



Swiss Re SONAR  
New emerging risk insights

May 2018





Combining the experience from the past and anticipating the future is important if we want to navigate an ever-changing risk landscape.

Sharing our knowledge can help create a pro-active and pre-emptive risk management culture.



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# Overview


## Emerging risk themes by potential impact and timeframe

### 0–3 years

  A brave new world? – Emerging geopolitical risk

 A slow poison – the erosion of risk diversification

  Towering infernos – combustible cladding

 You pollute it, you own it – environmental liability and insurance

 The dangers of shiny objects – tech hypes, fails and fraud

 Funny money? – Do we need to worry about cryptocurrencies?

  Who’s on watch – colliding ships



  Faking it – the business of counterfeit medicine



### > 3 years



  Asbestos reloaded – USD 100 billion in losses and counting


 Coming back to bite us – lurking cyber risks

  Algorithms are only human too – opaque, biased, misled

  Eyes wide shut – the world is sleeping less

  Paradise lost – the price of ecosystem services

  Dumbed down – is digitisation undermining human skills?

 Fed up? – Uncertain future of monetary policy regimes

  The plastic in our veins – health risks from tiny particles

 Your printed heart – longer lives for artificial organs?

 Inked in – the risk of tattoos

#### Most affected business areas

-  Property
-  Life & Health
-  Operations (incl. legal and regulatory)
-  Casualty
-  Financial markets

#### Potential impact

-  High
-  Medium
-  Low

## Foreword

Sleep deprivation, printed hearts, biased algorithms or lurking cyber risks are just some of the risks arising from new technologies. For the re/insurance industry technological innovation usually provides both opportunities and challenges. In this new edition of Swiss Re SONAR report, you will find the latest updates on emerging risks as well as longer-term trends shaping the risk landscape.

As new risks emerge, those already well known might lose their significance. Some might also re-emerge in different guises in different areas. This year's Swiss Re SONAR report discusses topics such as asbestos – an in principle well-known risk, which we still may underestimate in some of the emerging markets.

To find out more, we encourage you to read this latest edition of the Swiss Re SONAR report – our analysis of the risk landscape and the different risks that might lie just beyond the horizon. Published since 2013, this is the first time the SONAR report is published under the Swiss Re Institute brand. This fact underlines Swiss Re's commitment to risk research and knowledge sharing with the re/insurance industry, other stakeholders and the wider public.

The SONAR report is not about forecasting the future, but rather about preparing for its potentialities. Sharing knowledge through proactive risk dialogue across stakeholders can help the re/insurance industry create a pro-active and pre-emptive risk management culture that enables disciplined risk-taking. Ignoring emerging risks is not an option. We've launched this report in this spirit and look forward to discussing further with you.

Patrick Raaflaub  
**Group Chief Risk Officer**

Tired people make more mistakes.  
And lack of sleep is also associated  
with heightened risks of heart attacks,  
strokes, obesity and other diseases.





# Introduction

## Navigating an ever-changing risk landscape

Today's dynamic risk landscape confronts the re/insurance industry with new challenges and opportunities both at an ever faster pace and in increasingly unexpected ways. Changes in our environment modify known risks, create new ones and open opportunities for the insurance industry to reduce, mitigate or transfer risk. Swiss Re fosters an open risk dialogue with its clients and wider stakeholders. A comprehensive understanding of emerging risks, their integration into Enterprise Risk Management and transformation into attractive solutions are important.






This report features 18 new emerging risk themes and 7 emerging trend spotlights. They are meant to trigger an informed dialogue of what might lie ahead for the insurance industry and society. We define emerging risks as newly developing or changing risks. The latter are difficult to quantify and their potential business impact cannot yet be fully estimated with any certainty. Nevertheless, they may have a major business impact on the insurance industry.

To assess and underwrite risks, the insurance industry relies on experience, that is on historical data for identified and insurable risks. But the industry has also to deal with a future risk landscape that is changing constantly and where reliance on historical data is not sufficient. Foresight and sound future intelligence are therefore key to reduce surprises and bolster the industry's resilience. Sharing knowledge through different forms of risk dialogue among stakeholders can help the insurance industry address emerging risks more effectively. To this extent Swiss Re has been providing a forward-looking perspective by publishing its SONAR report annually since 2013.

Swiss Re identifies emerging risks, first and foremost, through its proprietary SONAR tool, an internal crowdsourcing platform that allows for collecting input and feedback from underwriters, client managers, risk experts and others across the company. The emerging risk themes outlined in this report are based on early signals collected throughout the year. They neither reflect the entire emerging risk landscape of the insurance industry nor that of Swiss Re. They have been categorised according to their estimated impact and potential timeframe to materialise as well as to the line of business (see figure page 2) where the biggest exposure seems to rest.

The report opens by providing our overview of macro trends at work in the re/insurance markets and in societies at large. These macro trends and their grouping into societal, political, technological & natural and competitive & business themes serve as a backdrop and ordering structure for the emerging risk insights. The emerging risk themes have been complemented by emerging trend spotlights highlighting current developments which we deem relevant.

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

-  for **Property:** Towering infernos – combustible cladding
-  for **Casualty:** Asbestos reloaded – USD 100 billion in losses and counting
-  for **Life & Health:** Eyes wide shut – the world is sleeping less
-  for **Financial Markets:** A brave new world? – Emerging geopolitical risk
-  for **Operations:** A slow poison – the erosion of risk diversification

Some of the emerging risk themes and trends presented in this and previous reports may never materialise. But others definitely will. The earlier the re/insurance industry starts adapting to new risks, the better prepared it will be to successfully protect its bottom line, develop new products and write profitable business.

So the risks and underlying trends highlighted in this report also give rise to new opportunities. Given the breadth of the risk landscape, possibilities for solutions are vast, and the insurance industry could and should expand its role of mitigating risks. By providing re/insurance with new products, our industry plays a vital role as an innovation enabler. At the same time, it brings its risk management expertise to the table to avoid losses occurring in the first place, and to increase the resilience of societies.



The technological revolution is in progress and poses many opportunities as well as important questions for the insurance industry.





# Macro trends

## Screening of interdependent macro trends

Tomorrow's risk landscape is shaped by macro trends and their increasing interdependency. To make informed decisions and create products and solutions for tomorrow's risks we need to understand the macro trends that drive these risks. At Swiss Re, we assess macro trends through discussions with experts, in-depth reviews and surveys on a yearly basis.

For 2018, we have identified 23 macro trends that have high relevance for the re/insurance industry within the next five to ten years. These trends cover societal, political, competitive and business as well as technological and natural environments. The environments and macro trends are very much interlinked and have been evolving and influencing the re/insurance landscape for several years. Moreover, they're constantly changing in terms of their implications, significance and interdependency with other trends.

In this section, we provide more detailed insights into the four environments and the identified macro trends. In addition, we highlight three overarching topics that highlight the strong interdependencies between certain macro trends.

### Societal environment

- Growing middle class in HGM
- Longevity & radical medical innovation
- Connected & collaborative society
- Mass migration & urbanisation
- The future of work & talent gaps
- Rising social inequality & unrest

### Political environment

- Public sector moving risk to private sector
- Protectionism & fragmented regulation
- Increasing nationalism
- Instability of geopolitical & economic systems
- Low yield environment & risk of inflation

### Technological & natural environment

- Climate change & resource scarcity
- Structural change of energy production, distribution & consumption
- Massive expansion of digital & cyber risk
- Data as an asset
- Technology application as efficiency play
- Disruptive digital technologies
- Autonomous transportation & robotics

### Competitive & business environment

- Re/insurance value chain disaggregation
- Rise of collateralised reinsurance
- Strategic partnerships with non-insurance companies & institutions
- Regional champions going global
- Increasing digital customer interaction



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### Societal environment

Society is being shaped by changing demographics, shifts in wealth distribution and technological advancements. These dynamics allow instant communication and the sharing of information on a global scale. For the insurance industry, these trends offer great opportunities: The growing middle class in high growth markets bodes well for increasing insurance penetration. At the same time, radical medical innovation (see page 15 “The future is genomic” and page 19 “Your printed heart”) offers new opportunities in diagnostics and therapy within the health domain. But there are also troubling signs such as rising health care costs, strained state pension funds, continuous economic migration and increasing automation of work.

How does the public react to these challenges? It has become increasingly frustrated with national governments and public policies in different areas of the world. The separatist protests in Catalonia, demonstrations calling for stricter US gun control, women’s marches for equality and social media campaigns like #metoo may be indications of increased potential for social unrest. Growing inequality undermines social cohesion and the stability of economic and political systems (see page 22 “A brave new world?”). Inequality is not just about economic disparities but also about inequalities regarding access to health and education. The upside is that digital technology has led to some improvement. For example, medical advice or online tutorials are now more widely accessible to a large part of the global population through the ubiquity of mobile interfaces.

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### Technological & natural environment

The digital revolution is progressing with both the exponential increase of data and cyber risk as one of the most difficult risk trends to manage. Technological advances are touching all areas of the economy and political landscape. The ability to compute and analyse data efficiently and effectively will give a clear competitive edge to those companies that fully harness tech capabilities. However, with advancement comes evolved and increased risk. Cyber risks will grow exponentially due to concentration risk from increased interconnectedness. Formerly independent systems, processes, data analytics and data sources are becoming inter-linked and interdependent. Single events will increasingly have a systemic impact, as they become more widespread and span multiple industries and geographies (see page 27 “Coming back to bite us”). In turn, more systemic risks in terms of inter-connected software and digital platforms open up vulnerabilities to new digital risks.

Data will allow companies to operate more accurately and provide their products in an efficient and effective manner. At the same time, to allow their data to be accessed and used, individuals may feel motivated and empowered to protect and/or monetise their data accordingly (see page 23 “Precious information”).

Climate change mitigation and potential failure of adaptation are key risks highlighted across most risk and trend reports (see page 29 “Insatiable demand for energy”). The transition to a low-carbon economy and adjusting production and consumption of energy will continue to be front and centre for investors and society as a whole, and will become a driver in the majority of business decisions.



