerging risk themes identified in this year's edition are:

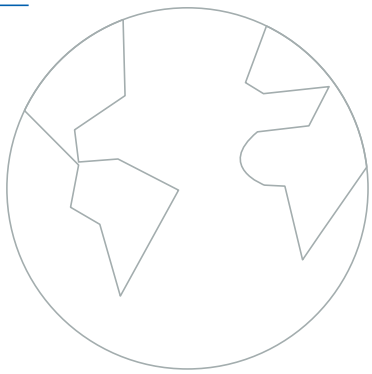
- for Property:
  "Thawing permafrost – accelerating climate, infrastructure and health hazards"
- for Casualty:
  "Legal tech – is AI rendering justice?"
- for Life & Health:
  "Eroding trust – new worries for public health and medical science"
- for Financial Markets (incl. insurers' assets):
  "Challenges in construction – raw material shortages and price increases"
- for Operations (incl. regulatory changes):
  "Quantum computing – a threat before an opportunity"

Macro trends

Identifying and monitoring macro trends enhances understanding of the risk landscape of the future. Based on internal surveys and workshops, Swiss Re curates a set of macro trends deemed to be of high importance for insurance in the next decade. The macro trends portfolio is reviewed annually and informs strategic priorities and associated decision making, and the creation of solutions for emerging risk pools. Having conducted a thorough re-inspection of the selected trends in the immediate aftermath of the COVID-19 pandemic, the macro trends portfolio remains largely unchanged in 2022. The only exception is the macro trend "Low-yield environment & risk of inflation." In light of present developments, it was adjusted to "Rising interest rates amid high inflation." Below you will find the overview with all macro trends, followed by three overarching themes connecting this year's SONAR topics, as well as descriptions for each macro trend.

Demographic and social environment

- Growing middle class in high growth markets
- Longevity & radical medical innovation
- Mass migration & urbanisation
- Changing workplace and talent gaps
- Rising social inequality & unrest



Political and economic environment

- Macroeconomic fragility
- Challenged globalisation
- Geopolitical & economic instability
- Rising interest rates amid structurally higher inflation risks
- Infrastructure funding needs

Technological and natural environment

- Addressing physical climate change risks
- Rising importance of biodiversity and ecosystem services
- Transition to a low carbon economy
- Expansion of digital & cyber risk
- Data as an asset
- Digital products and processes
- Disruptive digital technologies
- Autonomous transportation & robotics

Competitive and business environment

- Re/insurance value chain disaggregation and rise of alternative re/insurance providers
- Consolidation of platforms as a business model through strategic partnerships
- Regional champions going global
- Increasing digital customer interaction
- Increasingly litigious environment
- Rising importance of Environmental, Social and Governance (ESG)

Climate change and the transition to a low-carbon economy

Climate change – one of the key emerging risk trends and one that is here to stay – is reshaping the economic landscape by driving price changes, structural shifts and new regulations. In parallel, it is also influencing exposure to other emerging risks, such as from loss accumulation due to permafrost thawing (see "Thawing permafrost – accelerating climate, infrastructure and health hazards," p 36) to risk from transmittable diseases and potential pandemics (see "How to better prepare for the next pandemic", p 24), and risk from invasive species (see "Invasive species – if climate change adaptation goes wrong," p 49).

Efforts to mitigate climate change and achieve net-zero greenhouse gas (GHG) emissions are gathering pace globally. However, in our view achieving the worldwide goal of net-zero emissions by 2050 (limiting global warming to > 1.5°C above pre-industrial levels) will require more urgent transformation of the global economy, with collective action from both the public and private sectors. Transition away from fossil-fuel dependency to renewable energy sources while at the same time boosting energy efficiency, is crucial to achieving the net-zero goals. The shipping industry is one of the industries in focus for cutting CO_2 emissions and indeed, its transition to low-carbon fuels has already started (see "New fuels to decarbonise the shipping industry," p 39).

Successful transition to net-zero emissions by 2050 will need short- and mid-term target setting and progress monitoring. It will also necessitate management of the potential hurdles, risks and unintended consequences inherent in change projects. Decarbonisation is easier for some industries than others, and in most cases reducing emissions is intertwined with other targets for sustainability (see "Sustainable farming revolution," p 51). To smoothen the transition, societal effects also have to be taken into account. These include growing inequalities and changing opportunities for workforce and consumers. Some transition risks will be mitigated by technological advances, but novel technology can in turn also create new risks. The insurance industry has a vital role to play in the transition, by spreading best practice, providing specialist risk transfer knowledge and capacity to partners in other sectors of the economy, and as an enabler for investment in the innovation necessary to make carbon reduction and removal a reality.

Technological disruption – reality and hype

Technology regularly makes headlines, from medical advances, the ever-newer applications of artificial intelligence (AI) (see eg, "Legal tech – is AI rendering justice?" P 57), to endeavours in outer space (see "Commercial space age – coverage for satellites on collision course," p 32). Advances in vaccine development became particularly evident during the pandemic and highlighted economy's reliance on medical technology (see "How to better prepare for the next pandemic", p 24), while in other sectors scientific breakthroughs are driving innovation (see "Biotech boom drives innovation and risks," p 44). Tied also to new societal demands, technological progress is giving rise to nascent dynamic markets, such as in the area of childbearing (see "Baby dreams – risks in the fertility services," p 22). This particular case also exposes very clearly how scientific advances can bring about a variety of new economic risks in high-growth sectors, related regulatory uncertainty and potential technological or procedural glitches.

New technology can disrupt traditional processes, longstanding value chains and entire industries. With that, workplace processes, human behaviours and skills requirements also need to change. This applies as much to insurers and insureds. The two are closely inter-linked: the potential to insure very much depends on new insurance skills, knowledge and technological infrastructure. When looking at new technology, re/insurers also have to consider both impacts on existing coverages, as well as opportunities for new risk transfer products (see "Underwriting crypto asset risks – what are the odds?" p 46).

Ideally, the benefits from technological advances prevail over unintended negative effects. Often, this is the case. Sometimes though, technological advances and their disruptive impacts are overhyped. And sometimes, the benefits and risks of new technologies do not play out synchronously. In the case of quantum computing (QC), for example, where expectations regarding potential benefits have been set high, it could well be that cyber threat scenarios become relevant to the insurance industry before any widespread application of QC in business operations (see "Quantum computing – a threat before an opportunity," p 41).

Increased global uncertainty and risk awareness

The war in Ukraine has shaken Europe and the world. The crisis has hit markets already pressured by the pandemic years, further stressing supply chains, trade relations, and energy markets. Fear of prolonged high heated inflation and economic recession have risen, with the impact already showing in sharply higher prices for key commodities. Port blockages in Ukraine, one of world's largest wheat producers, are also threatening global food supply, leading to rising concern for food security in different parts of the world.[1] In parallel, new geopolitical risks and pandemic-related supply chain disruptions are affecting energy markets. While sanctions drive up oil and gas prices, the transition to new and greener energy cannot easily keep pace, as electrification of mobility (eg, largely depending on batteries) is facing shortages of relevant minerals and other raw materials. These developments create economic stresses for a number of world regions, and they could cause social unrest.

In globalised markets and interconnected production networks, supply chain disruptions for raw materials translate into delivery delays for both inputs and end products – as was the case most recently in a shortage of electric cars. Supply chain issues have been exacerbated by continued pandemic measures affecting logistics and workforces, but also by natural catastrophes, cyber-attacks and large accidents like cargo ships burning or blocking a critical waterway. In some sectors more affected by inflation, price hikes may also lead to long-term structural shifts. For instance in construction, there is concern that inflationary pressures and raw material scarcity may affect quality and durability of buildings (see "Challenges in construction – raw material shortages and price increases," p 29).

The accumulation of risk factors and losses has also heightened society's risk awareness. Current global challenges do not only highlight rational acknowledgment of risk accumulation, but also bring out irrational beliefs, threats and trust issues. Trust between large segments of the population and government officials as well as academic experts has been challenged by the pandemic, and the possibility exists that conspiracy theories and alternative views on health and other behaviours will negatively impact societal resilience more broadly (see "Eroding trust – new worries for public health and medical science," p 20).

[1] The Washington Post, "Ukraine's wheat harvest, which feeds the world, can't leave the country" 7th April 2022.

The 24 macro trends

Our set of 24 macro trends is categorized into four different areas, or environments (see graph on p 8). Short descriptions of these macro trends outline how each is developing and provide current insights.

Demographic and social environment

Growing middle class in high growth markets: The size of the global middle class increased from 1.8 billion people in 2009 to ~ 4 billion by 2021 (more than half of the world population) and is projected to reach 5.3 billion by 2030, with a large portion thereof in China. The associated increase in consumption and spending will coincide with increased insurance penetration.

Longevity & radical medical innovation: Radical medical innovation and increasing awareness of healthy lifestyles are triggering longevity improvements, impacting extended purchasing power and interest for new security in pension-related products. The COVID-19 pandemic has facilitated the accelerated implementation of Electronic Health Records globally.

Mass migration & urbanisation: Linked to the growth of middle classes, this trend is most pronounced in developing countries and high growth markets and will lead to accumulation and concentration of risk in urban areas. The pandemic did not halt this trend, but it provided an opportunity for planners and policy makers to take transformative actions towards creating cities that are greener and more sustainable.

Changing workplace and talent gaps: The role of offices is being redefined, as the "hybrid model" of working has become the new normal. In both advanced and emerging economies, demographic shifts and changing skill requirements, partly driven by human-machine interaction at the workplace and the overall automation of jobs, lead to a fierce competitive landscape for recruiting and retaining talented employees.

Rising social inequality & unrest: Increased unemployment and reduced economic activity during the COVID-19 pandemic led to higher income inequality across many countries. By providing affordable and innovative products to society and by engaging in effective public-private partnerships, the re/insurance industry can do its part to counteract rising inequality.

Political and economic environment

Macroeconomic fragility: The rise of global uncertainty, due to factors including the ongoing pandemic and the war in Ukraine has significantly worsened the global macroeconomic outlook. Risks have risen around the current stagflation-linke environment turning into a "hard landing" or recession amid the energy price shock and faster central bank tightening, leading to renewed pressure on global resilience.

Challenged globalisation: In an environment where alliances are uncertain and international cooperation is being challenged, parallel supply chains are emerging in an effort to reduce economic interdependence and make existing supply chains more resilient.

Geopolitical & economic instability: Persistent geopolitical tensions across the globe, not least the war in Ukraine, will hurt the global economic outlook through various channels. These include energy markets, the financial system, trade flows and consumer and business confidence.

Rising interest rates amid structurally higher inflation risks: High inflation (now a multi-year problem) is forcing central banks to raise interest rates more aggressively, which in turn is likely to lead to "hard landings" in key economies over the next 12 months.

Infrastructure funding needs: The pandemic has delayed infrastructure maintenance and exposed existing infrastructure to new pressures. However, it could also reshape the priorities of the infrastructure industry with increased focus on technology, resilience and sustainability.

Technological and natural environment

Addressing physical climate change risks: Physical climate change risks together with economic value accumulation in exposed areas are leading to an increase in frequency and severity of secondary peril disaster events. These now make up more than half of global annual insured catastrophe losses, underlining the need for urgent mitigation actions.

Rising importance of biodiversity and ecosystem services: Biodiversity and ecosystem services are vital for societies and economies to function. Recently, there has been increasing focus in business to understand the tangible implications of the decline of biodiversity and ecosystem services.

Transition to a low carbon economy: Achieving net-zero emissions in a timely manner requires political, technological and behavioural change. In this context, risk transfer capacity and risk insights are central to enabling innovation in clean energy technologies and decarbonisation processes.

Massive expansion of digital & cyber risk: The potential for critical infrastructure breakdown in areas such as power, gas, water and strategic industrial sectors poses a growing accumulation risk. This leads to the development of a new and growing market for cyber insurance. Premiums for cyber insurance are expected to continue growing materially, having increased at an annual rate of 20 – 30% in the past few years.

Data as an asset: Data, technology and digitalisation are rapidly changing the insurance industry. Harnessed properly, these powerful forces offer new opportunities for the incumbent insurance industry to maintain its relevance for consumers.

Digital products and processes: Digitalisation is accelerating as we develop novel ways to manage data abundance at affordable cost. Improved data analytics capabilities will affect future decision making on the organizational level. COVID-19 has heightened the sense of urgency for re/insurance companies to accelerate their digital transformation journeys.

Disruptive digital technologies: Technologies such as Artificial Intelligence, Machine Learning and Quantum Computing could reshape the industries and societies, hence transforming the overall risk landscape.

Autonomous transportation & robotics: The future of mobility is autonomous. Autonomous transportation and robotics such as self-driving cars and drones will have many implications for insurers and their insurance liability and coverage issues must be addressed.

Competitive and business environment

Re/insurance value chain disaggregation and rise of alternative re/insurance providers: Disruption across the re/insurance value chain is visible, with access to ecosystem data enabling better understanding of customer behaviours and offering opportunities for embedded insurance. Meanwhile, investor demand for access to existing and novel risks through innovative risk transfer schemes remains significant.

Consolidation of platforms as a business model through strategic partnerships: As traditional industry borders fall away, ecosystems enabled by digital platforms will greatly influence the future of insurers' business models.

Regional champions going global: A number of key High Growth Markets are still dominated by national reinsurers and insurers. Some of them are currently developing global ambitions beyond their respective home markets, and have made critical steps to increase their international presence.

Increasing digital customer interaction: Mobile phone ownership and social media use continues to rise, presenting a significant opportunity for insurance companies to gain a better understanding of their customer base and enhance and customise their client offering.

Increasingly litigious environment: Mainly a US phenomenon, an increased propensity to litigate has led to claims severity increases. Litigation funding has grown over the last few years, and we expect this trend to continue.

Rising importance of Environmental, Social and Governance (ESG): As societies, including the public and private sectors, work towards meeting ambitious ESG pledges, the investor community is driving material developments in ESG disclosure enhancement and standardisation.

“We want to navigate an ever-changing risk landscape”

The risk landscape is constantly changing. Why is it so important to keep an eye on the bigger picture and what are the most important shifts? John Dacey, Chief Financial Officer at Swiss Re, has been following re/insurance market trends for years and shares his insights.

John Dacey
Group Chief Financial Officer, Swiss Re

Swiss Re identifies and tracks a set of – currently 23 – macro trends central to the insurance landscape. What is the purpose?
As a global risk knowledge company, Swiss Re aims to continuously enhance its understanding of the risk landscape of the future. Curating this set of macro trends is central to that aim. The macro trends portfolio is reviewed annually and informs strategic priorities and associated decision making, as well as the creation of solutions for our clients and partners. Combining the experience from the past and anticipating the future is indispensable if we want to navigate an ever-changing risk landscape and provide the best product suite to our clients.

How have trends changed over the years?
Technology has become an important driver of democratizing access to all aspects of life, such as advancements in radical medical innovation. Nonetheless, such cutting-edge technologies remain associated with significant costs, making their availability limited to affluent segments of the population, contributing to social disparity and inequality.
The vast explosion of data and the subsequent competition were a key enabler for many emerging changes in the world. We see cyber risk as the next big hurdle in the uninsurable risk landscape and the key risk pool we need to focus on, including risk prevention.

Any other dynamics you would highlight?
Geopolitically, the world continues to face unprecedentedly turbulent times, with risk of further escalation. This backdrop leads to multiple developments, including macroeconomic challenges leading to inequality of wealth, income and opportunities.

Finally, managing the transition to net-zero remains a key societal priority. In recent years, global lockdowns due to COVID-19 paused environmental pollution momentarily, but global warming cannot be halted unless strong climate policy actions are implemented now.
The latest economic crisis has put low-carbon investments at risk due to economic uncertainty and the interruption of global supply chains. However, the energy price shock that followed the start of the war in Ukraine may act as a catalyst for increasing demand for renewables.

10 years of SONAR – lessons from emerging risks

For a decade now, Swiss Re's annual SONAR publication has promoted dialogue about emerging risks in the insurance industry and beyond. In doing so, it has supported avoidance of unnecessary losses, enabled timely risk mitigation, and highlighted paths for new insurance opportunities.

Emerging risks – new or changing risks – matter. If not mitigated, they can impair lives, cause damage and necessitate unexpected expenditure for households and businesses. They can be expensive for insurers too, via claims, financial losses and operational challenges. SONAR's purpose is to foster early risk dialogue and awareness when there is still time to adapt to emerging risk scenarios, and to mitigate potential impacts for the insurance industry and society at large.

SONAR – how it all began

SONAR originated in 2000, when Swiss Re's Risk Engineering department launched the "Systematic Observation of Notions Associated with Risk (SONAR)" and the related emerging risk management framework. SONAR was developed as an internal format, the aim being to detect new exposures and changes in the risk landscape that could affect Swiss Re and/or its clients. In 2013, Swiss Re decided to share its emerging risk insights gathered through SONAR publicly: the annual SONAR publication was born. Our conviction was and remains that sharing emerging risk insights and open dialogue fosters enhanced awareness and understanding of risks, thereby enabling prevention and mitigation of flagged risk potentials. This helps make societies, and also the insurance industry, more resilient.