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## Political environment

Last year, the majority of macro trends discussions were dominated by the newly installed Trump administration as well as by several political events within European Union countries, for example Brexit and elections in France and Germany, where populist parties gained strong support. Although the overall consequences have so far been less pronounced than predicted, the trend towards populism and protectionism continues to drive ideas, decisions and policies. It is also shaping uncertainty in various countries including Brazil, Italy, Mexico, Poland and Russia. Europe is heavily involved with on-going Brexit negotiations and upcoming decisions and implementation. Tough negotiations continue on trade agreements (in particular driven by the US) (see page 22 “A brave new world?”).

Inflation is at a tipping point combined with low unemployment and wage inflation in the US. Moreover, central banks are expected to tighten monetary policy in the year ahead (see page 25 “Fed up?”). In addition, there could be more tension in international cooperation generated by China’s growing economic power.

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## Competitive & business environment

The re/insurance value chain continues to transform rapidly. Efficiency gains enabled by the digital revolution, changing customer expectations and newly emerging partnerships with non-insurance companies and Insurtech start-ups are leading the changes (see page 39 “Testing phase”). Traditional roles along the re/insurance value chain are shifting, with new players offering solutions for specific points of interaction along the entire value chain. Geographically, regional champions are developing global ambitions beyond their respective home markets, and increasing their international presence. Bundling capabilities with strategic partners and using new data to provide the consumer with a convenient end-to-end insurance experience is set to be a key differentiating factor (for a risk perspective on this topic see page 43 “The dangers of shiny objects”). Players need to think about their value proposition and how to align processes and talent accordingly.

The global reinsurance market has been growing continuously since 2011, with alternative capital reaching USD 89bn in 2017 (Aon’s Reinsurance Market Outlook 2018). Alternative Capital is playing a significant role thanks to a strong rebound of CAT bonds in 2017. Collateralised reinsurance has gained most traction, highlighting the importance of alternative providers.

### Digital ecosystems

Vast amounts of electronic data, the prevalence of mobile and smart interfaces such as conversational chatbots, virtual and augmented reality technology (VR/AR) and the increasing application of artificial intelligence (AI) are accelerating the ongoing digitisation in various industries and reshaping customer expectations (see page 26 “Algorithms are only human too” and page 32 “New realities”). This blurs traditional industry boundaries, which in turn prepares the ground for digital ecosystems.

A digital ecosystem is a highly customer-centric model, where users enjoy an end-to-end experience of a wide range of services and products. These are provided by a network of diverse, multi-industry players through a single access platform. Service and product suppliers bridge openings along traditional value chains by forming ecosystems that extend beyond what end users could previously obtain from one player or a single platform. Digital ecosystems centre on fundamental everyday needs of consumers and commercial customers, such as mobility, wellbeing, travel, finance and home. In the mobility area, for example, car manufacturers, garage networks and innovative start-ups could team up to rethink mobility. Re/insurers could cooperate with the above players to provide the consumer with convenient and safe ways to get around.

Several interconnected macro trends that have been on the radar for the past years underlie the emergence of digital ecosystems. Some of these trends are critical for re/insurance. These include increasing digital customer interaction, strategic partnerships with non-insurance entities, the disaggregation of the re/insurance value chain and technological developments offering efficiency gains and disruption. The drivers for digital ecosystems are technology-enabled scalability of services through APIs (Application Programming Interfaces), users who look for maximum convenience levels, and aligned incentive systems among parties involved.

A focused ecosystem mindset, a fundamental change in partnership paradigm as well as data access and analytics capabilities are all important pillars of success to compete in a digital ecosystem economy. Players will need to co-exist with competitors and non-sector players, and adopt expanding roles. Business models will have to stand their ground against other digital ecosystems and not only traditional industry players. All of this poses challenges for established re/insurance players, but also offers the opportunity to realign priorities and processes, build up new capabilities and access new risk pools.

### Social inequality & unrest

Most of the societal, technological and political trends are highly interlinked and could lead to increased social tension. Some specific examples of trends affecting social inequality and unrest include the future of work, automation and nationalism. Increasing domestic inequality could lead to further nationalist movements and populism in certain countries (comparable to political events such as Brexit). This, in turn, may have implications in politics, leading to change in policies and frameworks that will influence economies and international relations on a wider scale.

Institutions and governments in the developed world will need to think of possible adaptations regarding future private savings shortfalls, increased public sector debt levels (see page 42 “Hamstrung?”) and healthcare costs. The same issues could also come up in emerging markets, although the Asia-Pacific region does benefit from income and consumption growth by the new upper middle class. Major Latin American and African economies have a more difficult starting point as many have experienced debt crises and broader political and economic instability in recent years. Knowledge and human capital-intensive businesses will be impacted by the rise of AI in the medium to long-term, transforming the existing workforce. This could fundamentally lead to significant increase in unemployment and be a key trigger for social unrest.



There is more pressure on governments to introduce long-term and sustainable responses in social welfare, as costs associated with rising social inequalities are predicted to be substantial for the public and private sector. However, the predictions are vague at the current stage, and this adds more complexity to manage those impacts, which cannot be readily quantified. It is uncertain whether governments will politicise these topics more strongly in the coming years, blaming globalisation and technological advancements for deteriorating domestic job prospects.

To address inequality and social issues, societies and governments may have to delegate certain responsibilities to private corporations and other institutions as part of their business and sustainable investment strategy.

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## Migration, urbanisation & climate change

Human and ecological environments are changing ever more rapidly. Digitisation, supported by urbanisation, are likely to be the most extreme and pronounced in Asia and will help to create a rising middle class. As noted by the Brookings Institute in 2017, close to 90% of new entrants into the global middle class (those earning between USD 10–100 per day) are expected to come from China and India. This growth will push China and India ahead of the US as the highest absolute population of middle class persons by the year 2030. Urbanisation and the movement of people from rural to urban areas is very much linked to this. The UN Department of Economic & Social Affairs estimates that by the year 2030, 5 billion people will live in urban settings, compared with approximately 2.5 billion today. Over 90% of this increase will occur in high-growth markets, with the overwhelming majority happening in China and India.

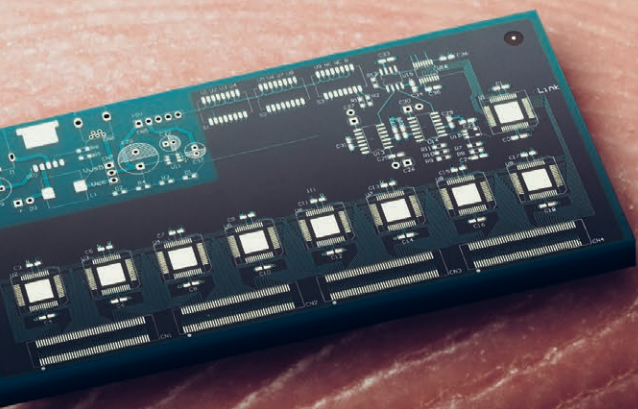
Migration trends are the major factors in urbanisation since cities offer more opportunities and an attractive social fabric. Migration will remain a broader topic for governments and organisations to navigate. This phenomenon is deeply rooted in global social inequality. Moreover, it is likely to remain a difficult issue going forward. Migration, and more specifically urbanisation, will have a negative impact on rural areas with a drain of knowledge and talent. On the other hand, opportunities, too, will be created in urban centres as these continue to grow. Studies from the World Bank show a direct relationship between urban population and per capita growth. Also, increasing returns to scale can be achieved from a supply chain perspective. Material consequences worth highlighting include further pressure on already stretched resources, transportation systems and infrastructure.

The accumulation and concentration of risk resulting from the impacts of migration and urbanisation will rise. Individual events will have exponentially higher exposure to a diverse set of risks, also due to increased interdependencies and concentration of these risks across all industries and areas of the economy. Climate change will accentuate the development and will likely have major consequences for the re/insurance landscape. We will gradually see shifts in the intensity, duration and timing of extreme weather events, and that might increase the share of natural catastrophe losses. A large proportion of urbanisation is currently happening in coastal areas. Rising sea levels, increased severity of coastal storms (and related storm surge), coupled with increased population centres and value concentrations magnify risk exposures.

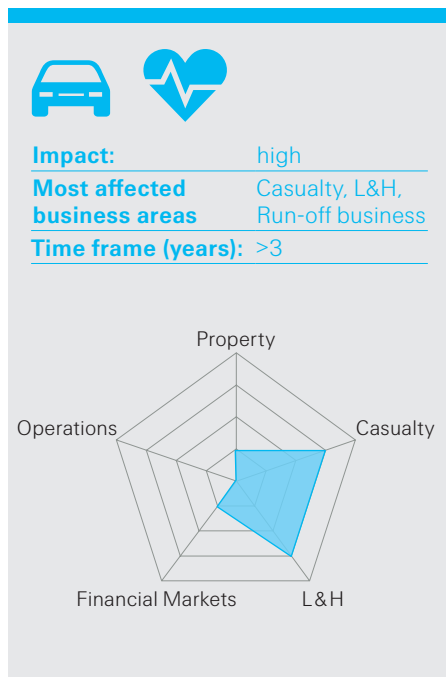
# 18 Emerging risk themes and 7 Trend spotlights







## Societal environment



### Asbestos reloaded – USD 100 billion in losses and counting

Asbestos almost proved to be the nemesis of the insurance industry. Twenty-five years ago, the deadly cancer diseases asbestos caused almost brought down Lloyds.<sup>1</sup> And the industry is still counting losses. The latest total loss estimates for the US alone are approaching USD 100 billion.

The long latency of the claims is the main reason it's so difficult to pin down exact numbers. Workers' exposure happens while mining asbestos, manufacturing asbestos products or using it in construction. But the illness only develops 40 to 50 years later. And of course, claims only come in then.

Has society since learned its lesson and banned asbestos? Many countries have bans in place. Some have partial bans of at least the most dangerous forms of the substance. But not even all European countries have banned the use of asbestos completely. And a significant number of countries have done precious little, in particular in emerging markets. Four million metric tonnes of asbestos were still being used in Russia, India, China, Indonesia, Brazil and some other countries in 2013.<sup>2</sup> In 2016, 2 million metric tonnes were mined and used mainly in Asia and Latin America.<sup>3</sup> Just three years ago, a UN report showed that "one third of the 900 million people living in Europe and Central Asia are potentially exposed to asbestos at work and in the environment."<sup>4</sup>

The latest statistics recorded 15 000 deaths annually due to asbestos over the last three years.<sup>5</sup> These numbers only take into account those who were exposed to asbestos 40 to 50 years ago. People currently inhaling the fibres are not included. The tens of thousands breathing in asbestos today could develop cancer and claim insurance coverage 40 to 50 years down the road.

One obvious way to alleviate the problem is to enforce national asbestos bans. The International Ban Asbestos Secretariat cites 62 countries that have introduced such bans. Absent from the list are the US, China and Russia. Other mitigating courses of action would be to reduce employees' exposure through the wearing of proper respirators. Enforcement of strict safety regulations when demolishing buildings with asbestos is also a must.

#### Potential impact:

- Detailed data on affected workers is still not available. Still, given the countries at risk, it is fair to assume that tens of thousands workers are exposed at the time of writing.
- We need to consider those passively exposed to asbestos fibres in the air. These fibres may stem, for example, from badly maintained buildings and structures or released accidentally during building construction work.
- Because there are safe substitute materials, the World Health Organization (WHO) and International Labour Organization (ILO) both recommend banning the material in construction.
- Wherever possible, asbestos should be excluded from re/insurance contracts.

1 <https://www.independent.co.uk/news/business/news/ten-years-after-lloyds-of-london-scandal-investors-face-new-threat-of-financial-ruin-45905.html>

2 [www.asbestos.com/mesothelioma/worldwide.php](http://www.asbestos.com/mesothelioma/worldwide.php)

3 <https://minerals.usgs.gov/minerals/pubs/commodity/asbestos/mcs-2017-asbes.pdf>; [http://www.euro.who.int/\\_data/assets/pdf\\_file/0009/341757/Asbestos\\_EN\\_WEB\\_reduced.pdf](http://www.euro.who.int/_data/assets/pdf_file/0009/341757/Asbestos_EN_WEB_reduced.pdf)

4 <https://news.un.org/en/story/2015/04/497532-one-three-europeans-potentially-exposed-asbestos-new-un-study-shows>

5 <http://oem.bmj.com/content/early/2017/09/02/oemed-2017-104298>





Emerging trend  
spotlight

**The future is  
genomic:  
Moving towards  
precision medicine**

What began in 1990 and cost around USD 3 bn has not only changed medicine but also life and health insurance: We're talking about sequencing the human genome project. Today, genomic medicine is still an emerging branch of medicine. It involves using an individual's unique genetic makeup to customise medical care.<sup>6</sup> Over time, however, genetic testing will become a cornerstone of diagnostics. For example, it will allow physicians to identify and classify tumours based on their genetic signature, in addition to their location in the body. Liquid biopsy, a minimally invasive technique that can identify molecular bio-markers in the blood and other body fluids, could ultimately benefit cancer patients and improve survival outcomes. The same might also be true for so called CRISPR technology that allows genome editing.<sup>7</sup>

As beneficial as these technologies might become for patients, they also raise important questions and create new risks and exposures for life and health insurers. Genetic Risk Scores (GRS) for example, help group individuals into low and high risk groups for common disorders such as heart disease, diabetes and most cancers. Along with traditional risk factors used in insurance underwriting, reliable GRS become an additional or alternative technique for risk stratification of insurance applicants. However, current best practice in the insurance industry does not require would-be insureds to undertake any genetic tests as part of the application procedure. If individuals do not share reliable and risk-relevant genetic information with their insurers, they increase insurers' exposure to adverse-selections.<sup>8</sup>

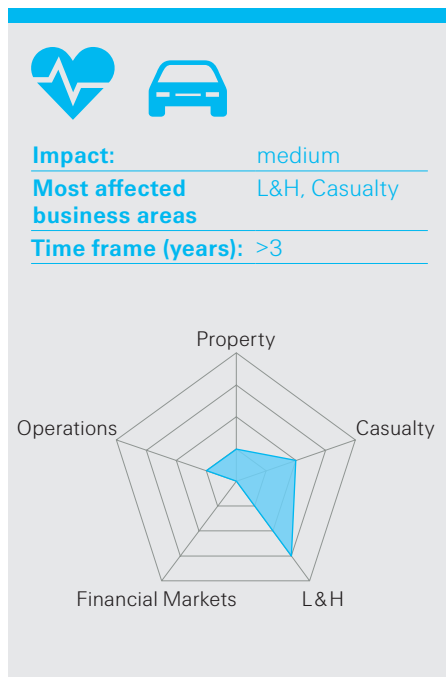
Liquid biopsy on the other hand poses a different risk: Widespread clinical acceptance and the premature use of liquid biopsy as a diagnostic screening tool enhances the risk of over-diagnosis, that is identifying a "disease" that would not have caused symptoms or premature death. From experience, life insurers know that this scenario can lead to controversial claims affecting multiple lines of business. This would apply especially to critical illness products that do not have strong definitions and/or those that pay for earlier stage cancers.

Alongside the risks and benefits that genome editing can bring healthcare, there are also potential impacts for the re/insurance industry. Side effects from CRISPR-based gene therapies could lead to liability claims for suppliers of CRISPR tools and to the pharmaceutical industry.

6 Genomic Medicine, Swiss Re Institute Risk Dialogue Series (2017) <http://institute.swissre.com/search/?dialogueSearch=Genomic+medicine>

7 CRISPR stands for Clustered Regularly Interspersed Short Palindromic Repeats, and occasionally, it has been dubbed gene scissors. The method allows for targeted intervention on genome level.

8 For a focus on life insurance impacts see Seeing the future? How genetic testing will impact life insurance, Swiss Re Centre for Global Dialogue (2016).



### Eyes wide shut – the world is sleeping less

Consider these two facts: Firstly, two out of three losses worldwide are due to human failure.<sup>9</sup> Based on Swiss Re’s *sigma* research, this would mean that people trigger a loss volume of USD 3 billion per year.<sup>10</sup> Secondly, life insurance generated premiums of USD 2.6 trillion in 2017.<sup>11</sup>

These two facts are linked because tired people make more errors and<sup>12</sup> insomniacs are at a greater risk of dying earlier than would otherwise be the case.<sup>13</sup> The lack of sleep is associated with increased rates of heart attacks, strokes, obesity and other diseases.<sup>14</sup> Sleeping less can also contribute to the development of Alzheimer’s.<sup>15</sup> And recent research found that chronic sleep restriction increases risk seeking behaviour.<sup>16</sup>

If these trends change the loss patterns in property and casualty or mortality rates, this could have a multi-billion dollar impact on the insurance industry in the long run.

Moreover, there are indications that the risk is real. The world is indeed sleeping less.<sup>17</sup> Flexible work schedules, teleworking breadwinners holding multiple jobs or making long commutes, mean that people are spending less time sleeping and more time awake. More artificial lighting and new light qualities and technologies (LED, OLED etc.), as well as extensive use of smartphone and computer games, are adding to the problem.

#### Potential impact:

- For Life & Health, a general shift in mortality patterns could result. If incidences of strokes or heart attacks with fatal outcomes increase, more policies would need to be paid out earlier, which would change the dynamics of the whole multi-billion dollar life industry. This must be viewed in the light of other risk drivers which contribute to strokes and heart attacks, such as diet or lifestyle.
- P&C business could be affected by the fact that more mistakes can occur through human action in sensitive work environments such as oil rigs, operating theatres, professionally driven vehicles (e.g. aircraft, trains, buses) or medical professions. This, in turn, can lead to an increase in frequency or severity in the affected lines of business. Some examples: for industrial facilities this could mean more man-made losses such as explosions. In the medical context, such human failures could lead to an increase in medical malpractice claims.
- Motor liability in general could face changing loss patterns with more tired drivers at the wheel.
- Fatigue affects performance and well-being of workforce also in the re/insurance industry.

9 Human failure – assessing key drivers behind man-made losses, Swiss Re Fact sheet 2016 [http://www.swissre.com/library/factsheets-publication/human\\_failure\\_assessing\\_key\\_drivers\\_behind\\_man\\_made\\_losses.html](http://www.swissre.com/library/factsheets-publication/human_failure_assessing_key_drivers_behind_man_made_losses.html)

10 [http://www.swissre.com/media/news\\_releases/nr20171220\\_sigma\\_estimates.html](http://www.swissre.com/media/news_releases/nr20171220_sigma_estimates.html)

11 <http://www.oecd.org/daf/fin/insurance/Global-Insurance-Market-Trends-2017.pdf>

12 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2517096/>

13 <http://news.berkeley.edu/2017/10/17/whywesleep/>

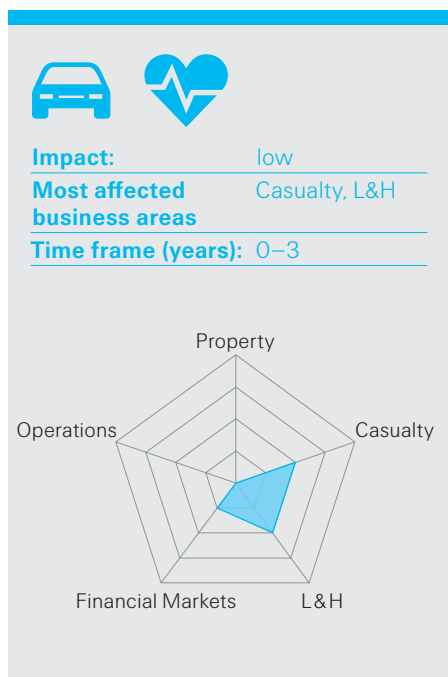
14 <https://academic.oup.com/sleep/article/33/5/585/2454478>; <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2869.2008.00732.x>; <https://academic.oup.com/eurheartj/article/32/12/1484/502022>

15 <https://www.nih.gov/news-events/nih-research-matters/sleep-deprivation-increases-alzheimers-protein>

16 Maric A, et al., Insufficient sleep: Enhanced risk-seeking relates to low local sleep intensity, *Annals of neurology* (2017), <https://www.ncbi.nlm.nih.gov/pubmed/28833531>

17 <http://advances.sciencemag.org/content/2/5/e1501705.full>





## Faking it – the business of counterfeit medicine

If you're criminally inclined, counterfeiting drugs may be something to consider. According to the World Health Organization (WHO), fake drugs are a fast growing multibillion dollar enterprise. Large profits, combined with light penalties, fuel this illicit industry. 42% of the dubious medical products come from Africa, 21% each from Europe and America as well as a significant proportion from Asia. While some are used in local markets, the USA is way out in front regarding incidents with faked drugs. Asia is only second, while Africa comes in last.<sup>18</sup>

Worldwide fake anti-malarial drugs were the most commonly reported, followed by antibiotics, painkillers and "lifestyle products" such as diet pills and erectile dysfunction treatments.<sup>19</sup>

With so many people at risk, the insurance industry can't ignore the problem. Fake drugs kill people, exacerbate proliferation of transmittable diseases, and increase resistances to antibiotics and other drugs. The WHO estimates that 100 000 to 1 million people die each year as a result.