Looking back at 10 years of sharing emerging risk insights

What lessons can we draw from the emerging risks featured in past SONAR reports? One learning is the central role of scenarios to depict new, changing or slow-burning risks. For example, "supply chain vulnerability" flagged in the inaugural 2013 SONAR report was inspired by actual events: the Japan earthquake and tsunami, and the Thailand flood. The events expanded scenario thinking by contemplating what further triggers could be considered: "Supply chain disruption can result from a number of different events outside the control of an organisation, such as natural catastrophes, pandemics, cyber risks or terrorism."[2]

The article further highlighted globalisation, outsourcing, interconnectedness of risks, challenges to identify non-physical loss triggers and accumulation potentials. In hindsight, today this all seems prophetic.

What is SONAR? The process behind the report

Identification

- Internal platform for risk dialogue
- External inputs from research, think tanks, industry organisations, public institutions and NGOs
- Regional and business area inputs

Vetting

- Emerging risk specialists condense, select and further research topics
- Subject matter experts and business representatives review
- Senior management sign-off

Dialogue

- Emerging risk insights are communicated and discussed with external partners
- Internal mitigation and business solution process picks up
- Risk insights are translated into action

Infectious disease threats

What did we flag?

SONAR has prominently featured infectious disease and pandemic risks over the years, and also highlighted different aspects of the microbial threat cluster. Apart from the pandemic scenario impacting supply chains, the 2013 article "Emerging infectious diseases" underlined risk factors and disease triggers such as increased human mobility, food trade and strategic use of pathogens. The same edition covered drug resistance and the implications for Life & Health and casualty lines. Subsequent reports expanded on the emerging risk landscape for viruses and bacteria, hospital hygiene, prescription habits ("The antibiotic boomerang", 2015), and farming ("Too much of a good thing – antimicrobial overuse in animal farming", 2017). SONAR has also addressed disease origination several times (eg, "Bugs on the march – underestimated infectious diseases", 2017), inter-species transmission ("Rising pandemic risk", 2015) and vaccination refusal and scarcity ("Vaccination – a shot worth more than politics and profitability", 2019).

Where are we now?

Unfortunately, one of our scenarios materialised with the COVID-19 pandemic. The modern world – with population growth, increased interactions and interconnectivity, cross-border and increased economic activity, and diminishing natural resources and habitats – will likely face more such challenges in the years to come, with potentially rising frequency and severity.

What lies ahead?

Going forward, rapid cooperation will be key, be it on scientific disease research or preventive disease management measures. With respect to associated financial protection and risk transfer solutions, public private partnerships and other stakeholder cooperation should be part of the mix.

Regulations can shape risk emergence

SONAR is about identifying new risks and shifts in the risk landscape. However, new or changed risks to society and the insurance industry do not emanate exclusively from new risk phenomena alone. Changes in regulation and market conditions can also shape potential insurance impacts and opportunities.

A case in point is the underestimation of the frequency and severity of wildfires, which SONAR featured in 2015, with a regional focus on the US and Australia.[3] The article argued that climate change and human negligence aggravate wildfire risk. Indeed, wildfire losses increased in the following years.[4] Insurers in California reacted with premium increases and decreased appetite to provide cover. This in turn triggered the state to introduce a one-year ban on non-renewing policies in 2021. Unfortunately, such market distortions introduced by regulatory intervention prolong incentives for homeowners to dwell in high-risk areas.

But legislation can also have beneficial effects on risk mitigation, if it incentivises prevention and punishes risky behaviour. This was and will remain the case for many forms of environmental pollution. In SONAR, we flagged different aspects of pollution, such as "Air pollution as a mortality driver" in 2014, "Ocean pollution from microplastics" in 2016, and "You pollute it, you own it – environmental liability and insurance" in 2018. Apart from regional-specific regulatory dynamics, which can make the legal side of pollution complex, potential liability claims also depend on the technical possibility to single out polluting parties, attribute respective damage and provide causal linkage. While liability regimes to prosecute different sorts of pollution have risen in many markets over past years, this is not yet the case for microplastics.

Climate change and the low-carbon economy

What did we flag?

While treating climate change as a macro trend (see macrotrends section), SONAR has focused on new – and potentially near-term – uncertainties in relation to warming temperatures. These include interaction with other risk factors and trends, thus highlighting areas in need of better understanding and with potential for under-rated risk (accumulation). Apart from spotlights on extreme events and the 2013 article "Underestimated nat cat exposures", SONAR also picked up on slow developing risk trends, such as "Climate change in Life & Health" in 2019 and "Methane hydrate – an upcoming energy source?", a potential accelerator of greenhouse gas emissions, in 2014.

Where are we now?

As we transition to a low-carbon economy, the insurance industry will need to assess and address new emerging risks ("Moving to a low-carbon future", 2020). Key risk trends include rising losses from so-called secondary perils such as heavy precipitation events, droughts and wildfire. Other emerging risks include climate change litigation and associated risks and opportunities from the reduction of the re/insurance value chain's carbon-footprint to reach net-zero greenhouse gas emissions.

What lies ahead?

Insurers will need to be proactive in tackling emerging risks to best support the move to a low-carbon economy. This includes dealing with prototype risks in relation to low-carbon technologies. It also means addressing non-intended transition risks so potential threats can be mitigated and turned into opportunities for the insurance industry and society.

Digitalisation risk

What did we flag?

SONAR has regularly featured digitalisation, interconnectivity, advances in computing and emerging cyber risk. The pace of digital innovation and emergence of associated cyber security risks has been high over the past years. Related SONAR articles include "Cyber attacks" (2013), "Cloud computing security" (2014), "Computing at the edge – cybersecurity overstretched?" (2020) and this year's "Quantum computing – a treat before an opportunity". Digitalisation harbours cyber threats from the changing relationship between humans and digital technology. SONAR pointed out potential deficiencies for machines ("Wiggle room – Artificial Intelligence and healthcare", 2019) and humans ("Dumbed down – is digitisation undermining human skills?", 2018).

Where are we now?

Cyber attacks, particularly ransomware attacks, targeting private companies and public infrastructure are on the rise. Additionally, social media disinformation, which SONAR already addressed in 2014, and manipulation, such as "deepfakes", flagged in SONAR in 2020, have become prevalent. Of striking relevance is the growing interdependency and integration of different technologies that make today's digital world so effective and at the same time so vulnerable. The merging of systems, platforms and hardware is keeping cyber security experts busy.

What lies ahead?

Cyber is an ever-evolving threat, requiring ongoing vigilance and refinement of cyber defences. As cyber security demands increase on all fronts, more and more investment is needed. "Cyber fatigue" is a growing risk itself.

Emerging risk latency

Many of the risks flagged in SONAR have materialised through key events and associated claims at a later point in time. Such an achievement is bittersweet given SONAR's aim to foster early mitigation action. Success would be avoidance of losses thanks to early action triggered by SONAR. This starts with monitoring and investigating new emerging risks and taking bold decisions amid high uncertainty. Solar storms, for instance, are a latent risk which have not yet led to large insurance claims. However, given increasing infrastructure values, future space weather events could result in larger losses.

Emerging opportunities

From risk detection to assessment and mitigation, emerging risk management is a means to turn a threat into an opportunity. Cyber risk is a good example of how emerging risks can develop into a market segment. Understanding emerging cyber risk is a prerequisite for probabilistic modelling and to maintain the insurability of cyber risks. By encouraging due attention to new cyber risk downsides, SONAR has helped build improved understanding of the challenges emanating from the cyber risk landscape, and in turn has contributed to making cyber insurance a risk transfer solution and market segment.

[2] Swiss Re SONAR Emerging risk insights June 2013, p 8.
[3] Swiss Re SONAR Emerging risk insights May 2015, p 18.
[4] According to our SIGMA CataNext data, 72% of all market insured losses were between 2016 and 2020 (overall time frame 1980 – 2020)


INDIENS
Tasse

Demographic and social environment

Eroding trust – new worries for public health and medical science

Trust in the healthcare sector and governments declined to record lows in 2021.[5] Mistrust in public health officials and medical professionals fosters harmful behaviour and increases the risk of higher morbidity and mortality, particularly in future health crises.

Potential impacts

- If people refuse treatment, avoid preventative measures, or turn to dubious alternatives for their health conditions, there could be negative consequences on morbidity. In addition, treatment costs and in extreme cases mortality may rise. The workforce in the insurance industry could also be impacted.
- Individuals, professionals, and organizations providing harmful treatments may face liability claims.
- Longer lasting and more expensive public health crises may result if growing societal divisions hamper effective resolution of public health emergencies.
- In the case of a future pandemic, increased excess morbidity and mortality may occur if large shares of the population do not trust guidance from public health institutions, further undermining societal resilience.

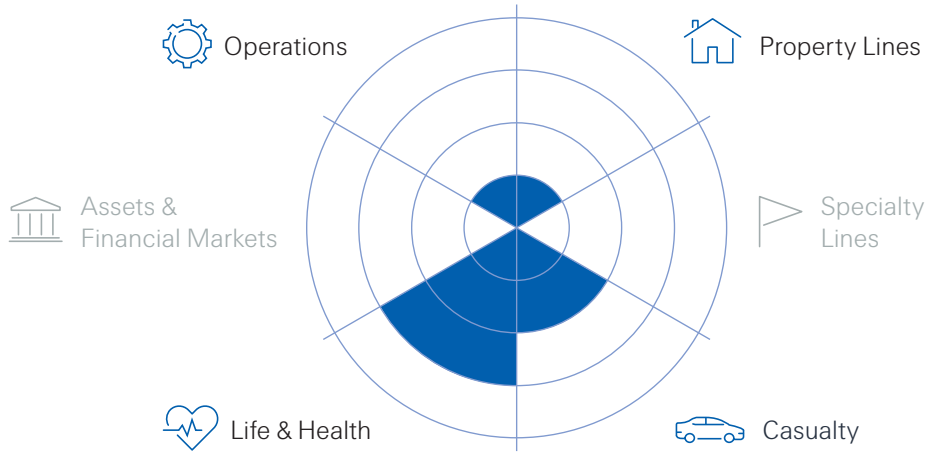
Impact

High
Medium
Low

Time frame

0 – 3 years
> 3 years

Impacted business areas



Nothing tests trust like a crisis. With the COVID-19 pandemic affecting nearly every layer of life, trust in public health officials and medical experts has been challenged. Heated debates over the severity of the COVID-19 and adequacy of government measures have threatened the effectiveness of public health policies. According to a study from 2021, scepticism reduced compliance with COVID-19 shelter-in-place guidelines.[6] Anti-vax groups emerged, unwilling to follow restrictions or vaccination recommendations. Often, such sceptics showed wider disagreement with official plans to mitigate the crisis, in turn hindering the efforts to control the pandemic.

Long distrust?

Crises come and go, but feelings of distrust can persist. Ongoing lack of trust in medical science can undermine efforts to contain infectious and other preventative diseases. For instance, the World Health Organisation (WHO) recently listed vaccine hesitancy as one of the 10 main threats to global health.[7] Caution has been on the rise since the early 2000s due to the public debate that developed surrounding a (since retracted) publication suggesting a link between the mumps, measles and rubella (MMR) vaccine and autism. Consequently, measles has seen

a 30% increase in cases globally, and some countries that were close to eliminating the disease have instead seen a resurgence.

Societies with a high level of mistrust in experts and institutions may well be less equipped to tackle possible future health challenges, creating down-side risk for people's health, and the economy.[8] Rejection of evidence-based medicine and scepticism around the science that underpins it can spark resistance to timely treatment or prevention. Fallout from such mistrust can also negatively affect preparedness and resilience in future crises.

Social media is an amplifier

As faith in current public health systems is undermined, it may boost attractiveness of alternative healthcare approaches not underpinned by science. These trends are being exacerbated by growing reliance on social media as a news source. In the latest pandemic, for instance, the internet became rife with dubious approaches to treat COVID-19, including off-label use of the anti-parasitic drug ivermectin, the side effects of which resulted in severe health issues and in extreme cases, even death.[9]

On the other hand, social media can also be beneficial when used as a tool to engage society and distribute important information from government or public health institutions. Transparent communication and concise language in dialogue could create better acceptance of crisis management at national level. Insurers can also play an integral part in this process as a partner to health institutions and individuals. The role of insurers in pricing risk and providing risk information is vitally important in strengthening resilience against future health crises.

Related articles in SONAR

- "How to better prepare for the next pandemic", SONAR 2022, p 24
- "Vaccination – a shot worth more than politics and profitability", SONAR 2019, p 16

[5] Edelman Healthcare Sector Trust Barometer 2021
[6] Brzezinski, A. et al., "Science skepticism reduced compliance with COVID-19 shelter-in-place policies in the United States," Nature Human Behavior 5 (1519 – 1527), 2021
[7] "Ten threats to global health in 2019," WHO, 2019
[8] Chaudhuri, K. et al., "COVID-19 vaccine hesitancy in the UK: a longitudinal household cross-sectional study" BMC Public Health 22 (104), 2022; Lenton, T. et al., "Resilience of countries to COVID-19 correlated with trust," Scientific Reports 12 (75), 2022
[9] "Poisonings rise as Americans treat Covid with anti-parasitic drug," Financial Times, 25 September 2021

Baby dreams – risks in the fertility services

Increasingly, people wanting to become parents are turning to fertility services. These include "social freezing" as a means to postpone conception, fertility treatments and/or pregnancy surrogacy. The treatments pose risks for the involved parties.

Potential impacts

- The fertility industry is growing rapidly on account of medical advances and the evolution of legal boundaries and regulations. From the risk perspective, it is also becoming more complex. Failure of services, unexpected outcomes and third-party damage may become common subjects of lawsuits. This could lead to new forms of product liability, professional indemnity and medical malpractice claims.
- Employers (including insurers) offering fertility services as an employee benefit may also face liability, regulatory or reputational issues, with emergence of new forms of employer liability or worker compensation claims.
- Potential health impairments and subsequent medical needs of children, parents and other individuals involved will impact Life & Health lines of business.

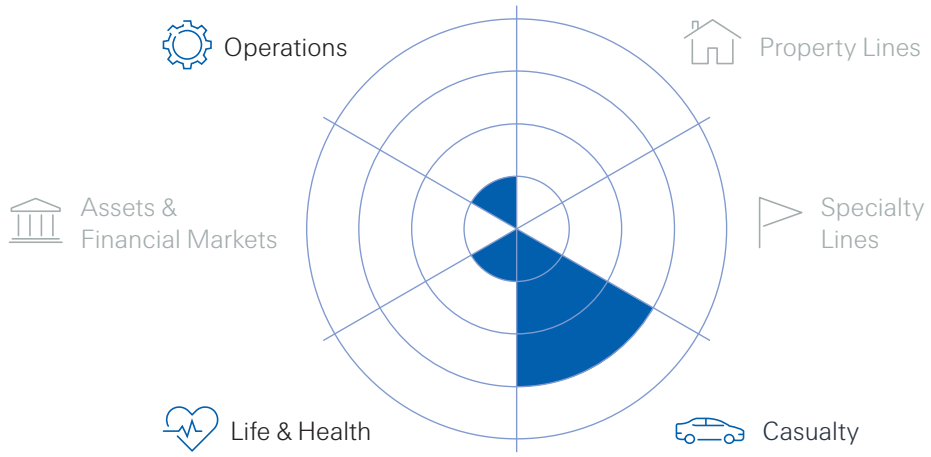
Impact

High
Medium
Low

Time frame

0 – 3 years
> 3 years

Impacted business areas



A growing market

The ability to conceive without medical assistance gets harder as people age. This has led to rising demand for fertility treatments. These treatments can be expensive, and some employers offer them as benefits in an attempt to attract new and retain existing employees.[10]

As demand rises, investments in the industry are growing. Fertility treatments offer many benefits, but they also harbour numerous risks.

Risk for parents, donors and surrogate mothers

Many fertility procedures require intensive hormone treatments or surgery. As with all healthcare procedures, errors during medical intervention are possible. Providers of the treatments are under intense pressure to produce healthy children. However, the success rate for in vitro fertilization is still relatively low, for example at only around 29% in Europe.[11] Further, chances for success decrease with parents' age.

Modern fertility treatments may involve sperm donors, egg donors, and surrogate mothers. Most participants give freely consent, but some potential surrogate mothers may be under economic pressure to participate, particularly in developing countries.[12] They may undergo medical procedures and be exposed to negative physical consequences and mental stress, raising ethical concerns and potential L&H claims.

Beyond medical intervention, failures can occur elsewhere. The equipment used to store frozen sperm, eggs or embryos can malfunction, resulting in devastating

consequences for those whose genetic material was stored for future use.[13] Such cases – typically leading to product liability or professional liability claims – diverge from risks commonly observed in the medical context.