Fake drug criminals exploit the increasingly complex global supply chain network. The internet has raised the availability of fake drugs outside the local regulatory frameworks through online pharmacies and other channels. In 2016, when the Irish authorities seized around EUR 350 000 worth of illegal drugs, the majority of them originated from countries such as the US, UK, Switzerland and Singapore.<sup>20</sup>

### Potential impact:

- L&H: Ineffective or poisonous fake drugs increase mortality and drive up health costs, affecting individual health as well as epidemiological dynamics.<sup>21</sup> These effects are probably the most pronounced in low to middle income countries, although developed markets with health insurance systems can also be affected.
- Liability, product recalls, supply chain, and reputational risk: Most companies in the supply chain will be covered by product liability, product recall and errors and omissions insurance.<sup>22</sup> Manufacturers may be held liable for harm caused by fake versions of its products. Original product manufacturers will accumulate litigation costs – some of which are covered by insurance.<sup>23</sup>

18 <http://www.psi-inc.org/geographicDistributions.cfm>

19 <http://www.who.int/medicines/regulation/ssfc/surveillance/en/>

20 <https://www.irishtimes.com/business/health-pharma/irish-authorities-seize-350-000-worth-of-illegal-medicines-1.2678309>

21 <https://www.telegraph.co.uk/news/2018/03/29/governments-urged-tackle-scourge-fake-drugs/>

22 <http://riskandinsurance.com/countering-counterfeit-drugs/>

23 Morgan, R.B and Neal, K.D. (2008) "How To Prevent and Defend Claims Resulting from Counterfeit Products" How To Prevent and Defend Claims Resulting from Counterfeit Products\_2008.pdf



Many people die while on the waiting list for transplants.







## Your printed heart – longer lives for artificial organs?

Artificially produced organs are supplementing human organ donation to an increasing extent. As organ donation is not keeping pace with the increasing demand for organs, innovation in this field is highly significant for patients, the medical system, and the insurance sector.

According to the British Heart Foundation, the number of patients waiting for a heart transplant has grown by 162% over the last ten years. Even though the growth in demand for heart transplants is impressive, more patients are waiting for kidneys and other organs.<sup>24</sup> Also the lack of transplant tissues is a prevalent problem in many parts of the world. In the USA, 20 people a day or 7 300 a year die while on the waiting list for transplants. In 2016, although 116 000 were on the waiting list, only 33 611 transplants were actually performed.<sup>25</sup> Artificial organs therefore hold out major hope.

A patient for a heart transplant has an average waiting time of 191 days.<sup>26</sup> So artificial organ technology is currently used as a stopgap before patients receive a biological organ. A company in the US provides patients with fully functioning artificial hearts. Such devices, called “total artificial hearts” (TAH), have already been implanted in over a thousand patients.<sup>27</sup> One patient was supported for nearly four years with the artificial device before receiving a successful human heart transplant.

However, artificial organs do not currently have a long life span. They merely serve as interim solutions – as “a bridge to a transplant.” But innovations around artificial organs or cellular therapies to restore normal function are emerging rapidly, utilising various technologies including 3D-bioprinting techniques, and stem cell-based therapies. Fully functional, long-term artificial replacements – from tissue to complex organs – are the target in so-called “destination therapy.”<sup>28</sup>

The artificial organ market is expected to grow at 9.1% compound per year to USD 45.2 billion by 2022. Given the lower risk of organ rejection and the ability to mass produce organs to meet the demand, it’s a very promising industry that could solve the current organ supply shortage.

### Potential impact:

- Major organ transplant is a listed condition under a typical Critical Illness product. However, artificial organs are a grey area. It is not clear if a valid Critical Illness claim payment would be triggered if the transplanted organ were a bio-artificial organ or if it were grown in a laboratory using human cells. As flagged by the UK Institute & Faculty of Actuaries: Would the payment still be declined because the organ did not originate from a human donor?<sup>29</sup>
- The UK Institute & Faculty of Actuaries raise the concern whether artificial organ transplants fall under the same legal definition as biological organ transplants.
- The potential impact on medical malpractice and product liability depends on the corresponding regulations.

24 Wynn, Nay: What if... artificial organs were sufficient enough to replace the need for donors: Impact on the term assurance and critical illness products. London: Institute & Faculty of Actuaries, 2017.

25 <https://www.organdonor.gov/statistics-stories/statistics.html>

26 Bentley, T. Scott and Phillips, Steven J.: 2017 U.S. organ and tissue transplant cost estimates and discussion. Milliman Research Report, 2017.

27 [https://en.wikipedia.org/wiki/Artificial\\_heart](https://en.wikipedia.org/wiki/Artificial_heart)

28 De Mol, B. Lahpor (2013) <https://www.ncbi.nlm.nih.gov/pubmed/24345368>

29 Wynn, Na, 2017





### Inked in – the risk of tattoos

Tattoos have become fashionable in many parts of the world. In Europe alone, over 60 million people have tattoos. And every fourth person in the US is estimated to have one. Tattoo prevalence in young adults may be more than twice this number and is sometimes more pronounced with women than men.<sup>30</sup>

But tattoos are chemical injections pinched into our skins by physical procedures. More than 100 colorants and 100 additives are in use. Known risks come from the application procedure, and they include viral (hepatitis and HIV), bacterial and fungal infections. Obviously, these risks increase when tattooing is applied under unhygienic conditions or with deficient materials and procedures. Insights into the long-term risk from the ink and its accumulation in the body as well as from the expected boom in tattoo removals are still not clear.

A European Commission report from 2016 on the safety of tattoos and permanent make-up states that complications such as chronic inflammatory dermatosis may not develop until decades afterwards. The report acknowledges the association of tattoo application and removal with side effects like allergies, inflammation, pigment changes and infections.<sup>31</sup> Another long-term concern is cancer, since some of the ink ingredients can release carcinogenic substances under certain conditions. Still, no evidence for a relation between cancer and tattoos has been found so far.

Tattoo inks and their composition are of particular interest. Recent studies have shown chemicals in tattoo ink could enter the blood stream and accumulate in lymph nodes as nanoparticles. This could affect the immune system’s ability to fight infections. Tattoo ink is largely unregulated. The FDA has repeatedly issued warnings regarding unsafe tattoo inks available in the US.<sup>32</sup> Tattoo inks are also believed to be in cosmetics, and as some contain metals, they could as yet pose unknown hazards for the skin.

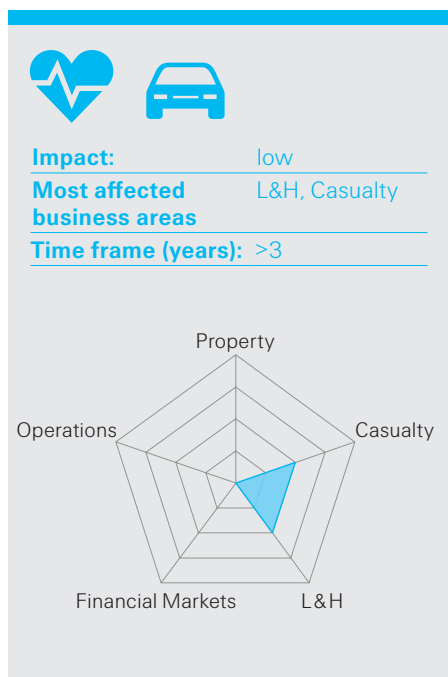
#### Potential impact:

- Impacts are most likely to Life & Health lines of business: an increase in the spread of HIV or Hepatitis C is possible, if hygienic standards are not adhered to during the tattooing.
- Health insurance is impacted since tattoo art has been steadily increasing. Moreover, physicians and dermatologists have also encountered a broad range of medical side effects from tattoo application and its removal. Thus, ailments such as skin bacterial infections, persistent inflammation, and hypersensitivity with chronic dermatosis could be examples of the unintended consequences of tattoos. This could contribute to an increase of health costs for the individual. Health insurance may also be impacted for removal of tattoos. This is because the rising number of these cases will increase pressure on insurance to cover the removal on medical or aesthetic grounds.
- To lesser extent, impacts may also come from product liability covers for tattoo paints or from professional indemnity covers of tattoo studios. As more studies highlight the potential risks associated with tattoo inks and its particles in nano-size within a human body, it may become easier to isolate adverse health effects of a potential patient to one particular ink and to the manufacturer/producer.

30 <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/safety-tattoos-and-permanent-make-final-report>

31 <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/safety-tattoos-and-permanent-make-final-report>

32 <https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm316357.htm>; <https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm048919.htm>



## The plastic in our veins – health risks from tiny particles

If it's proven that plastic particles can impact your health, will manufacturers of plastic be exposed to increasing product liability claims? This is just one of the possible concerns for the insurance industry in the context of plastic risk. Signs of health risks from plastic particles are growing.