Risks for children

Gender selection and genetic testing for diseases before implanting an embryo are common. Inherited or new genetic disease may nonetheless be missed, and is more likely as parents get older. Mishaps or mix-ups in medical clinics have also been documented, resulting in situations that can be traumatizing for parents and later, for their offspring.[14]

There have also been initial efforts to genetically modify children. While "designer baby" practices currently remain illegal, the range of conditions and predispositions that can be screened out legally around the world may expand going forward, opening new avenues for medical malpractice.[15]

Children born with the assistance of fertility treatment may also face health risks, including lower birth weights and need for intensive care.[16]

Regulatory gaps and claims

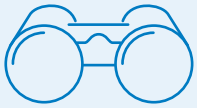
This suite of risks intersects with loose and fragmented regulation. Legal frameworks vary widely from country to country. These differences contribute to fertility tourism – prominently for surrogacy – and may generate ambiguity in the areas of medical malpractice and liability.[17]

So far there have been claims resulting from the failure of freezing tanks (a USD 15 million verdict),[18] children conceived from supposedly healthy sperm donors being born with a severe inherited disease,[19] and mixed-up embryos.[20] Given the rapid expansion of the market and scientific advances that will open new treatment opportunities, liability and L&H claims severity and frequency will likely increase.

Related articles in SONAR

– "Genetic engineering," SONAR 2015, p 19
– "Precision medicine," SONAR 2016, p 12

[10] Weigel, G. et al., "Coverage and Use of Fertility Services in the U.S.," KFF, 15 September 2020; "Employers prioritize family-friendly benefits," WTW Survey Report, 3 June 2020.
[11] Passet-Wittig, J. and Bujard, M., "Chapter 26: Medically assisted reproduction in developed countries: Overview and societal challenges," in Research Handbook on the Sociology of the Family, Edward Elgar Publishing, 2021.
[12] "Making babies, pushing boundaries: the great Greek fertility market," Balkan Insight, 9 July 2021.
[13] "The fertility industry is poorly regulated – and would-be parents can lose out on having children as a result," The Conversation, 23 August 2021.
[14] "California couple sue clinic for alleged IVF swap 'horror'," BBC News, 9 November 2021.
[15] Cyranoski, D., "What CRISPR-baby prison sentences mean for research," Nature news, 3 January 2020.
[16] Passet-Wittig, J., and M. Bujard, "Chapter 26: Medically assisted reproduction in developed countries: Overview and societal challenges," in Research Handbook on the Sociology of the Family, Edward Elgar Publishing, 2021; Scherrer, U. et al., "Systemic and Pulmonary Vascular Dysfunction in Children Conceived by Assisted Reproductive Technologies", Circulation 125 (1890 – 1896), 2012.
[17] Darnovsky, M., and D. Beeson, "Global surrogacy practices," ISS Working Paper Series/ General Series 601 (1 – 54), 2014; Erasmus University Repository: Global surrogacy practices (eur.nl); "The fertility industry is poorly regulated – and would-be parents can lose out on having children as a result," The Conversation, 23 August 2021; "The Wild West of Fertility Clinics," The Regulatory Review, 10 August 2021.
[18] "Five fertility clinic patients awarded USD 15m after failure of freezing tank," The Guardian, 12 June 2021.
[19] "Sperm donation is largely unregulated, but that could soon change as lawsuits multiply," The Conversation, 18 January 2022.
[20] "California fertility clinic sued for mixing up embryos," Reuters, 10 November 2021.



How to better prepare for the next pandemic

Using learnings from the COVID-19 experience, the world can be better positioned to respond to the next pandemic in a rapid and coordinated way. Calls to action include strengthening national healthcare systems and closing the health protection gap.

A WHO panel examining the global response to COVID-19 has concluded that the pandemic should not have caught the world unaware.[21] Population growth, urbanisation, more human intervention into wildlife and biodiversity, climate change and other factors are all conducive to large infectious disease outbreaks.[22] Beyond COVID-19, major outbreaks this century have included SARS, influenza, Ebola and Zika. So, are we ready for the inevitable next pandemic?

The good news

The COVID-19 outbreak was followed by a swift response by the life sciences industry and remarkable collaboration across research groups to produce urgent scientific insights. The virus was sequenced within days of discovery; tests were available within a week, and treatments after just months; and several vaccines were available within a year.

Reflecting on this experience, among the recommendations of a UK government-sponsored report to the G7 to prepare for future pandemics are establishing ready availability of diagnostics services; developing prototype antiviral therapeutics, including antibody therapies applicable to the kinds of pathogens that could cause pandemics; and investing in modernising vaccine technology and associated R&D.[23]

The long haul

The world will continue to grapple with the negative effects of the pandemic for a while yet, including the hit to general healthcare and people's mental health, and the lingering impact of those afflicted by long-COVID.[24] To boost resilience against future pandemics, there needs to be renewed focus on disease and population monitoring, prevention, improving early-care services and tackling other already existing and long-standing healthcare system challenges. Rebuilding trust in doctors, healthcare and institutions is also essential.[25] In this context, building back better means designing services around people and their needs. Healthcare professionals need to be equipped with new skills, especially around digital health, to best respond to patients' needs.

Finally, a truly global cooperative approach would improve preparedness for the next pandemic. This includes information, expertise and experience sharing, and coordination on response measures.

Closing the health protection gap: digital insurance can help

Swiss Re data show that the global health protection gap has widened during the COVID-19 era.[26] The impact of the pandemic on households will vary depending on the quality of national healthcare systems and success of containment policies. Poorer countries face a two-fold challenge: COVID-19 has exposed large shortages of intensive care beds, and the task is to scale up supply on very limited budgets.[27] At the same time, these countries need to protect COVID-19 patients from what can be very large healthcare costs. In low-income countries, out-of-pocket expenditure typically represents more than 40% of household healthcare spending, compared with only 24% in advanced markets.[28] This leaves households vulnerable to financial stress. Affordable health insurance can play a central role in reducing this financial risk and thereby make individuals and households more resilient.

Consumer surveys indicate that the pandemic experience has led to increased risk awareness and interest of buying insurance. But affordability remains an issue. Technology and data can improve underwriting of pandemic-related and other healthcare risks. This is key in making insurance products more affordable and efficient. At the same time, digitisation improves access to cover. Social media and mobile phones allow more people, including the most remote and/or those on low incomes, to buy insurance. This is an important step in closing the health protection gap.

[21] "An Evidence-based quest to protect human health," The Independent Panel, (accessed 19th May 2022).
[22] Smith, K. et al., "Global rise in human infectious disease outbreaks," J R Soc Interface 11(101). 2014; Franzke, C. and Czupryna M. "Global risks of infectious disease outbreaks and its relation to climate," Environ. Res. Lett. 16(8), 2021; Ka-Wai Hui, E., "Reasons for the increase in emerging and re-emerging viral infectious diseases" Microbes Infect. 8(3), 2006.
[23] "The 100 Days Mission to Respond to Future Pandemic Threats report" by the UK Government Cabinet Office represents recommendations by the partnership for pandemic preparedness to the G7 (published 12 June 2021).
[24] "COVID-19 – the longer-term health burden," Swiss Re SONAR 2021, p 16f.
[25] Parker, S., "Pandemic preparedness also means strengthening trust in our institutions," Swiss Re Risk Perspectives Blog, 7 March 2022.
[26] "Resilience Index 2021: a cyclical growth recovery, but less resilient world economy," Swiss Re Sigma Report, 2021.
[27] Ibid.
[28] Ibid.

“Increasing flexibility comes at a price”

What is the future of work and where are the biggest risks lingering? Cathy Desquesses, Chief Human Resource Officer at Swiss Re, took the time to reflect on the impact of COVID-19 and digitization.

Cathy Desquesses
CHRO & Head Corporate Services

COVID-19, digitisation and increasing interconnectivity have changed the way we work – including in our industry. How will our workplace look like going forward?

Change in the work landscape is constant and needed. Digitisation and increasing interconnectivity are long-term trends. But what we’ve seen in the last two years is a massive acceleration because of the pandemic.

Hybrid forms of working are now widely accepted. Employees have much more choice and flexibility when it comes to their worklife. Hybrid working has also helped to level the playing field, meaning greatly reducing the difference between headquarters and regions or between full time employees and contingent workers. It has also reduced the need to physically travel to meet and debate. Lastly, it also enhanced trust between managers and teams. At Swiss Re you can – in agreement with your line manager – choose when and how you want to work, while keeping personal interactions at the center. We call this Own The Way Your Work™, our trademarked programme. This was in place well before the pandemic and allowed us to continue working without any disruption to the business.

You just pointed out the advantages, are there also risks associated with this change?

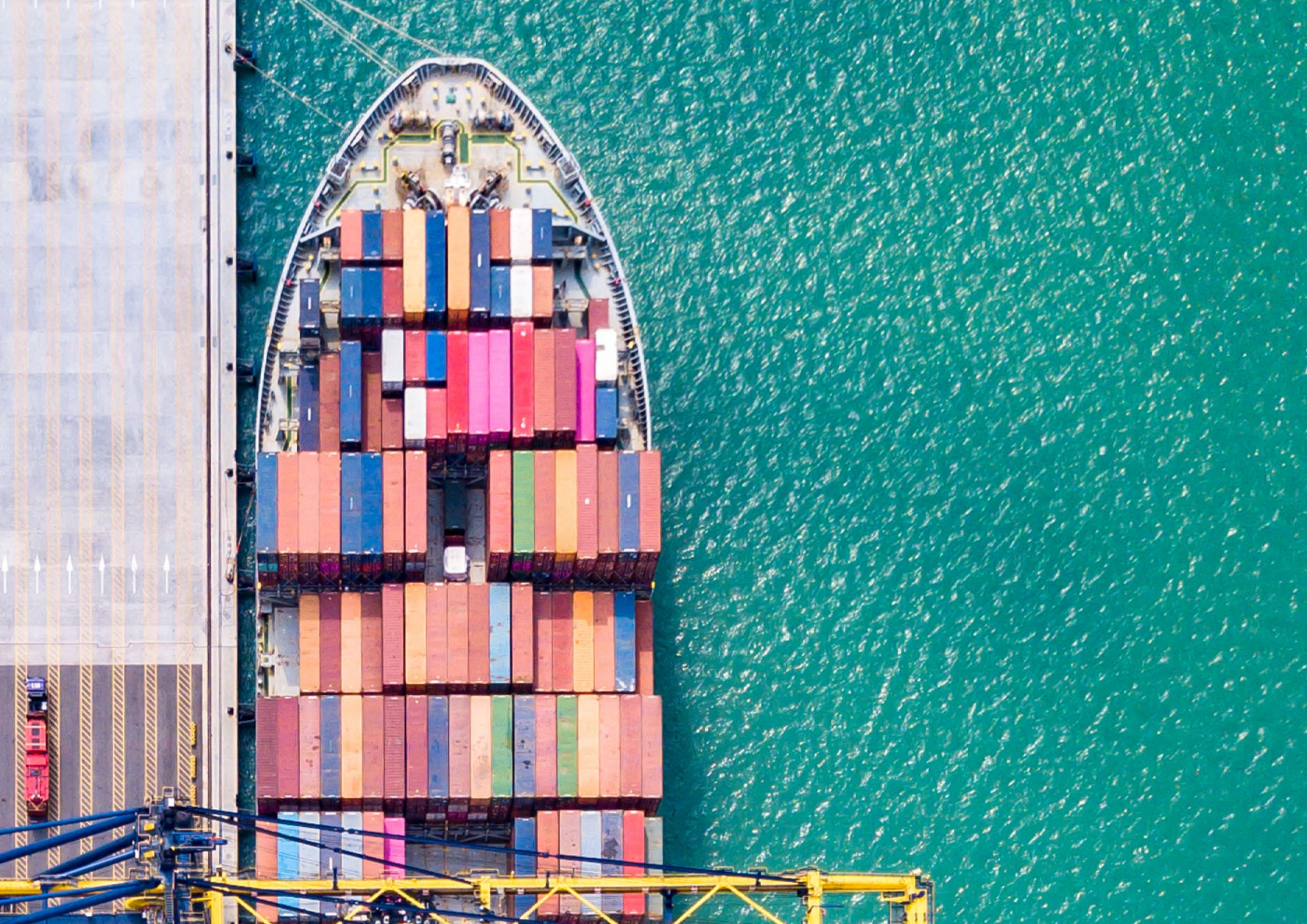
Yes, increasing flexibility comes at a price which we as an employer will have to minimize. Hybrid or remote working blurs the boundaries between work and private life. The mental health of some employees may suffer. Besides the feeling of never being “off work”, employees also run the risk of feeling isolated when working from home. It’s also more difficult to build a corporate culture if day-to-day interactions break away.

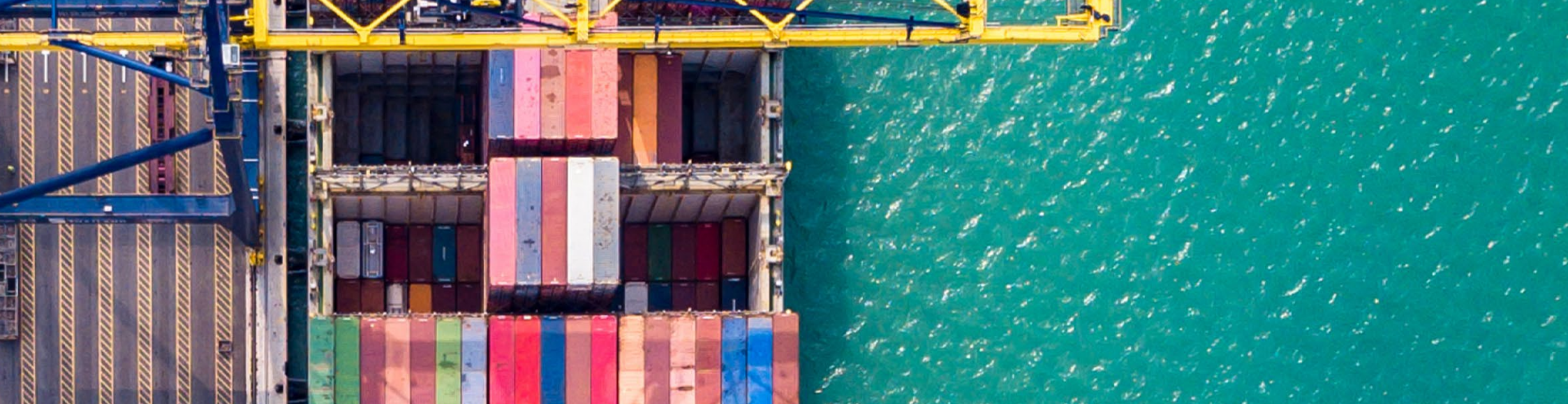
I also see a risk in so-called alternative working models that offer a lot of flexibility but run the risk of employees losing predictability or even job security. Creativity can also suffer as think tanks and other forms of co-creation require some physical connections. Also onboarding proved challenging. Meeting with colleagues and ‘feeling’ the culture in an office location are a very important part of a successful induction to new hires.

So, I think if we want to keep our workforce healthy and engaged, we have to continually develop our hybrid working environment and strike the right balance. I’m part of the Good Work Alliance of the World Economic Forum where we look at work environments that build on fair pay, flexibility but also focus on protection, diversity and inclusion, and fostering employability and a learning culture.

What skills are currently most needed in the insurance industry and what do you expect for the future?

In the insurance industry we increasingly see the need for skillsets in data, AI, cloud computing but also around sustainability. This isn’t different to other industries, so the competition for talent is real. To attract talent, companies will need to live up to their employee promise such as company purpose, attractive work conditions, and an inclusive company culture that builds on trust and respect for collective success.





Political and economic environment

Challenges in construction – raw material shortages and price increases

Scarcity of raw materials due to supply chain disruptions and rising wages are leading to high inflation in the construction sector, casting a cloud over construction quality and future insurance losses. Even if prices in the construction sector soften and align with general inflation, long-tail risks remain.

Potential impacts

- Rising building values and repair costs (from rising raw material prices and wage inflation) translate into increased claims severity in property and specialty lines of business.
- The risk of unexpectedly high claims is a challenge for long-tail business in particular, such as engineering where there is a long time lag between premium payment and claims filing.
- Raw material scarcities and price pressures may see builders "cut corners", leading to lower construction quality. This could lead to higher claims in property and professional indemnity.
- Increases in construction prices may also lead to rising valuations of real estate investments on the balance sheets of insurers. This is both directly through increased replacement cost, and indirectly on account of imposition of additional barriers to supply.

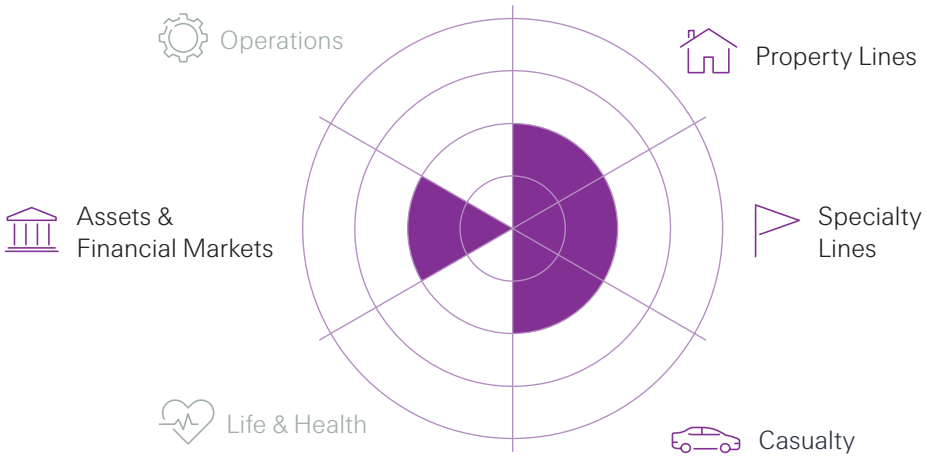
Impact

High
Medium
Low

Time frame

0 – 3 years
> 3 years

Impacted business areas



Construction costs rose significantly in 2021 as global demand bounced back from pandemic-induced recession. Supply-side issues in the form of raw material supply chain bottlenecks and labour shortages added to inflationary pressures. For example, price inflation for new, non-residential building construction in the US reached 17% in March this year, much higher than overall inflation in the economy. This year, the war in Ukraine has amplified inflationary pressures by further exacerbating supply chain disruptions and scarcity of specific raw materials.