In 2015 according to the EU,<sup>33</sup> we produced 322 million tons of plastic – that's 42 kg for each of us living on this planet. In the EU, it was 26 kg per person, of which only 9 kg were recycled. Where does the rest end up? Some of it is dumped in landfills and some is incinerated. The rest makes its way into the environment. One example is the large plastic garbage patch in the Pacific.<sup>34</sup>

The ocean isn't its final resting place however. Radiation and waves slowly wear down the plastic and the mixed-in additives to micro- and nano-size particles. These can be ingested by marine wildlife. Some of the plastic may cause health problems for animals. Nano-plastic in brains of fish have shown behavioural changes in experiments.<sup>35</sup>

The question, of course, is what happens if some of the plastic makes its way up the food chain to us? The marine food chain is not the only path, the terrestrial chain is also possible, as studies in the US have shown. Indeed, average Americans carry around a multitude of plastic residuals in their bloodstream such as flame retardants that they were exposed to from other sources.<sup>36</sup>

Research on this topic is still ongoing but indications are that some long-term negative health effects are indeed in the making. Some of these indicators are based on observations of animals. But what if nano-plastic cannot only cross the blood brain barrier in fish, but also in humans?

Ultimately, even a ban of plastics is conceivable. A well-studied case is bisphenol-A: This popular softener can interfere with the hormone system – especially in infants. Baby bottles with a bisphenol-A coating were removed from the market once this research was published.<sup>37</sup>

### Potential impact:

- If negative impacts on human health are proven, producers of plastic could potentially be involved in product liability claims. However, a product liability claim is only successful and compensation for bodily injury only granted provided the causal link between the product produced by the insured and the loss can be established. Given that there are various producers of plastics, proving the causal link might be difficult.
- Claims may also be filed from fisheries and other food producers if plastic particles exceed certain limits, and foods are no longer deemed safe for human consumption.
- In countries where ecological damage is defined by law, claims could be filed if an ecosystem is damaged.
- On the life and health side, health recovery costs may trend upwards in treatments for humans, and not always be adequately reflected in pricing.

33 [http://ec.europa.eu/environment/waste/pdf/plastic\\_waste\\_factsheet.pdf](http://ec.europa.eu/environment/waste/pdf/plastic_waste_factsheet.pdf)

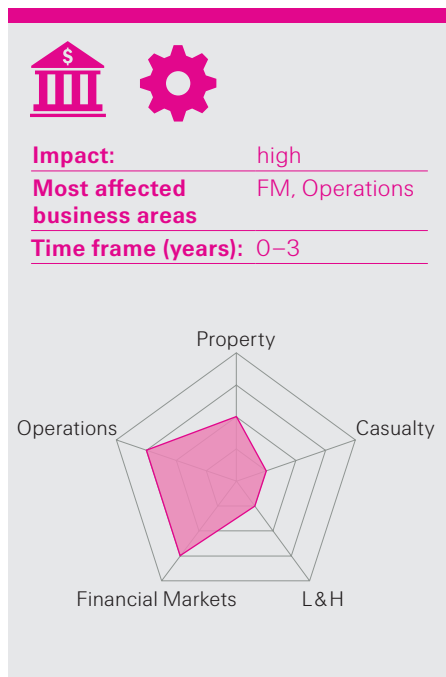
34 <https://www.nature.com/articles/s41598-018-22939-w>

35 <https://www.sciencedaily.com/releases/2017/09/170925104730.htm>

36 [https://link.springer.com/content/pdf/10.1007/978-3-319-16510-3\\_13.pdf](https://link.springer.com/content/pdf/10.1007/978-3-319-16510-3_13.pdf)

37 <https://www.nytimes.com/2012/07/18/science/fda-bans-bpa-from-baby-bottles-and-sippy-cups.html>

## Political environment



### A brave new world? – Emerging geopolitical risk

A new paradigm is evolving in the geopolitical landscape as power drifts to Asia, democratic influences decline and the relevance of global governance institutions erodes. This coincides with new forms of diplomacy and business attitudes. If you add the emergence of populism as a political force to this mix, the geopolitical risk landscape has become far more unpredictable and difficult to navigate.

After World War II, the global key powers were the US and the Soviet Union. Accompanied by its Western allies, the US exerted dominance over its bilateral relationships and various multilateral institutions (including IMF/World Bank, GATT/WTO, or NATO). Today, the international system has become multi-polar with the emergence of new power centres in populous nations including China and India and the resurgence of a more active Russia. Latin America, Africa and Europe are challenged to find their role.

These new powers are either vying for influence in hitherto Western-dominated multilateral institutions, or creating new institutions to enable them to act on more equal terms (the Asian Infrastructure Investment Bank would be a case in point). China's One Belt One Road Initiative indicate even greater ambitions.

The willingness of the US to shape and enforce global rules by projecting its economic and military power abroad is either in decline or shifting towards unilateralism. The latter trends are exemplified in military, trade and regulation, particularly under the impact of domestic developments. The fact the US media is referring to the so-called "culture war" between segments of the country's population highlights this shift.

If today's global institutions are bypassed when conflicts and tensions arise, they will lose their global influence as mitigating forces. In an extreme case, tensions could spiral out of control. Military conflict, even between major powers, may become inevitable. New forms of conflict, such as periodic and escalating cyber-attacks, are already becoming a regular occurrence.

In addition, ambitions and rivalry between major powers are blurring the lines between diplomacy, covert intelligence action, and open aggression. Such operations, sometimes dubbed "hybrid wars," feature aggressive propaganda, espionage, cyber-attacks and other actions. This triggers uncertainty for businesses and disables efforts to handle challenges which require international cooperation, such as combating climate change.

#### Potential impact:

- Heightened geopolitical tensions between the major powers: these could lead to conflict and, in an extreme case, trigger a major war.
- Even if not directly invested in the conflict locations, insurance will be impacted through turmoil in financial markets and in operational spheres.
- Global multilateral institutions become less and less relevant: established sets of legal rules, norms, and practices may no longer be applicable. The uncertainty fundamentally hurts the ability to run a global business.





Emerging trend  
spotlight

**Precious information:  
Market conduct and  
ethics in the age of  
big data**

Big Data and digitisation create both benefits and challenges for re/insurers. Companies are embracing new technologies to profit from the opportunities that digitisation and smart analytics techniques generate. However, the concept of “treating your customer fairly” remains at the forefront of regulators’ agendas. Moreover, using personally identifiable data in a transparent and legitimate way, while at the same time exploring new innovative ways of using data, has become a serious ethical concern for society as a whole.

The European Union enacted the General Data Protection Regulation (GDPR) in May 2018. It sets high data protection standards for all companies offering goods and services in the EU market, including those who are established outside the EU. GDPR is considered a “follower law” which means that it is expected that other countries follow the principles described by the regulation. Japan has already adopted many of the GDPR principles into their revised data protection laws; others are expected to follow.

The GDPR is strengthening individuals’ rights in an environment where digitisation and the new possibilities opened up by technology seemed to have reduced the control an individual holds over her or his own data. This at a time when data is seen as the most valuable currency and an individual’s identity is increasingly determined by their digital footprints. For re/insurers, GDPR means a strong focus on accepting accountability for dealing with personal data. It also means being more transparent about this kind of information and understanding whether automated decision-making, applying machine learning, or predictive risk profiling and selection could have a negative impact on the individual persons involved.

Legitimate and fair data use can also be perceived as a competitive advantage, especially in an environment characterised by increasing concerns over data privacy both from the customer side and from the wider public. Clear ethical guidance and customer communication to explain and justify internal processes can build trust between insured and insurer, and also with regulators. Strict adherence to laws and regulations, both for data- and consumer protection, and greater transparency concerning the benefits of big data and smart analytics for the individual will resonate with customers. It can thus be a differentiating factor in the stiffening competition between traditional insurance and new InsurTech start-ups.

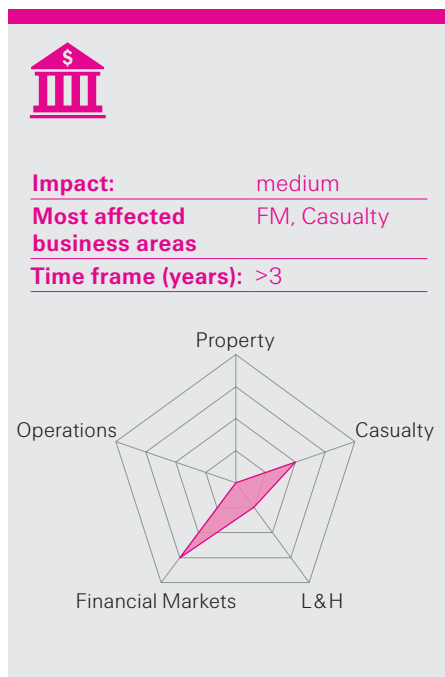




How will financial markets  
react to changes in monetary  
policies?







## Fed up? – Uncertain future of monetary policy regimes

Ten years have elapsed since the global financial crisis and the discussion about the lessons learned is still on-going. How can the next crisis be averted? And how do we respond if it does occur?

The role of monetary policy is at the centre of the current debate, particularly given the continuing failure of central banks to reach their inflation targets despite the widespread use of unconventional tools. The debate over monetary policy regimes has intensified in the last couple of years – the Peterson Institute’s conference on “Rethinking Macroeconomic Policy” in October 2017<sup>38</sup> is a recent case in point. The discussion is not only about central banks’ tools – such as interest rates, asset purchases, forward guidance, or yield curve control – but more broadly about the fundamental objectives of monetary policy. Some of the ideas currently being discussed include: (i) a change in the price level target (e.g. an increase to 4% instead of the commonly accepted 2%); (ii) introducing an inflation target band; (iii) price-level or nominal GDP targeting;<sup>39</sup> and (iv) an increased focus on financial stability.<sup>40</sup>

While none of these changes appear imminent, it’s worth remembering that central banks have operated under different frameworks throughout history, including regimes targeting money supply, exchange rates, and inflation. So it is useful to start thinking about the potential consequences of a regime change, even if this may still be quite a distant prospect.

We need to assess any changes to monetary policy targets and tools in the broader context in which they are adopted. For example, the use of a new tool in a crisis situation may have an immediate positive impact on financial stability, but may come with longer-term risks. The experience since the global financial crisis highlights just how difficult it is to measure the effectiveness of new policy tools and targets. It also demonstrates that introducing a regime change bears significant risks, with no clear-cut implications. How will financial markets react to any future changes? Would a change in the inflation target, for example, open the door to further modifications in the future, possibly also for political reasons? What if the new framework exhibits unforeseen weaknesses? Could this undermine the credibility and effectiveness of central banks?