For insurers, price increases can lead to unexpectedly severe claims, particularly in long-tail business, multi-year policies and non-proportional contract features. Over time, contract mechanisms in different countries and lines of business have been developed to mitigate and prevent extreme impacts of inflation. In engineering insurance, for instance, standard practice is to adjust premiums based on final contract value. An escalation clause can ensure that if a contract value exceeds a set threshhold during project execution, insurers have the right to renegotiate terms and conditions.

Less obvious incentives may lead to increases in claims frequency

In the coming years, price increases in the construction sector could indirectly impact claims. Scarcity of and higher prices for raw materials, alongside wage inflation, can increase incentives to innovate more efficient construction technologies. On the other hand, they may also encourage use of less expensive and often inferior materials from a fire and integrity standpoint. This can mean lower production and construction quality and, in turn, potentially much higher claims in property insurance. For example, combustible cladding can be visually identical to, but far less expensive than non-combustible cladding for buildings. In the event of a fire in a building with combustible cladding, however, the losses can be much higher. Price and wage inflation could also see contractors hire lower-cost and less-skilled construction site labour. This could result in lower-quality buildings, with possible implications for liability and property claims.

Increased uncertainties prompt insurers to monitor the risk

Today's geopolitical tensions have increased uncertainty around price developments in the construction sector. Insurers need to be able to distinguish between short-term spikes and long-term trend rises in prices. They need to establish a strong monitoring control framework and to react quickly to ensure profitability. At the same time, they need to also consider that increases in insurance prices can themselves contribute to higher inflation in the construction sector.

Related articles in SONAR

- "Towering infernos – combustible cladding", SONAR 2018, p 33
- "Scarcity of raw materials", SONAR 2015, p 33
- "Urban mining – Emerging trend spotlight", SONAR 2015, p 33

"In times of great uncertainty, the resilience of each economy will be essential"

Not just an experienced intellectual observer and advisor, but a leader and shaper of financial markets, Jean-Claude Trichet reflects on what to expect.

Jean-Claude Trichet
President European Central Bank (ECB), 2003 – 2011,

Member Swiss Re Strategic Council, 2012 – 2021

In a rapidly changing macroeconomic environment, how do you see the role of central banks evolving?
The global economy has passed an inflection point from low inflation and highly expansionary monetary policy – via the crises of a pandemic and the invasion of Ukraine – to rapidly increasing inflation and a sudden tightening of monetary policy. Central banks must now credibly regain control of inflation expectations in a highly uncertain macro environment. I find it reassuring that all major central banks have pledged to maintain annual inflation targets of 2% for the medium term. Central banks, of course, are not the only game in town: governments, parliaments, trade-unions and private industry must also play their part to constrain second-round inflationary pressures. If they do, I am reasonably confident we will return to a moderate inflation environment, around 2% in the medium term.

How will this sudden macroeconomic shift alter our transition to a low-carbon economy?
First, we should differentiate our longer-term goals from the process of energy transition. Transition will not be low cost – engaging disorderly into measures could cause energy price volatility, exacerbate inflation and send the wrong signals to the market. We should seek to optimise a progressive and orderly phasing out of fossil fuels.

Second, we must acknowledge that global real interest rates will rise. The global savings glut cannot continue, as transition requires enormous amounts of new sustainable energy investments and the obsolescence of fossil fuel investment stocks. This can only be sustained by real interest rates significantly higher than over the last decade, indeed even prior to the Great Financial Crisis of 2008.

Third, we must consider the demand for energy security from all countries. This has been underlined by the invasion of Ukraine. There is a geopolitical danger that we fall into three international power blocks – one led by the US with Europe, one by China with Russian support and a third block of unaligned states. If there is a lack of international energy cooperation, it will considerably handicap our ability to transition.

How do you believe the major events or trends of the last 10 years will shape the coming decade?
I would highlight three major past economic trends: the significant fall in productivity growth, particularly in advanced economies, the low global level of real rates and the erosion of the bargaining power of labour. These contributed to low growth, very low inflation and very low nominal interest rates. We may have had stability, but at high cost – even after Lehman Brothers and before COVID-19, the central banks of Japan, the US, the euro area and the UK added USD 9 trillion of tradable securities to their portfolios. I am confident that once we bring current inflation expectations back on track, we will not repeat such abnormalities.

COVID-19 was obviously the major event of the last 10 years. The pandemic demanded the cooperation of global economies, something far from being always achieved. It will teach us a lot about how we should collaborate in future crises. In times of great uncertainty, the resilience of each economy – and the will to cooperate – will be essential to contribute to global stability.


AMETHYST

Commercial space age – coverage for satellites on collision course?

Welcome to the commercial space age, where private firms build and operate rockets, host myriads of satellites and take people up to space for fun. With ever-more crowded orbits and debris in largely unregulated spheres, outer space hosts plenty of risks, opportunities and unknowns for insurers.

Potential impacts

- The growing space economy is generating demand for all sorts of risk transfer solutions, both for activities in outer space and for related infrastructure projects and services on Earth.
- Crowded space, new types of space operations and service offerings, and increased interdependencis mean higher value at higher risk in orbits, thereby changing the risk landscape for respective insurance covers.
- Lack of space regulation translates into legal uncertainties, operational ambiguity and potential for increased litigation costs, particularly in liability business.
- Collisions between space objects – satellites, space stations, rockets, space debris – in orbit, or should private satellites interfere with each other's service provisions, may incur property or casualty claims.
- Space-related services may also be interrupted by solar storms (space weather) and other natural causes. Outage of satellite services may have detrimental cascading impacts on Earth, as many space services are data services. Business interruption and data loss are among potential outcomes.
- L&H claims may be triggered by space-served (eg, geolocation or communication) data service interruption and subsequent interruption of emergency and urgent healthcare services.
- Space operations may be targeted for criminal or strategic reasons, potentially incurring cyber and property claims.

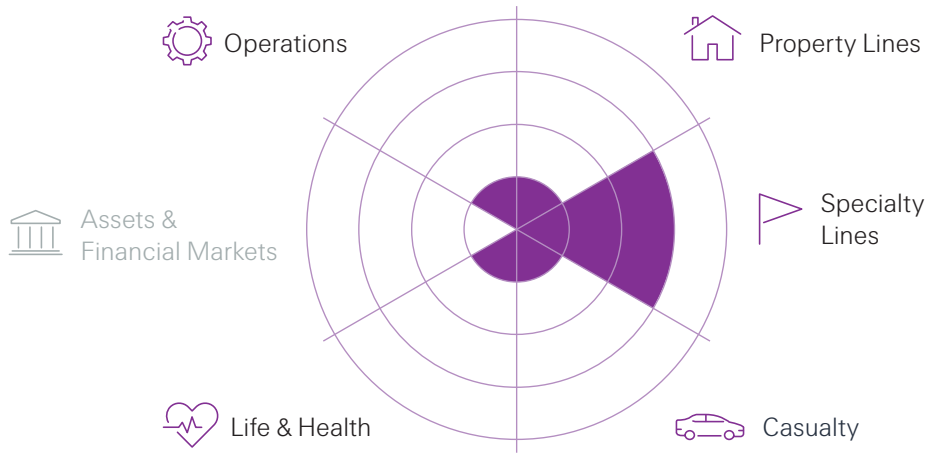
Impact

High
Medium
Low

Time frame

0 – 3 years
> 3 years

Impacted business areas



At the end of last year, China informed the UN office for Outer Space Affairs that for a second time, its space station had to conduct evasive manoeuvres to avoid collisions with Starlink satellites. The incident highlights that private companies like SpaceX – which launched Starlink – run space programmes and have joined national players in the space race. With dense satellite coverage, Starlink and competitors aim to provide high-speed broadband to even the remotest places on Earth.

National space organisations (eg, NASA) are eager to partner with new commercial players, and bodies like the European Commission advocate "space for everyone". This underlines the opportunities offered by space exploration, both commercial and public-sector sponsored.[29]

Ample space for growth

It is estimated that the commercial space industry will be worth USD 1 trillion by 2040, up from USD 350 billion currently.[30] Activities that will emerge and intensify range from the private launch of rockets for tourism and commercial payloads, to space stations and space mining. Most importantly, commercial interest is focused on satellite systems enabling ever more data services on Earth. This includes broader internet access and data services, such as navigation and climate change and weather monitoring.

Effective regulation is a balancing act

Increasingly, innovative technologies are born of private commercial activities, in addition to those from traditional government-funded missions. But for innovation to happen effectively, and to safeguard the economic benefits from space, there needs to be effective national and international regulation.[31] International collaborative efforts are needed to mitigate increasing orbital debris, encourage active debris removal and the timely disposal of end-of-mission spacecraft, and to find methods and technologies to removing defunct spacecraft.[32]

With more parties and objects roaming the orbit, the risk of collision of space infrastructure and debris increases, and this in a largely unregulated sector.[33] Binding international regulations to steer or restrict space traffic, that would oblige originators of debris to "clean up" or be held liable for damage, do not yet exist.

Insurers to step up?

Traditionally, insurers have offered third-party liability insurance to commercial space operators for damage to satellites, rockets and unmanned spaceflights. So far, appetite to offer liability cover for private space passengers is minimal. That could change. Soon, there could be new policies that insure for bodily injury for space travellers, flight delay, and directors and officers' (D&O) covers for the management of space operating companies. Such policies will need to be available on the market before space travel can transform into a fully-functioning tourism offering. Internationally-binding regulations to order space traffic, rights and duties could boost the currently limited appetite of insurers to provide L&H, liability or D&O covers in the context of space tourism and other space activity.

Related articles in SONAR

- "Space race reloaded – Emerging trend spotlight", SONAR 2016, p 31
- "Traffic jams in the skies", SONAR 2015, p 30

[29] "Council stresses the importance of participation of all in the space sector," Council of the EU, Press release, 26 November 2021.
[30] "Investing in Space Exploration," Morgan Stanley, 2020.
[31] With growing human population in space, also criminal justice may become a regulatory challenge. In 2020, a US astronaut committed the allegedly first crime while physically being in Space: "NASA Astronaut Anne McClain Accused by Spouse of Crime in Space," The New York Times, 23 August 2019.
[32] For a discussion of insurance challenges, scenarios and legal questions in in the context of growing space debris risk see "New space, new dimensions, new challenges: How satellite constellations impact space risk," Swiss Re Corporate Solutions, 2018.
[33] "The Commercial Space Age Is Here," Harvard Business Review, 12 February 2021.

Technological and natural environment

Thawing permafrost – accelerating climate, infrastructure and health hazards

Permafrost has been thawing at an increased speed over the past decades in both high latitudes and the mountainous regions across the world. This poses environmental, property and health risks, and may translate into property and liability claims, and also higher costs in L&H business.

Potential impacts

- Damage to property or infrastructure due to thawing permafrost can increase claims in property and engineering.
- This is also relevant with respect to the liability of engineers and architects involved in the planning, and public sector entities supporting or building infrastructure in permafrost zones or in areas exposed to risks associated with thawing of permafrost (eg, rockfalls).
- There could also be an increase in liability claims against projects that accelerate thawing of permafrost.
- Illness caused by pathogens and pollutants released by thawing permafrost may result in health claims.

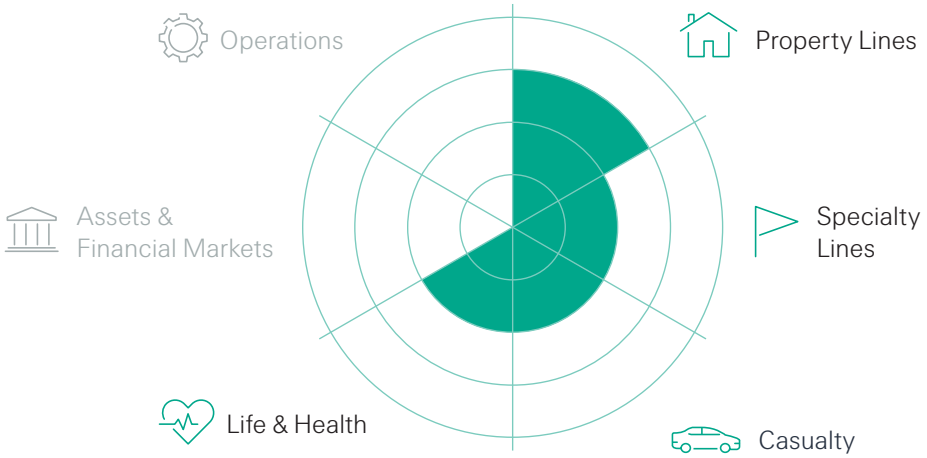
Impact

High
Medium
Low

Time frame

0 – 3 years
> 3 years

Impacted business areas



Permafrost is the ground (rock, soil and ice) that remains at or below 0°C (32°F) for two or more years, typically lying below the layer of ground that freezes and thaws annually.[34] Such conditions apply – or once applied – to a quarter of the northern hemisphere, with most of the planet's permafrost found in northern Russia, Canada, Alaska, Iceland and Scandinavia.[35] Permafrost is also found in mountainous regions at high elevations.

Climate change effects are expected to accelerate the thawing of large expanses of permafrost in numerous regions. This scenario presents many challenges, including ultimately for insurers. In the US, environmental groups have filed a lawsuit against a local authority that has approved a new oil and gas project in Alaska that would contribute to climate change.[36]

Opening Pandora's Box

An estimated 1 400 gigatons of carbon is entombed in permafrost, roughly four times the amount that humans have emitted since the Industrial Revolution.[37] A 2°C temperature rise above pre-industrial levels could result in a loss of about 40% of the world's permafrost by 2 100.[38]

As permafrost thaws, once-dormant microorganisms begin to break down organic matter, releasing CO_2 and methane. The latter is an even stronger greenhouse gas. This would further accelerate the path to irreversible climate change.

Damage to infrastructure …

Permafrost melt poses significant risks to infrastructure and buildings. A 2022 study concludes that infrastructure damage is already occurring and is "projected to continue, with 30 – 50% of critical circumpolar infrastructure thought to be at high risk by 2050."[39]

Erecting infrastructure on permafrost can have local impacts: models indicate that the interaction of the infrastructure with the frozen ground it rests on can accelerate degradation of permafrost compared to an area where there is no development.[40]

Even so, construction continues to advance in regions where there is permafrost, including that of energy industry infrastructure exposed to risks from thawing ground. In places such as Alaska, for example, energy companies already use so-called "thermosyphons" to stabilise thawing areas located adjacent to infrastructure.[41] Widening thawing of permafrost in energy-producing regions including in Russia and Canada has the potential to further damage roads, rail tracks, pipelines and port facilities erected on permafrost, creating energy delivery supply-chain disruptions. These could all lead to significant claims in property insurance.

… and to health, on a huge scale

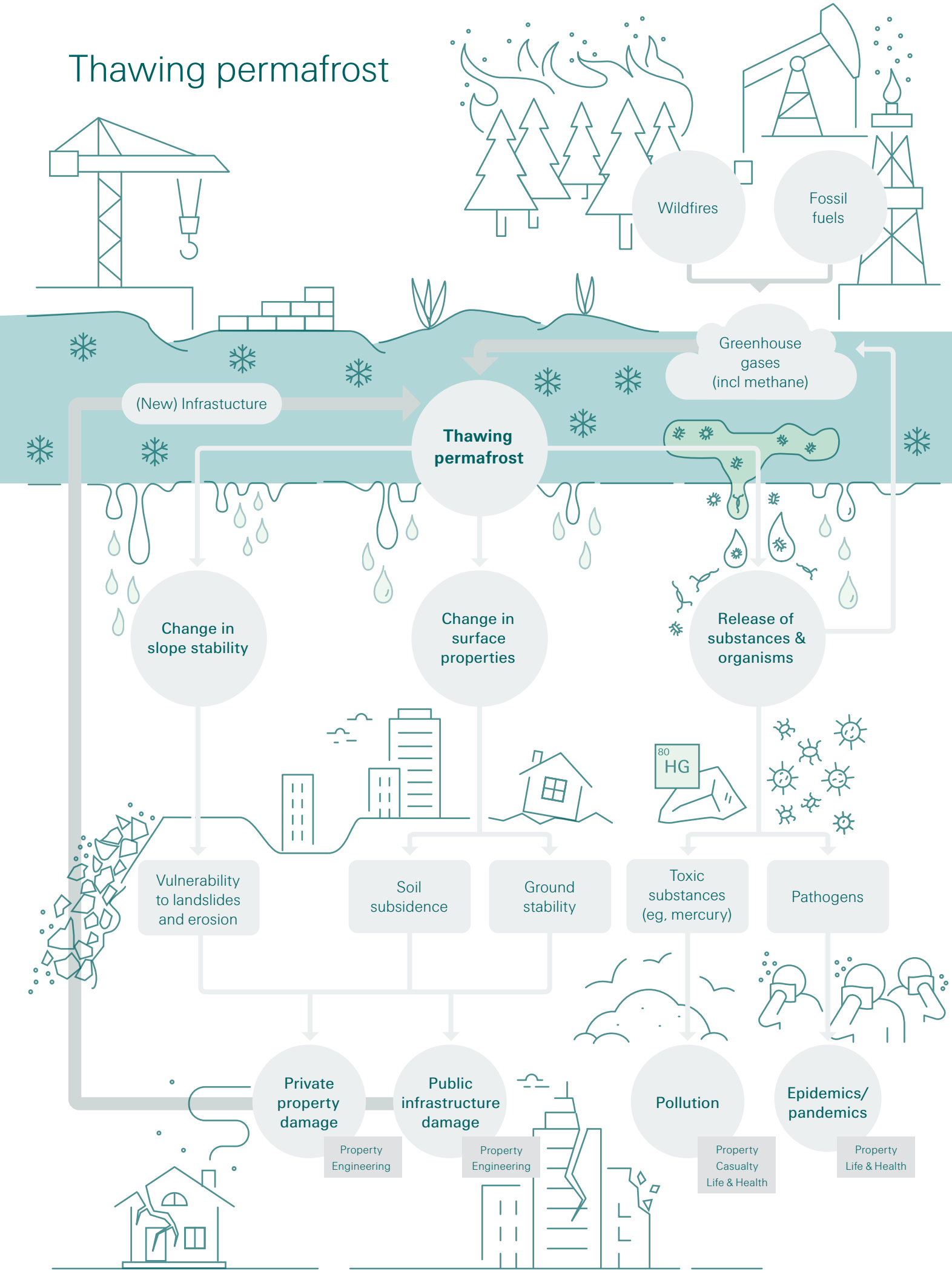
Thawing permafrost also poses risk to health, of both humans and animals. It can release pathogens previously trapped in frozen ground, such as anthrax.[42] Thawing also causes limestone deposits to release toxic substances, such as mercury and radon.[43] Mercury poisoning of water sources has been reported in permafrost regions. And radon is considered a major cause of lung cancer. In sum, further thawing of permafrost could have significant health consequences, which could also mean rising claims in L&H lines of insurance business.[44]

Related articles in SONAR

- "Bugs on the march – underestimated infectious disease" SONAR 2017, p 11
- "Special feature – climate change in Life & Health" SONAR 2019, p 42

[34] "Technical Documentation: Permafrost", US Environnemental Protection Agency (EPA).
[35] "Where is Frozen Ground?" National Snow and Ice Data Center (NSIDC).
[36] "Willow Project Complaint".
[37] "How Thawing Permafrost Is Beginning to Transform the Arctic," Yale Environment 360, 21 January 2020.
[38] Chadburn, S. E., "An observation-based constraint on permafrost loss as a function of global warming" Nature Climate Change, 7 (340 – 344), 2017.
[39] Hjort, J. et al., "Impacts of permafrost degradation on infrastructure," Nature Reviews Earth & Environment 3 (24 – 38), 2022.
[40] Schneider von Deimling, T., et al., "Consequences of permafrost degradation for Arctic infrastructure – bridging the model gap between regional and engineering scales," The Cryosphere 15 (2451 – 2471), 2021.
[41] "Using Thermosyphons on Alaska's North Slope," ConocoPhillips, Sustainability News, 28 February 2020.
[42] Stella, E. et al., "Permafrost dynamics and the risk of anthrax transmission: a modelling study," Scientific Reports 10(16460), 2020.
[43] Schaefer, K. et al., "Potential impacts of mercury released from thawing permafrost," Nature Communications 11(4650), 2020.
[44] "Climate change in the Arctic and radon gas: a rising threat from the ground up," National Collaborating Centre for Environmental Health (NCCEH – CCSNE), 11 March 2022.

Thawing permafrost



"When discussing emerging risks with our partners, peers and clients, we jointly increase our understanding of the risk landscape."

Bringing research to re/insurance underwriting, Swiss Re Institute's Chief Research Officer Christoph Nabholz discusses the role of emerging risks and risk dialogue.

Dr Christoph Nabholz
Chief Research Officer,
Swiss Re Institute

What role do emerging risks play in managing Swiss Re's forward-looking research agenda?
The Swiss Re Institute leverages Swiss Re's company-wide risk knowledge to facilitate an applied research agenda that addresses new and emerging re/insurance-relevant risk pools. We partner with leading research institutions and companies, to examine risks and develop solutions or services for our industry partners and others pursuing risk mitigation. Risk foresight is essential to this, and we integrate trend spotting for business opportunities and horizon scanning for emerging risks.

Swiss Re Institute's annual SONAR is a flagship publication acknowledged in the industry for its emerging risk thought leadership. SONAR conveys early risk signals from a broad range of insurance-relevant fields. Its qualitative approach can precede and complement in-depth quantitative research. Many companies use SONAR in their risk foresight processes, and we use it to engage clients and wider stakeholders in a risk dialogue.

Why is risk dialogue so important?
Dialogue is a key first step to engage with stakeholders and establish common goals. It helps us develop research partnerships and solutions that make the world more resilient.

When discussing emerging risks with our partners, peers and clients, we jointly increase our understanding of the risk landscape. This enables new mitigation measures and risk transfer solutions. Regular risk dialogue on the most material emerging risks also supports robust decision-making and business actions in times of increased uncertainty and crisis.

Can you make a concrete example?
Mental health is an area where we have pioneered insurance-focused research and development. Close interaction between underwriting, risk management and research functions has brought emerging aspects to the fore, like mental health issues among the young or mental health challenges from pandemic lockdowns. Both have been highlighted in SONAR (2020; 2021).

Via early risk identification and consumer-oriented market research, we support mental health knowledge and resilience. With the mental health platform Wysa, we offer clients a mental wellbeing app designed for insurance. A factor closely linked to mental health is sleep. SONAR highlighted the emerging risk of sleep deprivation in 2018, touching on impacts such as human failure, accidents, morbidity and mortality. We just published an in-depth paper and launched a research partnership with Oxford University to further explore sleep, as we focus on health benefits, measures, data pools and recommendations.

Another example is climate change, a well-established risk cluster where new aspects emerge over time. Related to this is the big risk cluster around biodiversity and ecosystem services. An effort that started in SONAR led to Swiss Re's "Biodiversity and Ecosystem Services Index", which draws on more thought and rigor around this topic.

New fuels to decarbonise the shipping industry

Shipping currently accounts for around 3% of global greenhouse gas (GHG) emissions. Switching to new fuels will be crucial to decarbonising the sector. It's not clear which fuels will prevail, and the associated risks are yet to be fully understood. In any case, the transformation will yield new opportunities along the entire re/insurance value chain.

The case for cutting CO_2 emissions from shipping is clear and insurers have committed support

The shipping industry aims to reduce its total annual GHG emissions by at least 50% by 2050 from 2008 levels, according to a strategy adopted by 173 nations in 2018.[45] Reaching this target will be crucial: if business continues as usual, the International Maritime Organization (IMO) forecasts that emissions from shipping could soar by as much as 130% over the next three decades.[46]

The IMO has announced new mandatory technical and operational measures that are due to start in 2023. Existing and new ships equal and above 5 000t Gross Tonnage need to gradually reduce their carbon intensity. An annual carbon intensity rating will measure emission performance relative to the previous year. Corrective actions will be needed for low-rated ships.

Along similar lines, in its "Fit for 55 Package", the EU has unveiled several proposals based on the polluter pays principle. These will have a significant impact on ship operators. For example, by including the maritime sector into the Emission Trading System and by newly taxing bunker fuel, operators of carbon-intense ships will be impacted more than ships using low-carbon alternative fuels.[47] Expectations of all stakeholders involved in facilitating the transition – including insurers – are on the rise. Several insurers have signed the Poseidon Principles for Marine Insurance and committed to assess and disclose the climate alignment of their hull and machinery portfolios. This is one the first concrete actions targeted as measuring the carbon intensity of underwriting portfolios.[48]

Switching to new fuels will require insurance covers

With the anticipated growth in shipping activity over the coming years, it is estimated that a 50% cut in absolute emissions is equivalent to a real-world reduction of about 85% in operational CO_2 intensity.[49] The key to decarbonising the shipping industry will be to switch to low-carbon fuels that can be produced in sufficient quantities and at a reasonable price. While zero-emission vessels must enter the market by 2030 at the latest, at the current point in time, alternative fuels with most potential such as green ammonia, green methanol and green hydrogen, are not yet readily available.[50] Switching to these new fuels on a large scale will require adaptation of both the ships themselves and the associated refuelling infrastructure, and ramping up supply of the chosen fuels. To advance the transition, insurers need to prepare to cover the risks involved with the introduction of the associated new fuels and technologies.

The technological overhaul of shipping will create challenges and opportunities for insurers

Take refueling, as one example. Refueling of cargo vessels, referred to as "bunkering", at present poses known risk. Refueling with alternative fuels such as hydrogen could pose new challenges and dangers that insurers would need to consider.[51] In the case of hydrogen, tanks needed to store hydrogen must be strong enough to withstand intense pressure. Hydrogen is highly explosive. While the risks are new, insurers will have limited loss experience and data points for the alternative fuels in the sector.

The transition of the shipping industry and related infrastructure will present new opportunities along the entire insurance sector value chain. However, insurers will have to carefully consider the associated changes in the risk landscape. Contributing to the understanding of advantages and risks of individual new technologies will also advance the industry's emission reduction efforts.

[45] "Initial IMO GMG Strategy," International Maritime Organisation (IMO); "World Nations Agree to At Least Halve Shipping Emissions by 2050," UNFCCC, News Article, 14 April 2018.
[46] "Fourth Greenhouse Gas Study 2020," IMO, 2020.
[47] "Decarbonisation in shipping: Overview of the regulatory framework," Standard Club, News & Insights, 11 November 2021; "How the Fit For 55 legislation will affect the shipping industry – and how you can prepare," NAPA, 3 February 2022.
[48] Signatories commit to measure the carbon intensity measured in grams of CO_2 per dead weight ton-nominal or dwt-nm (gCO_2/dwt-nm) and assess climate alignment (carbon intensity relative to established decarbonization trajectories) of their hull and machinery portfolios
[49] "Decarbonising shipping – the global challenge," Lloyd's Register (LR).
[50] Marine green fuel refers to fuels produced with renewable energy. In contrast, blue fuels are produced with natural gas and may be deployed until green fuels are available at scale.
[51] "For marine insurers, the transition to green shipping starts now," Swiss Re, 3 February 2022.

Quantum computing – a threat before an opportunity

The development of quantum computing (QC) capacity is progressing rapidly. With that comes new threats to data security which from the insurer's perspective, will likely outpace any benefits for the foreseeable future.

Potential impacts

- QC maturation comes with very high expectations, but also high uncertainty. It may take longer than anticipated for business-relevant applications to become available, and some could even fail. To this end, the quantum promise translates into strategic, investment and operational risk.
- The enormous strategic interest in QC raises potential for large-scale attacks on data security in general, but also for targeted attacks on quantum research and development organisations. Both cyber and property insurance losses may be triggered from an attack on an insured organisation.
- Should standard encryption keys for internet communication, digital banking and electronic commerce be hacked, there could be further cyber insurance and business interruption claims.
- Insurance operations could also be affected. If an insurer or one of its third-party suppliers experiences a data privacy breach, the company may suffer from reputational damage and financial losses. Transition to safer (post-quantum) data encryption will be time consuming and expensive.

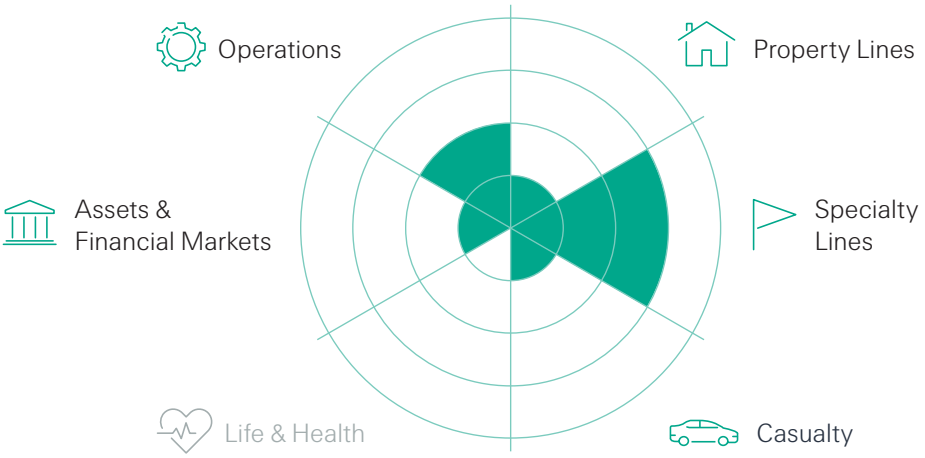
Impact

High
Medium
Low

Time frame

0 – 3 years
> 3 years

Impacted business areas



Quantum computing, a technology able to solve problems too complex for classical computers, is becoming a reality: first models are already on the market.[52] Insurers and other financial service providers will benefit from the accelerated processing power, high-speed data pattern recognition and elevated machine learning that QC promises. For insurers, QC opens unprecedented opportunities for simulation and modelling. The expectation is that risk pricing, for example, will be possible in real time, and that optimisation calculations for underwriting and investments will also be very swift.[53]

However, a fully-fledged quantum leap is still a few years off. And worryingly, before companies can profit from broad commercial application, QC will likely mature as a threat to existing IT-security protocols – particularly as a yet unseen force that can hack standard encryption keys used in online communications and data transfer.

The quantum promise

Conventional computing is based on "bits" that represent either a zero or a one. This current means of storing and processing data is boosted by QC's "qubit", which can be a zero, a one, or a superposition of both at the same time. Any additional qubit raises computing processing power potential exponentially. At present, quantum processor capacity has reached 127 qubits, and expectations are high that processor technology will progress further.[54] In the mid-term, a hybrid operating model – a combination of conventional and augmented quantum QC-inspired algorithms – will likely be used for specific industry applications.

There is much interest in QC, but significant hurdles remain to its adoption in existing commercial environments. One challenge is quantum computers' need for stable, ultra-low temperatures and, thus, high energy supply.[55] Furthermore, companies that intend to use QC could face talent shortages, with the new associated skill sets in high demand.

The quantum threat

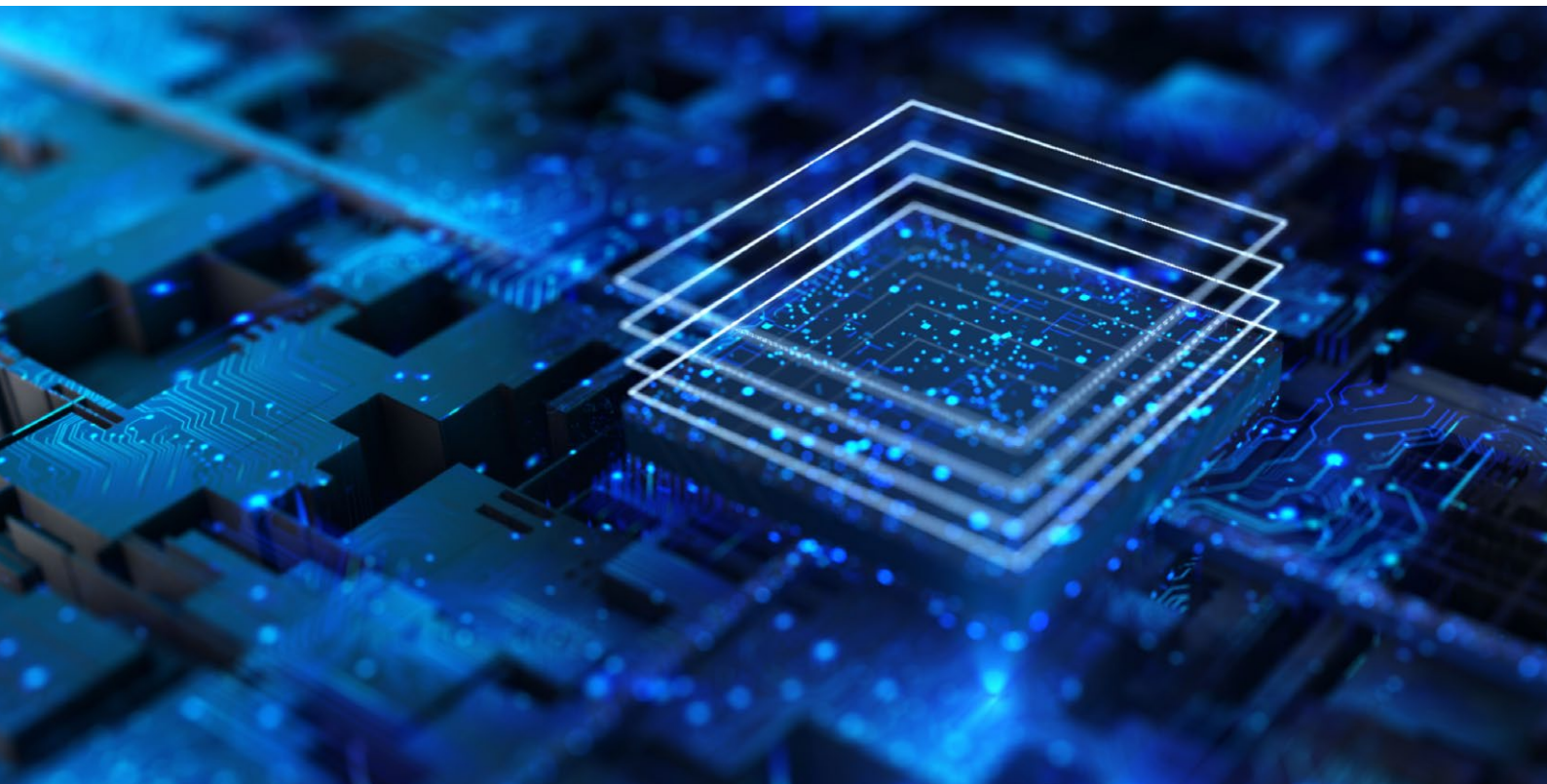
Nevertheless, QC's potential benefits have captured the interest of those striving for efficiency and lower costs. QC features prominently on military and intelligence research agendas also. The prospect of strategic first-mover advantage in QC is spurring global competition and plays an important role in geopolitical rivalries.[56] In some cases, quantum lab programs are being funded, and generously so, by national governments. Knowledge advances gained in such off-limit environments will likely be kept under wraps. For this reason, QC will likely be deployed for national interests before large-scale application in business become the norm.