### Potential impact:

- The economy and financial markets, including the re/insurance industry, could benefit if the framework change brings a positive long-term impact on financial stability.
- At the same time, the announcement could create uncertainty and lead to a rise in risk aversion with negative financial market and potentially economic consequences.
- An unexpected and sustained increase in inflation – a potential consequence of a regime change – would be harmful for the re/insurance industry, in particular for inflation-sensitive liability lines of business.
- By contrast, life insurers would benefit from a potential increase in interest rates as their liabilities typically have a longer duration than their assets.
- The change could open the door to further, possibly also politically motivated, adjustments in the future and ultimately threaten central bank credibility and independence.

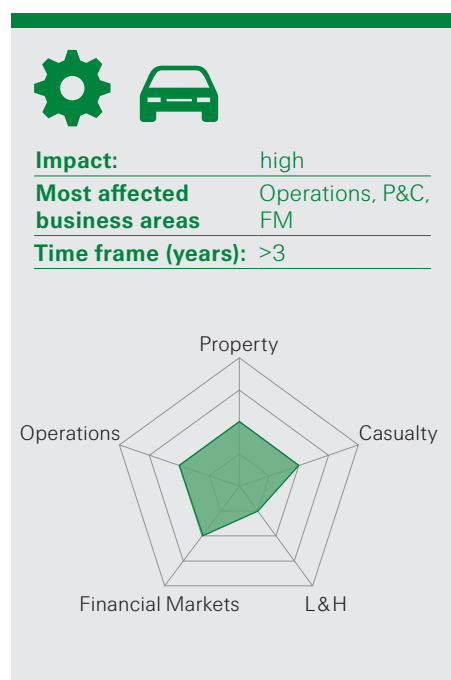
38 Key contributions included Olivier Blanchard, Lawrence Summers: Rethinking Stabilization Policy. Back to the Future, and Ben Bernanke: Monetary Policy in a New Era.

39 That is aiming to reach an inflation/nominal GDP growth goal on average over a longer period of time, instead of targeting the annual inflation/GDP growth rate. This would allow an overshoot of inflation/nominal GDP growth to offset an undershoot.

40 Note that the Riksbank adopted a variation band of 1–3% for the outcomes of inflation around the 2% target in September 2017.



## Technological & natural environment



### Algorithms are only human too – opaque, biased, misled

Are computers providing better decisions? Increasing numbers of business processes are driven by algorithms. We are seeing algorithms take over advanced service functions at an ever faster pace. This development is eminently relevant for the insurance industry, since it has a dramatic effect on several risk environments namely, financial systems, the analysis of risk pools and the pricing, underwriting and marketing of risk transfer.

Often, algorithms are portrayed as being objective, without human bias. But algorithmic applications are not infallible. The fact that “intelligent” algorithms base their actions on what they’ve learned from flawed human judgement may lead to discriminatory effects.<sup>41</sup> Discriminatory bias may also translate into defective modelling and prediction, bringing a two-fold risk to insurance and other industries.

The risk can be increased by non-transparent or black-boxed algorithmic services. For example, doctors are still responsible for errors that may occur from their diagnoses and procedures, even though they may not be able to assess the reliability of the AI-device they are using. The problem of black-boxing may also affect parts of insurance underwriting supported by intelligent digital tools. This also challenges auditability. The black box problem of algorithms has invited a new research area dedicated to reconstruct the backgrounds of algorithmic findings.<sup>42</sup>

Regulatory authorities are increasingly focusing on the “algorithmic economy”. There is also a growing ethical debate around this topic.<sup>43</sup> Up to now, there has been a lack of clear governance around development and application of algorithms. That said, antitrust laws have prompted the filing of charges relating to the non-transparent pricing tools applied by airlines.<sup>44</sup>

In October 2017 in the context of new EU data protection regulation, the EU stressed that profiling and automated decision making are prohibited unless certain conditions are met. This regulatory risk could have drastic impact in the fields of telematics, as well as in predictive or automated underwriting.

### Potential impact:

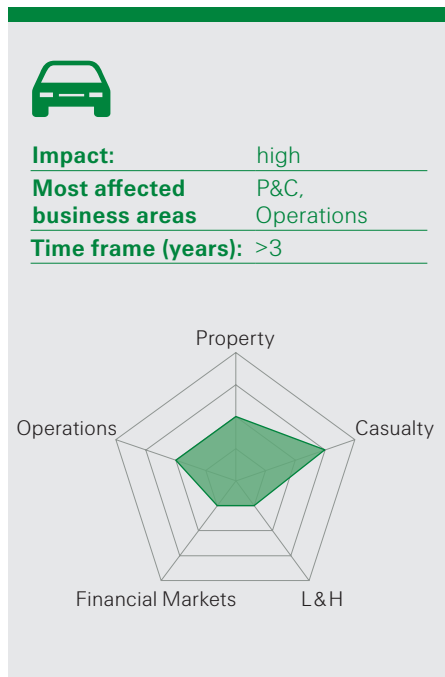
- Significant impacts on investments in financial markets are likely if automated high-frequency trading can be abused.
- As far as the insurance industry is concerned, algorithmic risk pooling, assessment and pricing have to be carefully analysed, as overreliance on models may prove costly. In underwriting, reliance on black-boxed underwriting tools may reinforce certain biases.
- Demands for specific skills such as data scientists will increase and may lead to shortage in the market.
- Insurance and/or its clients may be affected by property losses or liabilities, triggering respective covers.
- Feedback loops can amplify false inputs, potentially leading to losses.
- Regulation is paying increased attention to algorithmic business procedures, and pricing tools can come under scrutiny. Initial emergence of requirements relating to ensuring algorithms are “compliant by design” (e.g. data protection legislation, antitrust laws).

41 <https://blogs.wsj.com/digits/2015/07/01/google-mistakenly-tags-black-people-as-gorillas-showing-limits-of-algorithms/>; <https://www.wired.com/2009/12/hp-notebooks-racist/>

42 <https://www.technologyreview.com/s/609338/new-research-aims-to-solve-the-problem-of-ai-bias-in-black-box-algorithms/>

43 <http://journals.sagepub.com/doi/full/10.1177/2053951716679679>

44 <http://www.spiegel.de/wirtschaft/unternehmen/lufthansa-kartellamt-kritisiert-begruendung-fuer-teure-tickets-a-1185247.html>



## Coming back to bite us – lurking cyber risks

New computer systems and software may have teething troubles, which get fixed after a short while. But some flaws and vulnerabilities in hardware (chips) and software may remain undetected for longer. This dormant threat may be in the form of old bugs in “ancient” devices. Studies on medical technology found literally thousands of these vulnerabilities in such essential devices as pacemakers.<sup>45</sup> The more digital systems are integrated and connected, the larger accumulated losses can become.

Remember the “millennium bug”? It referred to the problem expected to happen to older computers unable to deal with the shift of time digits from 1999 to 2000. To avoid the expected failure when entering the new millennium, software was fixed or replaced before that date.<sup>46</sup> In retrospect, many considered the millennium bug merely a phantom risk that was overrated, since little of the perceived risk actually materialised in the end.

That said, the fact remains that assessment and mitigation of digital risks are a clear and present challenge. An example: Going into 2017, a company providing web-services and internet security to millions, Cloudflare, was caught out by the leap second added to the end of 2016 to synchronise terrestrial time with the earth’s rotation. The problem was resolved within 90 minutes, and reportedly only affected a limited number of users. Nevertheless, the reputational damage it caused was not inconsiderable and was due to an underestimated or overlooked glitch in the programming.<sup>47</sup> The take-away is a strong likelihood of undetected and unmitigated cyber risks, which may culminate in large losses. They may arise directly from soft- and hardware failure. Or they could spring from pre-existing vulnerabilities sought by hackers as an entry point to “weaponise” the targeted systems and trigger mayhem, or abuse them to enrich themselves.

The worldwide WannaCry ransomware attack in May 2017 revealed that many organisations were using old Windows operating systems which were no longer serviced from the vendor (end-of-life), or did not have the available security updates installed. This kind of negligence allowed the ransomware to spread more easily. The attack was estimated to have affected more than 200 000 computers across 150 countries, with total damages ranging from hundreds of millions to billions of US dollars.<sup>48</sup>

Meltdown and Spectre, hardware vulnerabilities affecting older, but very widespread chips such as Intel and IBM, recently taught further unpleasant lessons. Stemming from programmed life-cycle expectations for the systems, these weaknesses allowed a rogue process to read into the memories and processed data of affected computers.<sup>49</sup>

### Potential impact:

- Hardware flaws can have a very long tail risk, allowing for system failure and inviting hacker attacks. This is particularly relevant for large and complex industrial processes and critical infrastructures.
- Some “old” cyber risks may be underrated and mispriced.
- Vulnerability in medical technology may translate into mortality impact.
- In addition to the underwriting risk, (hardware) legacies may pose operational risk to insurance companies.

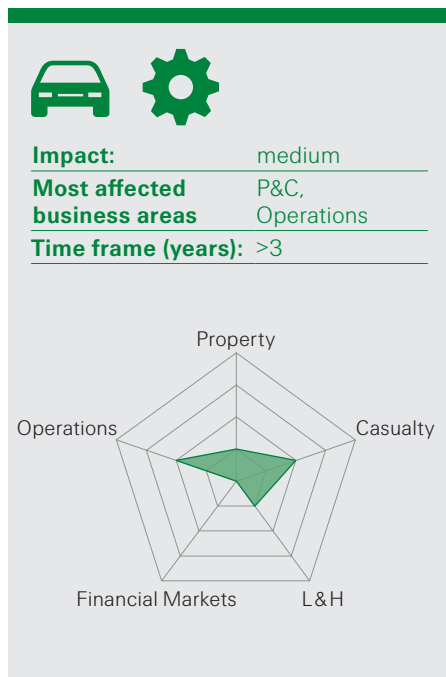
45 <http://www.bbc.com/news/technology-40042584>

46 <https://www.britannica.com/technology/Y2K-bug>; <http://www.bbc.com/news/magazine-30576670>

47 <http://www.bbc.com/news/technology-38488246>; <https://blog.cloudflare.com/how-and-why-the-leap-second-affected-cloudflare-dns/>

48 [https://en.wikipedia.org/wiki/WannaCry\\_ransomware\\_attack](https://en.wikipedia.org/wiki/WannaCry_ransomware_attack)

49 [https://en.wikipedia.org/wiki/Meltdown\\_\(security\\_vulnerability\)](https://en.wikipedia.org/wiki/Meltdown_(security_vulnerability)); <https://www.cnbc.com/2018/01/03/microsoft-google-respond-to-intel-chip-vulnerability.html>



### Dumbed down – is digitisation undermining human skills?

Ever been impressed by a child using the latest tablet as if this were an instinctive skill? Maybe you have watched a child trying to swipe a finger across the page of a printed book only to learn it needs a different movement to turn the page. The more we digitise the more our analogue skills atrophy.