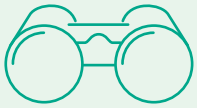
Deeper knowledge of QC will be of particular value in defending against quantum threats. Scenarios suggest that public key cryptography now used to protect online communication confidentiality and integrity could soon be at risk.[57] The quantum challenge to modern encryption is also a threat to financial market stability.[58] As the spectre of state-backed cyber-attacks rises, insurers and other industry players run the risk of being hacked and thus becoming victims of QC before they profit from it.

Related articles in SONAR

- "Biotech boom drives innovation and risks – Trend spotlight", SONAR 2022, p 46
- "What's next in insurance modeling – Trend spotlight", SONAR 2021, p 46
- "Computing at the edge – cybersecurity overstretched?", SONAR 2020, p 40
- "Big data", SONAR 2013, p 22

[52] "IBM Quantum System One," IBM Research; "Azure Quantum," Microsoft Azure; "Quantum Computing Service – Amazon Bracket," Amazon Web Services.
[53] Deodoro, J. et al, "Quantum Computing and the Financial System: Spooky Action at a Distance?", IMF Working Paper 71, 202.
[54] "IBM unleashes the Eagle, the world's most powerful quantum processor," New Atlas, 16 November 2021.
[55] Some quantum hardware technologies, especially photonics, won't require ultra-low temperatures and high energy supply. And even for superconducting devices which do, they are still estimated to favorably compare to the energy consumption of classical computers, as they need much less time – and thus energy – than the latter solving the same problem (eg simulating molecules, calculating derivatives price).
[56] "Threat Horizon 2024: The disintegration of trust," ISF, 2022.
[57] "In a quantum future, our economy needs to be protected. A cyber security expert explains why," World Economic Forum, 10 November 2021.
[58] Deodoro, J. et al, "Quantum Computing and the Financial System: Spooky Action at a Distance?", IMF Working Paper 71, 2021.





Biotech boom drives innovation and risks

Billions are being poured into combining key technologies to apply them to ever new areas of biotech, from therapeutics and pesticides to new materials. The resulting innovations are promising, but new risks are emerging at the same time.

Biotechnology – the merging of scientific and engineering approaches to manipulate biological organisms, cells and molecular structures in order to create new products and services – is booming.

One driver of rapid advances in these technologies is computing power and simulation. Artificial intelligence (AI) and high-performance computing combined with immense data storage capacity can assist in discovering new layers of meaning, hidden connections and patterns from data that would otherwise remain hidden. Such high-speed pattern recognition is already being deployed in cancer screening and other domains of pharmacology and medicine. Methods developed to tackle challenges in one field often find use to solve analogous cases in seemingly unrelated areas.

Expectations of biotech applications are high

The combined market value for biotech technologies was estimated USD 295 billion globally in 2019, generated by 11 000-plus companies with more than 880 000 employees.[59] For the coming two decades, it is estimated that bio-innovations will have direct economic impact in the single-digit USD trillion range globally each year, in the following areas[60]:

- Human health and performance
- Agriculture, aquaculture, and food
- Consumer products and services
- Materials, chemistry, and energy
- Sustainability
- Bio-machine interfaces
- Biocomputing

Many biotech innovations harbour disruptive potential, such as laboratory-grown meat that could dramatically undercut the global livestock industry, and is already being sold in several markets around the world.[61] Biotech applications will transform industrial processes. One European company is using enzymes that have been designed and replicated to recycle 100% of PET plastic waste for use in new bottles.[62] Other endeavours apply AI to drug development,[63] and give hint to future possibilities, such as quantum computing applied in cancer research and treatment.[64] Start-ups harnessing the innovative forces of biotech are blossoming around the world.[65]

Innovation means new risks

Like all new technologies, however, the biotech promise is accompanied by new risks.[66] Here are several risks that financial service providers may need to consider:

- Investment discount rate risk from unprecedented speed of innovation: with exponential growth of computing power, innovation may be outdated more quickly than we think, making today's hot start-up tomorrow's stranded asset. It remains to be seen whether the investment boom in biotech will further accelerate.
- Premature application: speed also means unproven products have the potential to create outsized damages. A human doctor can misdiagnose a finite number of patients, whereas quantum computer-aided AI diagnostics could affect millions. For insurers, such incidents could lead to liability, property or L&H claims.
- Complex vs. complicated: the ability to solve complicated problems by combining leading edge technologies may lead to applications of products and solutions in complex systems that are not yet fully understood. This may result in unwanted side effects, potentially raising regulatory issues and insurance claims (eg, in D&O).
- These technologies can also raise ethical and legal challenges, for example in relation to individual privacy. Also biosecurity may be threatened, as biotech can be weaponized.[67]

As some players seeking success in the biotech space may prioritise profit/progress over prudence, insurers must carefully analyse the related risks. This applies to both underwriting and asset management. Moreover, these technologies' disruptive potential should not be underestimated. For example, advances that allow for early cancer treatment could reduce or eliminate the need for cancer drugs or related hospital services.

Related articles in SONAR

- "The sorcerer's apprentice – DIY synthetic bio-hazards", SONAR 2020, p 21
- "Wiggle room – Artificial Intelligence and healthcare", SONAR 2019, p 31
- "The future is genomic: Moving towards precision medicine – Trend spotlight", SONAR 2018, p 15
- "Algorithms are only human too – opaque, biased, misled", SONAR 2018, p 26
- "Cancer treatment revolution? - liquid biopsy and immunotherapy", SONAR 2017, p 17
- "Good things in your gut - advances in precision medicine", SONAR 2017, p 22
- "Precision medicine", SONAR 2016, p 12

[59] Martin, D.K., et al., "A brief overview of global biotechnology," Biotechnology & Biotechnological Equipment 35, 2021.
[60] "The Bio Revolution: Innovations transforming economies, societies, and our lives," McKinsey Global Institute Report, May 13 2020.
[61] "Plant-based ingredients maker Motif FoodWorks raises $226 mln in funding," Reuters, 16 June 202.
[62] "Carbios Accelerates Its Industrial Development," Business Wire, 19 January 2022.
[63] "The Future of Biotech in an Artificially Intelligent World," Genetic Engineering & Biotechnology News, 5 January 2022.
[64] Abbott, A., "Quantum computers to explore precision oncology," Nature Biotechnology 39 (1324 – 1325), 2021.
[65] "Top 5 Global Startup Hubs: Biotechnology," StartUs Insights Research; "The 20 European Biotech Companies to Watch in 2022," Labiotech.eu, 5 January 2022.
[66] This report discusses a number of risks: "The Bio Revolution," McKinsey Global Institute, 2020.
[67] "Benefits & Risks of Biotechnology," Future of Life Institute; "11 Biotechnology Pros and Cons," Vittana.org, 17 November 2017.

Underwriting crypto asset risk – what are the odds?

From cryptocurrencies to Non-Fungible Tokens (NFTs) – the crypto assets market is growing. From an underwriting perspective, crypto assets may lead to unexpected losses and opportunities for new forms of insurance coverage.

Potential impacts

- Certain crypto assets may be implicitly covered by existing property or cyber policies. Consequently, there could be a notable rise in claims in those lines of business.
- Risky investments in crypto assets and unexpected associated tax liabilities may threaten company viability and trigger credit & surety claims.
- Efforts by individuals and companies to hide funds from authorities by investing in crypto assets may see an increase in the number of court cases and, in instances where illegal activities are not properly excluded in insurance policy terms and conditions, lead to D&O claims.
- Due to ESG issues along the value chain of crypto assets (eg, energy consumption), regulatory uncertainties and high volatility of the assets, dealings inengagement with crypto assets may lead to financial losses and reputational damage.

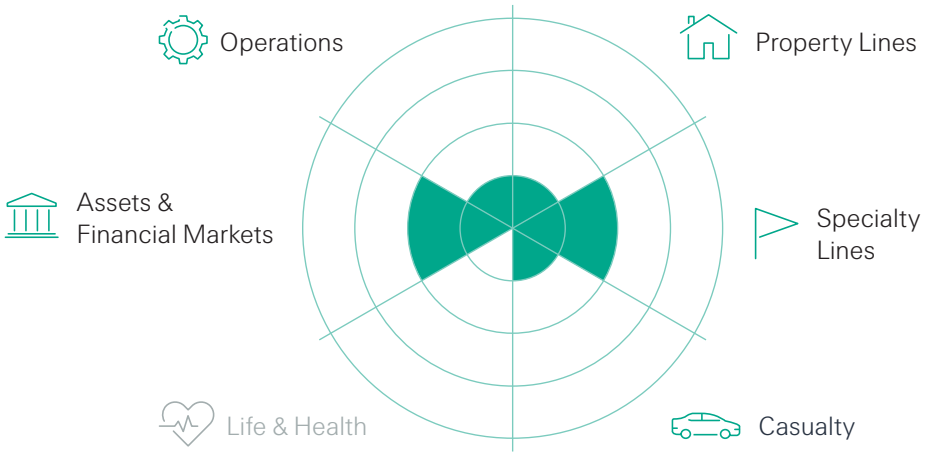
Impact

High
Medium
Low

Time frame

0 – 3 years
> 3 years

Impacted business areas



The crypto asset market is growing rapidly

Crypto assets are privately-issued digital assets secured with cryptography (see graph "Typology of crypto assets" on p 48).[68] They can take the form of cryptocurrencies, which perform the role of currency. They can also be tokens, which are digital representatives of interests, or rights to (access) certain assets, products or services. For example, investment tokens provide holders ownership or entitlement rights similar to dividends. Investment tokens can also provide rights to virtual assets, such as Non-Fungible Tokens (NFTs), and to physical assets such as collectibles and real estate. From an investment perspective, crypto assets have been referred to as a potential hedge against inflation or uncorrelated alternative assets. Notably, re/insurers have not yet made significant investments in the sector due to the high volatility of the assets and other uncertainties.

Losses for existing covers

Crypto assets theft is of growing concern. Hackers reportedly made off with several billions of dollars in virtual assets in 2021.[69] An open question for insurers in this regard is whether certain crypto assets are implicitly covered by existing property or cyber policies.

Recently, crypto assets have also been a contentious topic in court as they may be used to hide funds from authorities. For instance, dividing a family's Bitcoin assets

has become a major source of contention in divorce cases. There is a growing industry of forensic investigators who charge large sums to track the movement of cryptocurrencies like Bitcoin and Ether from online exchanges to digital wallets, in order to investigate whether a spouse has correctly declared the amount of crypto assets owned.[70] Similarly, directors and officers may hide funds by investing them in crypto assets. This can increase court costs for personal lines and D&O covers.

New risk pools for insurers?

With the rapid growth of the crypto asset sector, the question of insurability of such assets with new covers becomes more relevant. Digital assets, including digital artwork in the form of Non-Fungible Tokens (NFTs), cannot be insured against physical risks. However, insurers could consider providing coverage for the private key that ensures access to the NFT. In the case of offline physical storage of such access keys – a so-called "cold wallet" – insurers could also offer cover for loss of or damage to the wallet. Similarly, online accounts on crypto exchanges are vulnerable to hacking. Here insurers could provide cyber coverage, either for the operating entity of an exchange or to the individuals trading on it.

A relatively new development is the tokenization of material assets, from collectibles to real estate (see graph "Typology of crypto assets" on p 48). If tokenization of collectibles such as art works or other luxury goods gains traction, an increasing number of collectibles will need to be stored and maintained at dedicated physical locations. The storage facilities will need insurance coverage and could face accumulation risk as many valuable assets may be stored in the same location. In all cases, the lack of historical data and the dynamic nature of the crypto asset space make design and pricing of respective insurance covers difficult. In addition, a significant challenge for insurers in this space is the price volatility of such assets, as well as the challenges of verifying a loss such as a theft.

Due to the high energy consumption and resources required for server infrastructure, insurers may be reluctant to provide coverage barring improvements on emissions. Similarly, insurers would need to be able to clearly distance themselves from illegal activities associated with crypto assets.

Regulatory certainty can turn the needle

Large uncertainties remain around the regulation of crypto assets. Many financial institutions have concerns about becoming directly involved in providing services such as insurance for the crypto asset segment due to the perceived regulatory risks. The fluidity and "invisibility" of ultimate ownership make it hard to ensure compliance with regulations such as anti-money laundering (including "know your customer" requirements), international trade and economic sanctions, and "proceeds of crime" laws which would continue to apply to the financial institution counterparty.

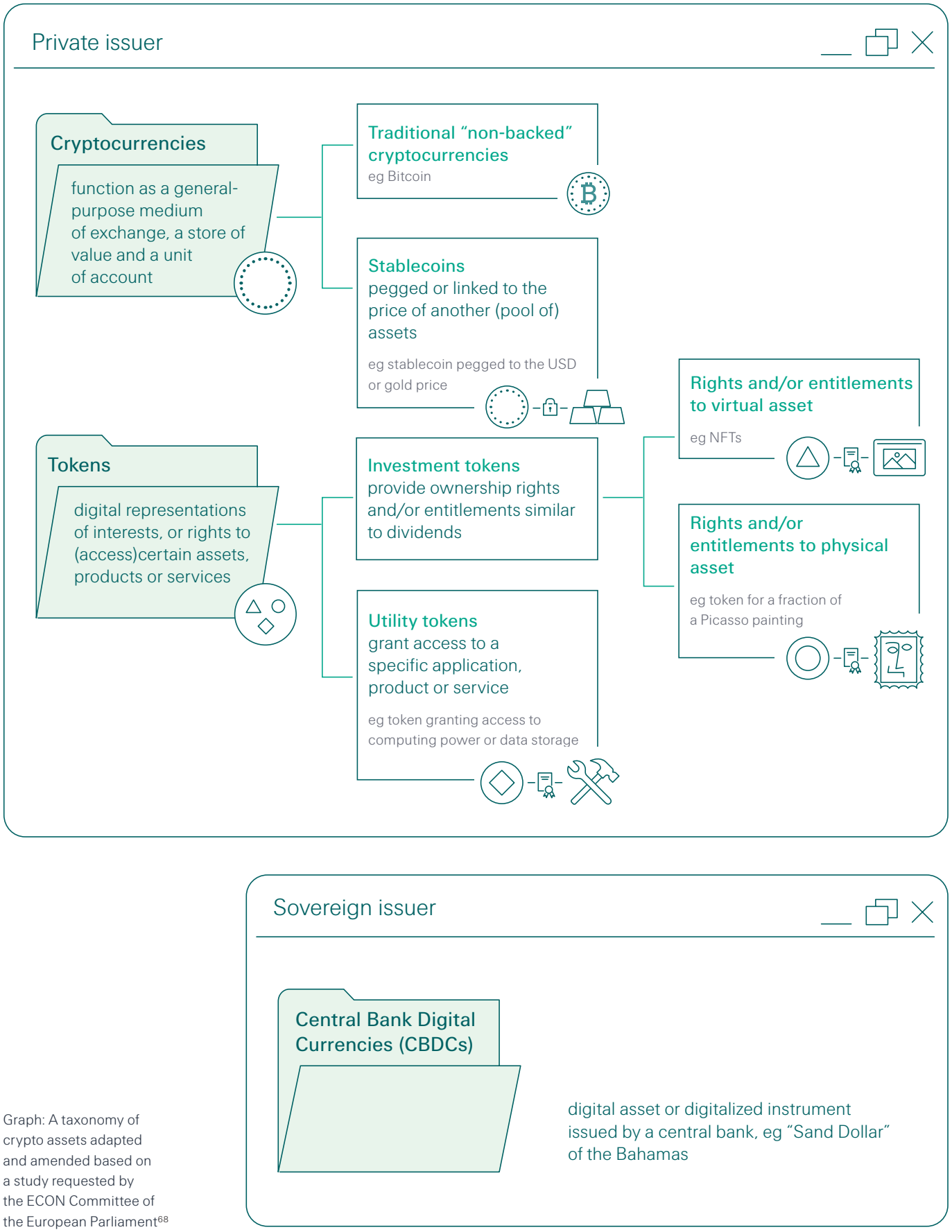
Regulators continue to investigate ways to fill the gaps. Some countries prohibit trading in certain crypto assets, which will hold back market development. Less restrictive but clear regulation and thus certainty would both accelerate sector growth, and open new opportunities for insurers considering investing in or providing insurance covers for crypto assets.

Related articles in SONAR

- "Funny money? – Do we need to worry about cryptocurrencies", SONAR 2018, p 40
- "Blockchain risks", SONAR 2016, p 23

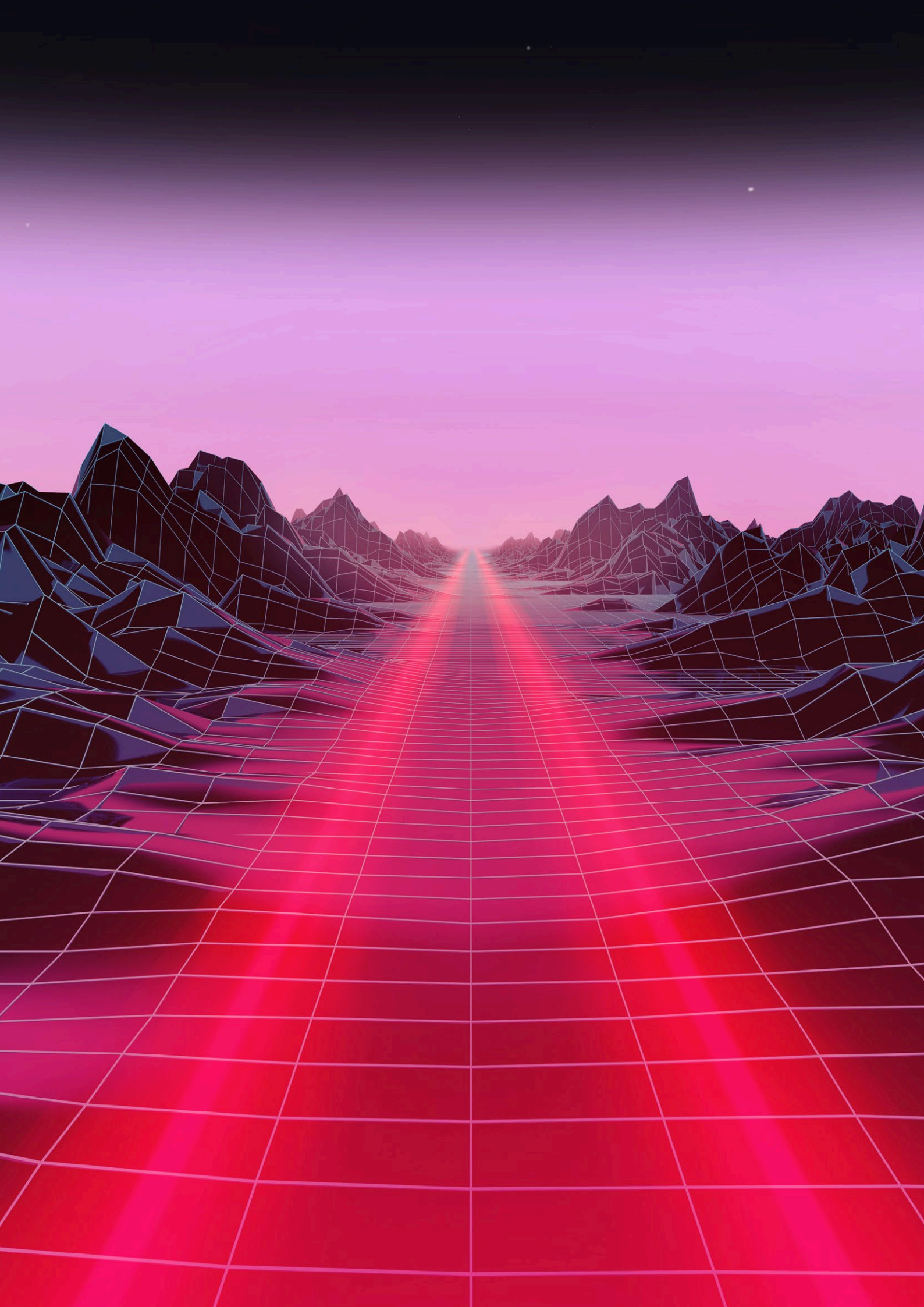
[68] eg "Assessment of Risks to Financial Stability from Crypto-assets," FSB, 16 February 2022; "Crypto-assets – Key developments, regulatory concerns and responses" European Parliament, 2020.
[69] "Crypto exchanges keep getting hacked, and there's little anyone can do," NBCNews, 8 November 2019
[70] "Divorcing Couples Fight Over the Kids, the House and Now the Crypto," The New York Times, 13 February 2022.

Typology of crypto assets



Graph: A taxonomy of crypto assets adapted and amended based on a study requested by the ECON Committee of the European Parliament[68]

[71] "Crypto-assets – Key developments, regulatory concerns and responses" European Parliament, 2020.



Invasive species – if climate change adaption goes wrong

Some non-native organisms imported for climate change adaptation can prove invasive by proliferating in uncontrolled fashion, with negative impacts on endemic species and ecosystems. These could lead to claims in property, liability and L&H.

Potential impacts

- The introduction of non-native species that turn out to be invasive, could generate property claims.
- Depending on local legal frameworks governing liability, an increase in liability claims in relation to invasive species is possible. This includes claims against those having introduced invasive species to new areas and land owners who fail to take action against invasive species on their property.[72]
- Invasive animals (eg, mosquitos) can transmit diseases and other illnesses, leading to L&H claims.

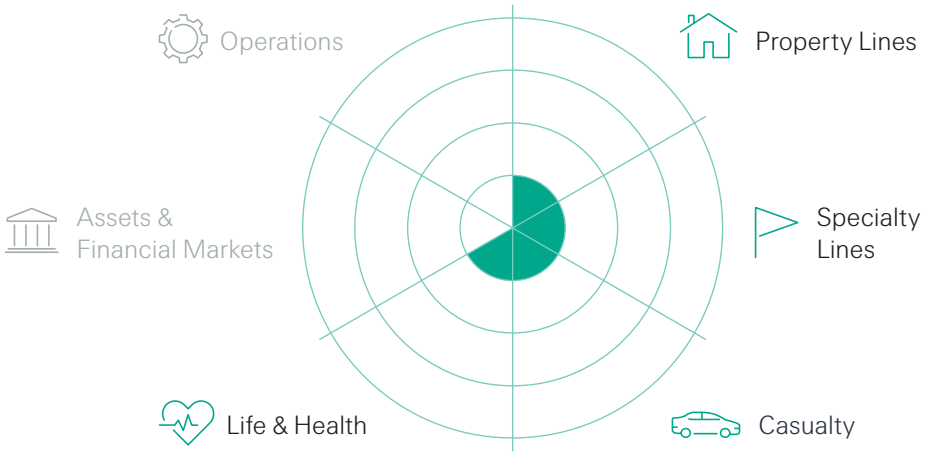
Impact

High
Medium
Low

Time frame

0 – 3 years
> 3 years

Impacted business areas



To "transplant" certain plant or animal species may be a feasible strategy in farming or forestry to cope with changing regional climate and weather conditions. But this also increases the risk of the introduction – intentionally or unintentionally – of invasive species and accompanying organisms into other ecosystems. The threat from release of so-called "invasive species" which cause environmental, human or economic damage, may accumulate on account of the climate change-induced vulnerabilities of the host natural ecosystems.

The global economic costs linked to the introduction of invasive species are already huge.[73] Invasive species cost global agriculture an estimated USD 540 billion annually.[74] The US economy alone faces a hit of more than USD 100 billion per year.[75] There is evidence that a trend of rising losses will continue.

Damage across multiple fronts

Invasive alien species, creatures and organisms that have spread beyond their original habitat — whether through human agency or not — can have significant negative impact on existing species diversity, the natural ecosystem and human health, as well as on the economy as a whole. Climate change and globalisation can add to the proliferation of invasive species. Rising temperatures, rainfall, humidity and drought can facilitate their spread and establishment, thereby strengthening their invasive ability.[76]

The resulting damage can include yield loss in agriculture, illnesses such as the West Nile Virus (carried by invasive mosquitos), land alteration, infrastructure damage and/or income reduction. There are large management costs (eg, research and control) associated with mitigating or eradicating invasive influences.

Climate change challenges the resilience of natural habitats to biological incursions, while simultaneously making natural habitats, agricultural and urban areas more vulnerable.[77] The development of effective control and mitigation strategies are being hampered by the lack of awareness on the part of the general public and decision-makers about the consequences of bringing non-native species into new habitats. A historic example is the afforestation efforts of emperor Menelik II who introduced Eucalyptus trees to Ethiopia in the 1890s. Whilst they have several advantages, eucalyptus trees can negatively impact biodiversity and consumes a lot of water, thus reinforcing water scarcities already aggravated by climate change.[78]

Nasty plants

Invasive plants and pests threaten food security, particularly in low- and middle-income countries that lack the means to prevent or manage such invasions. One example is the proliferation of the water hyacinth, an invasive species that has degraded aquatic ecosystems in many warmer regions of the world, causing environmental and cultural problems. It spreads rapidly, forming dense cover on the surface of freshwater bodies, blocking waterways, limiting boat traffic, and affecting fishing and trade. In Lake Victoria in eastern Africa, it can grow to such densities that ships cannot leave docks. The same could happen in other parts of the world.

Related articles in SONAR

- "Resilience at stake – forest's vital functions under threat", SONAR 2019, p 33
- "Paradise lost – the price of ecosystem services", SONAR 2018, p 31
- "Gene drives", SONAR 2016, p 15

[72] "Network Rail Infrastructure Ltd v Williams & Anr," Fenwick Elliott, 2 August 2018.
[73] "Building resilience to the economic threat of invasive species," Swiss Re and John Hopkins, 2018; The InvaCost database has enabled the generation or a reliable, comprehensive, standardized and easily updatable synthesis of the monetary costs of biological invasions worldwide. Here we found that the total reported costs of invasions reached a minimum of USD 1.288 trillion (2017 US dollars) over the past few decades (1970 – 2017), with an annual mean cost of USD 26.8 billion.
[74] "Biodiversity at Risk: Preserving the natural world for our future," AXA Research Guide Series, 2019.
[75] Pimentel, D., et al., "Update on the Environmental and Economic Costs Associated with Alien-Invasive Species in the United States," Ecological Economics 52 (273 – 288), 2005.
[76] Diagne, C., et al., "High and rising economic costs of biological invasions worldwide," Nature 592 (571 – 576), 2021.
[77] "COP26: climate change and its impact on invasive species," CABI, 2 November 2021.
[78] Madalcho, A. B., et al., „Is the expansion of Eucalyptus tree a curse or an opportunity? Implications from a dispute on the tree's ecological and economic impact in Ethiopia: A review," Journal of Ecology and the Natural Environment 11(6), 2019,

Sustainable farming revolution

Feeding growing human populations has always been a challenge. Higher agricultural productivity is not the sole target anymore. The motivation behind "climate smart" and "regenerative" farming practices is to feed more people, sustainably, while avoiding resource depletion, environmental pollution, and additional greenhouse gas emissions. How can insurance contribute?

Emissions from world food systems (16.5 billion metric tons of GHG in 2019) account for around 31% of total human-induced emissions.[79] We have seen consumer groups shifting to more sustainable foods, such as plant-based or locally-sourced produce. However, global consumption of meat and protein-rich foods is expected to rise in the coming years.[80] The challenge for agriculture is to improve productivity to feed more people, while at the same time reduce emissions.

Beyond monoculture

Unrestrained use of monoculture and industrial chemicals is being challenged, as a shift towards sustainable practices in large commercial and small-scale farming gains pace. Transition to climate-smart and regenerative agriculture can yield multiple benefits such as improved soil health and ecosystem biodiversity, climate-resistant crops and, at later stages, increased profit margins.[81]

Climate-smart agriculture fosters biodiversity and reduces dependence on fossil-fuel reliant production of fertilisers, the production and use of which currently account for 2.4% of global emissions. Active farmland management such as intercropping with nitrogen-capturing plants or use of biological fertilizers (eg, enlisting the help of bacteria) maximizes the ability of soils to absorb and hold more nitrogen, reducing the need for chemical fertilizers. At the same time, slower production cycles and ensuring appropriate mix of crops come with challenges that need to be managed. Solutions based on technological advancements and data such as precision farming, the deployment of robots, and the use of drones allow for more efficiency and refined farm management decisions.[82]

Climate smart farming and insurance

Insurers can play a vital role in faster adoption and scaling of sustainable farming practices by offering better-suited coverage solutions. They can offer affordable cover in the case of crop failure, and also risk-prevention support. This will help climate smart and regenerative agriculture gain traction, including by de-risking the upfront investment that is often required and mitigating the potential dip in performance while soils adjust and practices stabilise.

Not all farmers have sufficient financial or human capital – or even have access to internet – necessary to deploy new technologies for improved outcomes. To this end, small-scale farming can be served by micro-insurance schemes offering parametric covers that mitigate operational overhead.

More broadly, financial risk transfer in the form of insurance can enable long-term investments, helping fuel the transformation of practices. Insurance innovation lies in helping the agriculture sector optimise yields – highest possible yield with the minimum inputs. The insurance industry should support farmers in adhering to measurement, reporting & verification (MRV) procedures aligned with the UN Sustainable Development Goals, and also with carbon farming certification and food labelling requirements. These measures can support long-term transition to sustainable and resilient farming communities.

[79] Tubiello, F.N., et al,. "Pre- and post-production processes along supply chains increasingly dominate GHG emissions from agri-food systems globally and in most countries," Earth Syst. Sci. Data Discuss. [preprint], 2021.
[80] "OECD-FAO Agricultural Outlook 2021-2030: 6. Meat," OECD iLibrary.
[81] "Helping Farmers Shift to Regenerative Agriculture," Bain & Company, 2 December 2021; and "Regenerative agriculture works: New research and African businesses show how," IUCN, 25 October 2021.
[82] For digitally enhanced crop insurance see Swiss Re's analytics platform.