Digital assistance systems makes us complacent, obedient and less skilled. Car navigation systems are just one case in point. We see strange accidents where cars drive off a cliff or into a lake seemingly for no reason.<sup>50</sup> Scientific research has shown negative effects of reliance on digital systems for human long-term memory.<sup>51</sup> There are also reports of addiction to digital tools and contents, with detrimental effects on psychological well-being.<sup>52</sup>

While our trust in assistance systems remains unbroken, and their usage increases, humans are still held accountable and are expected to be able “take over the wheel” any time. Take autonomous driving, which is already in operation in some cars on the roads. While the law treats drivers mainly as it used to, actual driving practice and alertness are decreasing. The consequent widening skills gap not only impacts insurance risk, but also operational risks. What happens, for example, if underwriting or risk management rely on tools that are no longer supervised, controlled and – ultimately – understood by human experts? Unintended consequences can be reinforced if intelligent machines receive feedback from humans who understand less and less about the underlying problems.<sup>53</sup>

This “mushy middle of automation” makes us feel safer than we actually are.<sup>54</sup> Once we have fully autonomous systems many traditional human skills may become completely obsolete.

#### Potential impact:

- Overreliance on digital assistance can increase the number of accidents, e.g. in motor.
- For autonomous driving, the regulators may increase hurdles for fully autonomous driving. Who wants to drive an autonomous car, if you need to be alert and able to drive? This problem may affect the development of non-human driving systems/assistance and motor insurance.
- As humans gradually cede control to digital systems, the emerging risk becomes systemic.
- Shifts regarding liability lines (e.g. from motor to software liability for autonomous machines) with adequate governance of algorithms need to be considered.
- Catastrophic event losses may significantly increase should assistance systems fail and human skills are not available for work arounds.
- Trade-offs between digitisation and human skills entail significant operational risk to any re/insurance company embarking on digitisation.
- Digital addiction may be a cause for liability claims against tool manufacturers and digital content providers.<sup>55</sup>

50 <https://www.yahoo.com/news/family-4-killed-violent-car-142826702.html>

51 <http://www.bbc.com/news/education-34454264>

52 Cooper, Anderson. “What Is ‘Brain Hacking’? Tech Insiders on Why You Should Care.” CBS News, 9 April 2017. [www.cbsnews.com/news/brain-hacking-tech-insiders-60-minutes/](http://www.cbsnews.com/news/brain-hacking-tech-insiders-60-minutes/) see also the risk theme on algorithms

54 <https://www.wsj.com/amp/articles/tesla-uber-deaths-raise-questions-about-the-perils-of-partly-autonomous-driving-1522661400>

55 <https://www.theguardian.com/technology/2017/oct/05/smartphone-addiction-silicon-valley-dystopia>; <https://www.theguardian.com/technology/2018/mar/15/meet-the-tech-evangelist-who-now-fears-for-our-mental-health>; <https://www.theguardian.com/technology/2018/mar/18/dangers-of-digital-dependency>; <https://www.theguardian.com/technology/2017/aug/13/are-smartphones-really-making-our-children-sad>; <https://www.theguardian.com/books/2017/feb/26/irresistible-why-cant-stop-checking-scrolling-clicking-adam-alter-review-internet-addiction>; <https://www.theguardian.com/commentisfree/2014/jan/09/5-ways-internet-use-web-addiction>; <http://www.rmmagazine.com/2013/06/14/digital-dependence/>





Emerging trend  
spotlight  
**Insatiable demand  
for energy:  
Infrastructure in  
transition**

Meeting the energy needs of an expanding world population, while cutting back on global CO<sub>2</sub> emissions remains an important challenge. The International Energy Agency forecasts we'll need to add the energy production capacity of India and China in order to satisfy demand for energy in 2040.<sup>56</sup>

To meet this demand while managing climate change, we need a transition to a low- or no-carbon energy infrastructure. The drive towards this goal is gathering pace. Governmental actions in China and the increasing investments in clean energy underpin this trend. The bulk of the USD 60 trillion energy investments up to 2040 will flow into renewables.<sup>57</sup>

This influx of money continues to broaden the scale and complexity of our energy infrastructure. So do the associated risks. Volatility induced by wind turbines and other renewables is a serious issue for power grids. In Germany, the network operator Transnet had to spend EUR 1 billion in 2017 to protect power grid stability.<sup>58</sup> This highlights the fact that the resilience of energy systems depend on the intertwined risks of infrastructures (including smart grids), climate and weather conditions.<sup>59</sup> Added to this are cyber vulnerabilities<sup>60</sup> and water scarcity at the food-water-energy nexus.<sup>61</sup> In times of drought, the latter factor has to do with choosing between the use of water for irrigation, for drinking or for power.

To address all these drivers, smart grids, alternative decentralised energy generation, e-mobility, energy storage and highly efficient green buildings will be ingredients of our new energy infrastructure. Crucial factors to manage are:

- Performance: buildings and infrastructure will have to perform as expected, i.e. deliver the required energy savings, while maintaining reliability and the required quality of living.
- Standards: new standards will be required to assess these factors and make comparisons and benchmarks possible. These will develop and become more demanding over the years.
- Skill sets: new technologies will require a specialised workforce to design and install them correctly. There is currently a shortage of engineers and skilled workers in these fields.

The fast roll-out of a new infrastructure with new players and interfaces are accompanied by uncertainties and risks. An example was last year's statewide blackout in Australia caused by a safety mechanism in some wind farms.<sup>62</sup>

This is where insurance comes into play. Risk management and mitigation are our core strength. To ensure the underwriting of energy exposure risk remains a worthwhile undertaking, the industry must stay on top of developments and adapt its pricing models, insurance conditions and policies accordingly. New risks like the lack of wind for windfarms, water scarcity for hydro power or the absence of sunny days for solar energy also need cover. Assured revenue streams are also important to unlock investments by private investors necessary for renewable power.<sup>63</sup>

<sup>56</sup> <https://www.iea.org/weo2017/>

<sup>57</sup> [https://www.iea.org/publications/freepublications/publication/WEO\\_2017\\_Executive\\_Summary\\_English\\_version.pdf](https://www.iea.org/publications/freepublications/publication/WEO_2017_Executive_Summary_English_version.pdf)

<sup>58</sup> <http://www.dw.com/de/stromnetzbetreiber-tennet-meldet-rekordkosten-f%C3%BCr-noteingriffe/a-41989177>

<sup>59</sup> [http://institute.swissre.com/research/collaborations/in\\_focus/Risks\\_affecting\\_the\\_energy\\_industry.html#tab\\_3](http://institute.swissre.com/research/collaborations/in_focus/Risks_affecting_the_energy_industry.html#tab_3); [http://media.cgd.swissre.com/documents/20150921\\_World\\_Energy\\_Perspective\\_extreme\\_weather.pdf](http://media.cgd.swissre.com/documents/20150921_World_Energy_Perspective_extreme_weather.pdf)

<sup>60</sup> [http://www.swissre.com/library/archive/world\\_energy\\_perspective\\_the\\_road\\_to\\_resilience\\_financing\\_resilient\\_energy\\_infrastructure.html](http://www.swissre.com/library/archive/world_energy_perspective_the_road_to_resilience_financing_resilient_energy_infrastructure.html)

<sup>61</sup> [http://www.swissre.com/library/World\\_Energy\\_Perspectives\\_2016.html](http://www.swissre.com/library/World_Energy_Perspectives_2016.html)

<sup>62</sup> <http://www.abc.net.au/news/2017-03-28/wind-farm-settings-to-blame-for-sa-blackout-aemo-says/8389920>

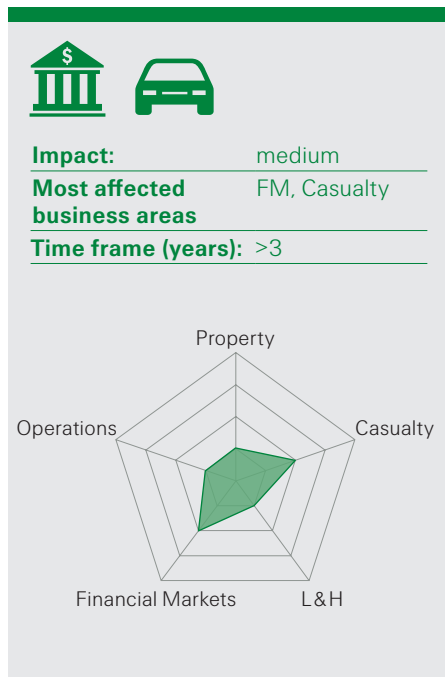
<sup>63</sup> [https://corporatesolutions.swissre.com/insights/knowledge/financing\\_resilient\\_energy.html](https://corporatesolutions.swissre.com/insights/knowledge/financing_resilient_energy.html)



Honey bees are critical agents in the pollination of crops. But their population is declining.







### Paradise lost – the price of ecosystem services

Ecosystem services are the benefits humans gain from natural ecosystems. Biodiversity plays an important role for the proper functioning of ecosystems. A recent assessment sponsored by the United Nations stated that “biodiversity and nature’s contributions to people,” which “are the bedrock of our food, clean water and energy,” decline in every region of the world.<sup>64</sup> The financial risk tied to this development was figured to double the global GDP of 2011. Climate change has been identified as one of the key drivers for the decline, together with habitat fragmentation, pollution and the lack of nature preserves and protected areas.