Sustainable farming revolution

Non-conventional farming settings

Alternatives include vertical farming, hydroponics, soil-free growth, and controlled indoor environment

\+ Decreased land-intense farming

Possibility to farm in urban/ suburban spaces or arid lands

Shorter supply chain

~ High initial investment cost and operational (infrastructure) risk

Labour intensive pollination, if no insects (bees, bumblebees) are involved

Precision agriculture

Use of information technology advancements (eg, sensors, robotics, drones, autonomous vehicles) in farming processes such as pest control or watering

\+ Increased productivity

Decreased labour intensity

Reduced use of fertilizers

~ Cyber-attacks can lead to business interruption and affect production

Dependency on internet, software, data providers etc. comes with a risk of service interruption

Intercropping and crop rotation

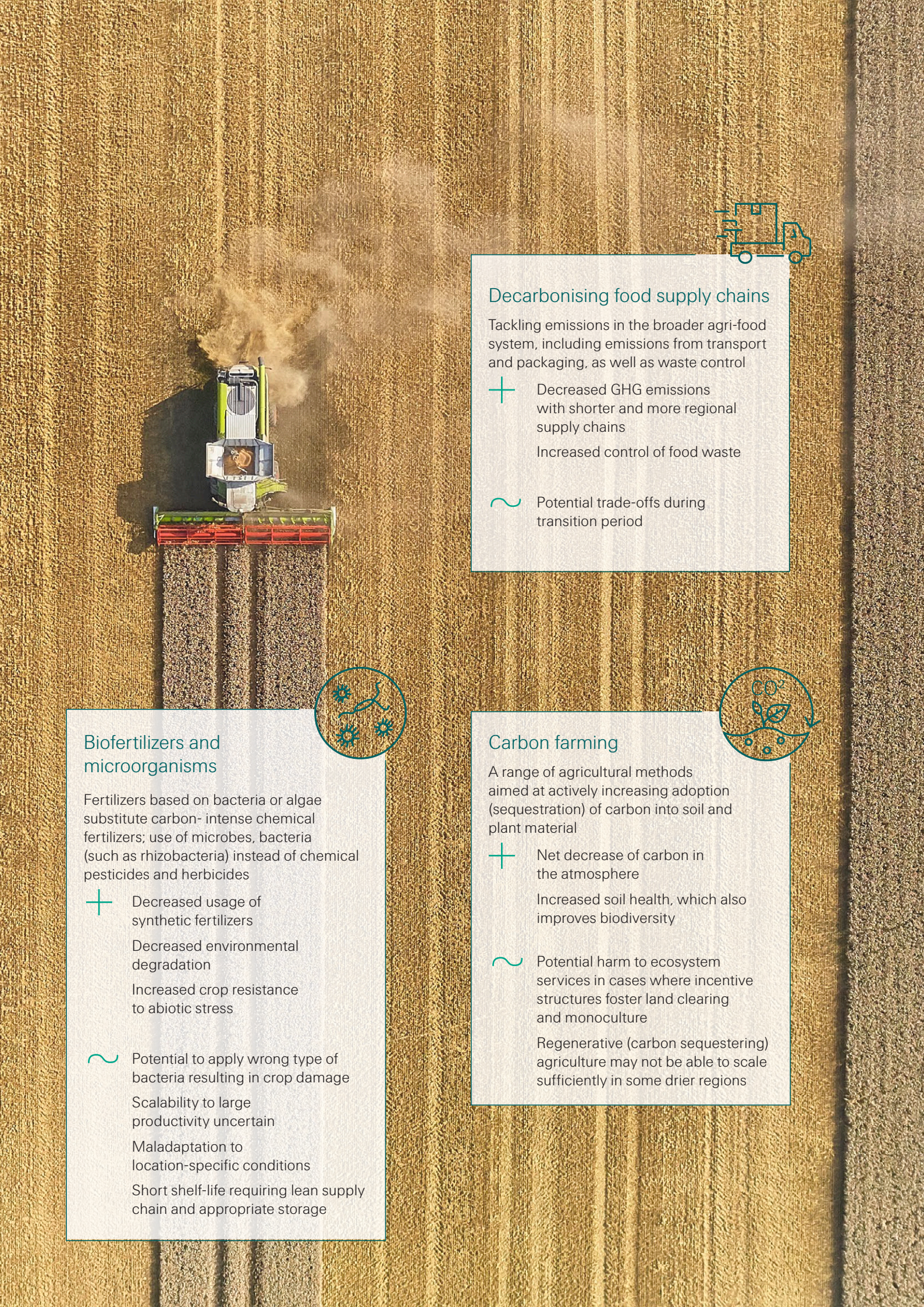
Different plant species grown together or in succession

\+ Less synthetic fertilizers required and potentially more efficient use of natural resources

Increased biodiversity, biological pest control and soil health

Decreased environmental degradation/pollution

~ Lower yields in the starting years compared to monoculture. However, there are views that yields can be higher once crops and soil has adjusted and matured



Decarbonising food supply chains

Tackling emissions in the broader agri-food system, including emissions from transport and packaging, as well as waste control

+ Decreased GHG emissions with shorter and more regional supply chains
+ Increased control of food waste

~ Potential trade-offs during transition period

Biofertilizers and microorganisms

Fertilizers based on bacteria or algae substitute carbon- intense chemical fertilizers; use of microbes, bacteria (such as rhizobacteria) instead of chemical pesticides and herbicides

+ Decreased usage of synthetic fertilizers
+ Decreased environmental degradation
+ Increased crop resistance to abiotic stress

~ Potential to apply wrong type of bacteria resulting in crop damage
~ Scalability to large productivity uncertain
~ Maladaptation to location-specific conditions
~ Short shelf-life requiring lean supply chain and appropriate storage

Carbon farming

A range of agricultural methods aimed at actively increasing adoption (sequestration) of carbon into soil and plant material

+ Net decrease of carbon in the atmosphere
+ Increased soil health, which also improves biodiversity

~ Potential harm to ecosystem services in cases where incentive structures foster land clearing and monoculture
~ Regenerative (carbon sequestering) agriculture may not be able to scale sufficiently in some drier regions

Competitive and business environment

Legal tech – is AI rendering justice?

Advances in artificial intelligence (AI), in particular machine learning (ML), can transform legal practices. For instance, lawyers may utilise "legal tech" to select cases with highest chances of success.

Potential impacts

- There may be a rise in liability cases in situations where AI software produces incorrect outcomes. This includes big law firms that may be held liable for the services they offer while using these types of technologies (eg, in accounting, taxes, licensing etc).
- Lawyers may be biased to focus on class action cases with higher chance of winning larger awards. Legal tech may help them to more quickly and successfully do so leading to further priorization of economic success over justice, and also an overall increase in the claims load for insurers.
- Increased claims load may also come from the number of low-value claims as efficiency gains from legal tech may lower legal costs for individual cases. Potential lines of business impact could be, for instance, motor liability (car accidents), employer's liability/worker's compensation (workplace accidents).
- Legal tech can benefit insurance operations such as by mitigating mistakes and fraud, and identifying high-liability risk or high-exposure cases.

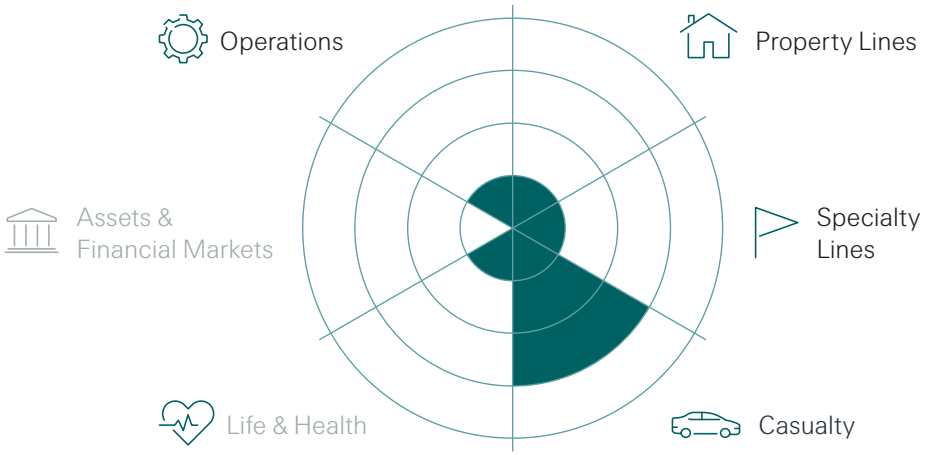
Impact

High
Medium
Low

Time frame

0 – 3 years
> 3 years

Impacted business areas



Legal tech is on the rise

Over the past decades, AI in law has advanced from academic research to impactful practical application. A 2020 OECD report lists numerous examples of AI that can be applied in the law profession,[83] including supporting judges in courts to reduce backlogs in cases,[84] increasing legal access to more citizens,[85] and reducing uncertainty around the application of financial regulations.[86]

Several high-profile legal tech start-ups are valued at more than USD 1 billion, thus reaching "unicorn status".[87] Simultaneously, many large and well-known law and consulting firms are investing in those legal tech start-ups that provide services to help lawyers in their daily tasks, from legal research to contract and litigation document generation.[88]

Challenges and limitations remain

Still, use of AI in law continues to face many constraints, not all of which are technical. Most AI systems rely on the right to access court data for their analysis. However, bulk access to this data in a comprehensive fashion remains difficult.[89] On the technical front, key challenges persist, including automatic detection of the structure of cases (eg, identifying the conclusion), and encoding the logic of statutes.

Law firms typically use software developed by specialized software companies. Early adoption of inadequate or inefficient software may lead to incorrect or insufficient outputs. A further risk emerges from the question of whether biases of algorithms trained on biased datasets can be worse than the biases of humans.[90] If biased software leads to incorrect advice, professional indemnity claims may emerge against lawyers, and liability claims may be lodged against the software companies.

How will AI impact the legal system?

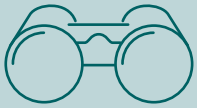
AI could impact the law itself by fostering the idea of " legal singularity," the notion that the need for interpretation can be removed from answers to legal questions.[91] Some even raise the concern whether the law could lose its ability to evolve if, with the application of AI, it becomes mechanically based on prior arguments.[92]

Another risk pertains to auditing implementation requiring both legal and software engineering skills. Gatekeepers to the law (lawyers/judges/legislators) will typically not be experts in reading code, and software engineers will typically not be experts in interpreting law. This raises the question of transparency and monitoring the technology.

But one of the biggest direct impacts to insurers could stem from lawyers using legal tech systems to zero in on those lawsuits/cases with most chance of success. This could conflict with the legal purpose of providing justice for all, and also lead to a significant rise in claims loads.

Related articles in SONAR
- "Macrotrends: Digital innovation", SONAR 2020, p 12
- "Blame your robot – emerging artificial intelligence legislation", SONAR 2017, p 32
- "Eroding rationality – the information challenge", SONAR 2017, p 39

[83] Mohun, J., and Roberts, A., "Cracking the Code: Rulemaking for humans and machines," OECD Working Papers on Public Governance 42, 2020.
[84] "Can AI Be a Fair Judge in Court? Estonia Thinks So," Wired, 25 March 2019.
[85] See in France Mes Aides, and for the issues that it created: Alauzen, M., "Splendeurs et misère d'une start-up d'Etat: Dispute dans la lutte contre le non-recours aux droits sociaux en France (2013 – 2020)," Réseaux 225 (121 – 150), 2021.
[86] See for instance the project in the UK led by the FCA, "Digital regulatory reporting" which seek to encode regulations (last consulted on Jan 17, 2021).
[87] "The battle to win at legal tech," Financial Times, 27 May 2021.
[88] "The Future of Law Firms (and Lawyers) in the Age of Artificial Intelligence," American Bar Association, 2 October 2020.
[89] The UK is aiming at publishing in a central form all court judgement only in April 2022. See The National Archives (2021). The National Archives to publish court and tribunal judgments, Jun 16 (last consulted on Jan 17, 2022).
[90] See for instance: van den Hoven, E., "Hermeneutical injustice and the computational turn in law" Journal of Cross-Disciplinary Research in Computational Law, 1(1), 2022. However, with the literature on legal biases being so enormous, incl. on the software COMPAS used by US courts to determine chances of recidivism, we refrain from providing a comprehensive literature on the subject.
[91] Markou, C., and Deakin, "Is Law Computable? Critical Perspectives on Law by Artificial Intelligence," Hart Publishing, 2020.
[92] Hildebrandt, M. "Code-driven law: Scaling the past and freezing the future," Critical Perspectives on Law and Artificial Intelligence, 2020.



Overcoming hurdles in automated underwriting

Technological advances are progressing the automation of nearly all steps in the underwriting process from pricing to claims handling, and all the way to portfolio analysis and steering. Associated challenges need to be properly managed.

Automation can make underwriting processes easier, more efficient and effective

Electronic business platforms with advanced data analytics, or new algorithms that digest large swaths of data, can provide swift pricing, in particular for standard insurance business. At the same time, automation may help to apply more complex models in predicting future claims, yielding more efficient risk pricing. In addition, such automation may lower costs, thereby also improving consumer access to insurance across markets.

Challenges to implementation remain

Common challenges in automation are potential flaws and biases. For instance, automated personalised engines can help customers understand what they are buying, but the engine may categorise the customers wrongly. This can often be traced back to biases in the training data used to build the algorithms (ie, the initial data used to train models).[93] Curating the input data carefully to flag such biases could be one way to go about it, with an emphasis on data quality rather than quantity.

However, if machine learning and other complex algorithms are involved, it becomes more difficult to understand and explain the model's actual workings and output. Such automation will also obscure individual accountability. Whereas in the past a person might have clearly been in a specific role with associated responsibilities, the higher reliance on algorithms makes the attribution of mistakes to algorithms, the companies which order them, or their users more challenging.

From an operational perspective, an important factor in the implementation of automated underwriting is governance and organisational framework. For a long while already, many large IT projects have been in the headlines for delays and being over-budget.[94]

Oversight and managing limitations will be key to success

More recently, government decision making based on automated systems has been in the spotlight.[95] This points to the important role of oversight, and of requiring human intervention in key parts of the process. Carefully controlling the degree of disintermediation of humans, most notably by letting human underwriters oversee part of the process, can help reduce the risk, while remaining cognizant that humans have biases too. Re/insurers need to ensure that humans still have the skills and ability to override machines' decisions, and also to perform complex underwriting tasks for which automation is not (yet) fit for purpose.

[93] "AI Regulation is Coming," Harvard Business Review, September-October 2021.

[94] Humphrey, S.W., "Why Big Software Projects Fail: The 12 Key Questions". In: Software Management, Reifer, D.J. (ed), IEEE Computer Society, 2005. Office scandal: What the Horizon saga is all about. BBC, Jul 22 (last consulted on 31.01.2022).

[95] For an example of such a scandal, see two recent ones: At the beginning of 2021, the Dutch government resigned following thousands of families wronged by social benefits, and despite a parliamentary report flagging the shortcomings. Mid 2021, a UK judge overturned the conviction of 59 post masters accused of stealing money when in fact, the reporting software for accounting was full of bugs, with the judge stating that their conviction was " an affront to the public conscience".
See "Dutch government faces collapse over child benefits scandal," The Guardian, Jan 14 2021; "Post Office scandal: What the Horizon saga is all about," BBC News, Jul 22 2022.

Appendix: Terms and definitions

What is SONAR?
SONAR stands for Systematic Observation of Notions Associated with Risk. It is Swiss Re's process for identifying, assessing and managing emerging risks. Experts across the company use a web-based platform to collect early signals of emerging risks. All signals are assessed and prioritised by an emerging risk management team, which closely interacts with topic experts from Swiss Re's different business areas. The team serves as a catalyst for risk identification and assessment to define and implement recommendations in collaboration with the business. The findings are regularly shared internally and summarised for external audiences here.

What are emerging risks?
We define emerging risks as newly developing or changing risks that are difficult to quantify and could have a major impact on society and industry.

What are emerging risk themes?
Emerging risk themes illustrate potential new or changing risk developments for the insurance industry. They are mainly derived from SONAR but also draw on other sources. All themes have been assessed and edited by Swiss Re's emerging risk management experts. This report only features new emerging risk themes (ie, topics covered in previous editions are not listed again). You can retrieve prior reports from our webpage: www.swissre.com/sonar.

What is meant by overall impact?
The overall impact of an emerging risk is an indicator of the potential financial, reputational and/or regulatory effect on the insurance industry. It is assessed on a scale from high to low:

- HIGH
  Potentially high financial, reputational and/or regulatory impact or significant stakeholder concern
- MEDIUM
  Potentially medium financial, reputational and/or regulatory impact or moderate stakeholder concern
- LOW
  Potentially low financial, reputational and/or regulatory impact,or low stakeholder concern

What is meant by time frame?
We divide themes into those likely to occur in less than three years and those likely to occur over a longer time horizon. This assessment should not be used as an indicator of when action is needed, as some themes likely to occur in the more distant future may, nonetheless, require immediate action to prepare.

What is meant by impact per business area?
Spider graph indicating the potential impact on major insurance industry business areas on a scale from 0 (= no impact) to 4 (= significant impact).

What are trend spotlights?
Boxes throughout the text provide selective spotlights on emerging trends which could become relevant for the insurance industry and its clients. The selection of topics is non-exhaustive, and descriptions are intended as food for thought and discussion starters rather than comprehensive reviews.

What are macro trends?
Swiss Re has identified a set of macro trends assumed to have a high impact on the insurance industry within the next five to ten years. The macro trends featured in this report have been selected independently through expert discussions and surveys. They provide context to the emerging risk insights from the SONAR process.

Glossary

AI	Artificial Intelligence
D&O	Directors and Officers
ESG	Environmental, Social and Governance
EU	European Union
FI	Financial Institution
GHG	Greenhouse Gas
GMO	Genetically Modified Organism
HGM	High Growth Market
IMO	International Maritime Organization
L&H	Life and Health
ML	Machine Learning
MMR	Mumps, Measles, and Rubella
MRV	Measurement, Reporting and Verification
NASA	National Aeronautics and Space Administration
NFTs	Non-Fungible Tokens
OECD	Organisation for Economic Co-operation and Development
PET	Polyethylene Terephthalate
QC	Quantum Computing
R&D	Research and Development
SARS	Severe Acute Respiratory Syndrome
SONAR	Systematic Observation of Notions Associated with Risk
WHO	World Health Organisation

Title
Swiss Re SONAR – New emerging risk insights
June 2022

Authors
Maren Bodenschatz, Rainer Egloff, Clément Guitton, Richard Heard, Ivana Hricova, Michel Messner, Bernd Wilke

Acknowledgments
We would like to thank all Swiss Re employees who provided input and feedback to the content of this report, and build bridges to their respective business areas.

Editing and realization
Maren Bodenschatz, Rainer Egloff, Katharina Fehr Hänggi, John Miller, Paul Ronke, Martin Weymann

Graphic design and layout
Media Services

Photographs
Getty images, iStockphoto

Visit www.swissre.com to download or to order additional copies of Swiss Re publications.

06/22,1507295_0622_EN

Swiss Reinsurance Company Ltd
Mythenquai 50/60
P.O. Box
8022 Zurich
Switzerland

Telephone +41 43 285 2121
Fax +41 43 282 2999
www.swissre.com