The most recent example to underpin these findings is the decline in global coral reefs. While accounting for only one square kilometre out of every 1 000 kilometres of open ocean surface, coral reefs are home to one out of four species of living creatures. They are the source of nearly all fishery, protect land against storm surges and provide significant income from tourism wherever they are present. According to the WWF one in four reefs worldwide is damaged beyond repair and two out of three remaining are under serious threat.

Insect abundance in a protected area in Germany tumbled 75% in 27 years. Studies from other areas in the world also indicate that populations of invertebrates are in decline. In respect to biomass, this means that the most abundant food sources at the base of the food pyramid are in serious decline. This development is threatening both fishery and the pollination of agricultural crops – witness the collapsing bee population due to factors such as pesticides and animal pests.

More examples of ecosystem services: in 2016, in Australia, the cost of managing the negative impact of the introduction of a species of weeds soared into the billions of Australian dollars. And if we look at our most precious resource, namely clean water, the bill is likely to become even larger. New York City, for example, has invested USD 2 billion in watershed protection to save USD 10 billion in water treatment costs.

#### Potential impact:

- The loss of ecosystem services could potentially hit the insurance industry on many sides – partly at the same time.
- Resource stress, e.g. a lack of clean water, increases cost for production and services, thus negatively impacting investment returns.
- Civil unrest and conflict over water or food scarcity, triggered by environmental degradation, can impact growth negatively.<sup>65</sup>
- Losses in agriculture: If South American leaf blight reached Southeast Asia, the entire natural rubber production might collapse in a short time.<sup>66</sup> This would cause potentially huge losses for the insurance industry.
- Larger losses from hurricane storm surges: mangroves and coral reefs are hotspots for marine biodiversity but they also protect land against storm surges. Losing them may increase storm damages across the globe.<sup>67</sup>
- Ecological damage: The EU and the US have laws covering ecological damage, which include biodiversity losses. These legal frameworks are also becoming more widespread.<sup>68</sup> The Environmental Liability Coverages the industry provides may be affected by this in the future.

64 <https://www.ipbes.net/news/media-release-biodiversity-nature%E2%80%99s-contributions-continue-%C2%A0dangerous-decline-scientists-warn>

65 <https://www.thecroforum.org/2016/11/28/water-risk/> ; <https://www.thecroforum.org/2013/10/15/esg-country-risk-management-a-new-horizon/>

66 <http://www.fao.org/3/a-i2157e.pdf>

67 <https://www.sciencedirect.com/science/article/pii/S0272771412000674>

68 See The Risk theme “You pollute it, you own it – environmental liability consequences for insurers.”





Emerging trend  
spotlight  
**New realities:  
VR and AR tech  
gaining traction**

Virtual and augmented technologies (VR and AR) are examples of sensor-enhancing electronics that are growing evermore important for the insurance industry. Primarily associated with gaming, VR and AR are growing in capabilities that stretch beyond gaming, for example towards education and logistics. With investments raising over USD 3 bn in 2017, we may see the adoption of VR/AR become a more common phenomenon for companies.<sup>69</sup> If adopted, this technology will change the way things are done and therefore many clients may need insurance coverage across their entire operations and supply chain.

Whilst often spoken of interchangeably, there is a difference between VR and AR. In AR, the visible natural world is overlaid with a layer of digital content. Think Google Glass. VR, on the other hand, stimulates a user's physical presence in an entirely virtual environment using electronic equipment such as a VR headset, or gloves with sensors.

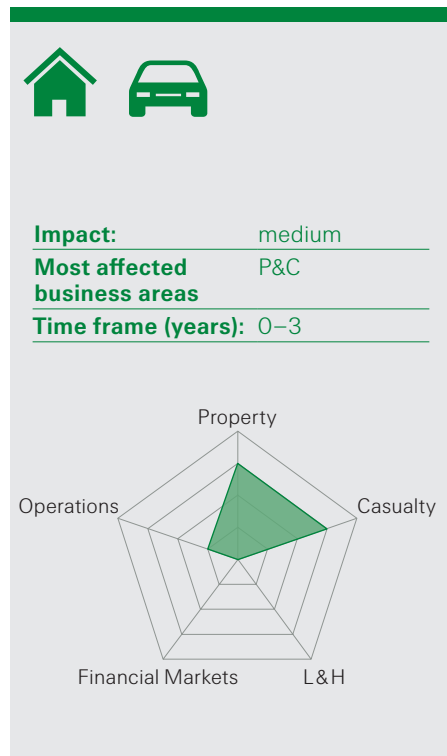
Applications of this technology have already expanded into insurance. An example could be the use of AR tech by risk engineers and technicians in the field since it offers hands-free operation and multiple data collaboration across geographic locations. Additionally, AR can be employed for the inspection of damage to ensure quick and error-free claims processing. These applications will increase insurers' adoption of AR which, according to market research experts, is a trend gaining traction in the insurance market.

Nevertheless, there are inherent risks, as with all new technology. And these may have an impact on liability, operations and people. Underwriters could use VR to explore a construction site. Often, these sites and buildings harbour sensitive information and are thus off limits for external visitors wanting to take pictures or make other recordings. Now this is a dilemma since this is exactly how the technology works.

VR and AR require masses of data that must be accurate, granular and peril-specific. Crucially the data must be kept up to date. It's worthy to note that the GDPR has an impact on the end-to-end processing of data for companies.

69 <http://www.digi-capital.com/news/2018/01/record-over-3b-ar-vr-investment-in-2017-1-5b-in-q4/#.WtRtZP4Ukbx>





## Towering infernos – combustibile cladding

Last year, London’s Grenfell Tower fire tragedy claimed many lives and made global headlines. But this was just the latest example of a risk that had emerged much earlier and is still inherent in many of the world’s buildings, namely combustibile façade cladding. Pre-dating the Grenfell event were the three separate fires engulfing skyscrapers in the UAE.

All three events shared the same ingredients:

- a gap between the external cladding and the building’s walls, which created a chimney effect increasing the intensity and facilitating the rapid spread of the fire.
- Lack of testing on the combination of certain types of material.

The main difference between Grenfell and the buildings in Dubai was that, in the latter, there was additional fire protection installed inside the buildings. So everybody in the Dubai fires was able to escape alive and the structural integrity of the buildings remained intact.

Still, there are potentially tens of thousands of buildings around the world wrapped in combustibile cladding. Dubai Civil Defence estimates that roughly 30 000 buildings in the state have combustibile cladding.<sup>70</sup> Other countries have also identified several thousand buildings that could be exposed to this kind of risk. This presents a smouldering danger in the insurance industry’s books. At risk are:

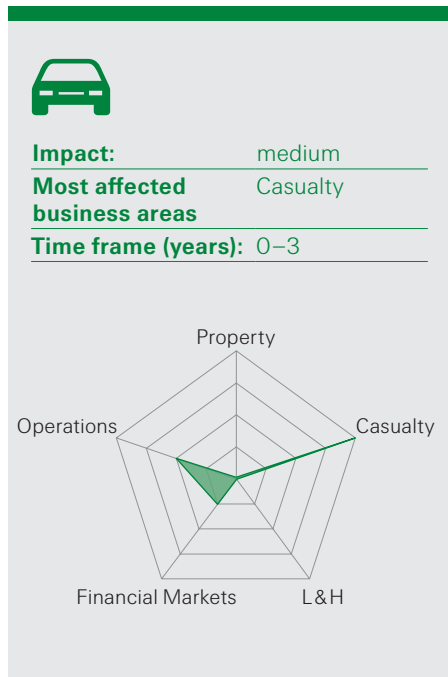
- property policies
- contractor all risks policies
- professional indemnities for architects and engineers who recommend/use the material
- professional indemnity for faulty workmanship, because the risk can increase if the material is not installed properly
- product liability and recall because it is now clear that the use of the material is problematic
- directors and officers policies

The situation is further complicated by the different regulatory standards in fire protection worldwide and the fact that current standards to test the flammability of such materials are not adequate. In other words: An approved material which has successfully passed small scale fire tests may still burn in reality.

### Potential impact:

- Depending on how thoroughly buildings are now reviewed worldwide, we may see refurbishments of existing ones. There can also be new cases of fires. Especially concerning are high-rise buildings in the fast-growing regions around the world. The overall design and the related fire protection of a building will determine if a façade fire spreads rapidly or is contained. A small fire may only require repairs. A major event can impair the structural integrity of the building, making a complete rebuild necessary. Faulty/combustibile materials used or cladding installed in the wrong way add to the risk.
- Several countries like Australia and the UAE have already tightened fire regulations or banned combustibile exterior cladding for certain uses. More action can be expected. Ongoing shifts in regulations require insurers to be alert. Risk assessment and underwriting policies may need adjustment to the new regulatory requirements.

70 <http://english.alarabiya.net/en/News/middle-east/2016/04/27/UAE-considers-new-fire-safety-laws-after-skyscraper-blazes.html>



### You pollute it, you own it – environmental liability and insurance

On November 5, 2015, the Samarco-owned iron ore mine in South-East Brazil burst, resulting in the spillage of 60 million cubic meters of iron ore waste – enough to fill 25 000 olympic-sized swimming pools. The sludge engulfed villages, contaminated rivers and caused massive destruction to the region’s flora and fauna. The companies responsible are facing two public civil claims worth USD 47.6 billion and USD 6.1 billion, respectively.<sup>71</sup> Claims costs, they said, already exceeded the insurance limit for civil damages.

Events like this one also happen in other emerging markets like China.<sup>72</sup> The deteriorating state of China’s natural resources not only triggered a shift in policies – it also generated a new law which, for the first time, makes responsible parties liable for clean-up cost and ecological damages – similar to the ones outlined in the Brazilian example above.

Environmental liability is not new to the insurance industry. It has existed for decades in the EU, the US and many developed countries. In China it is new – and the country is not alone in pushing for more stringent environmental liability regulation, also in practice. South Korea has also joined the group of countries introducing liability regulation for environmental damages or strengthening the laws; so are Australia, the Philippines, and now Singapore.<sup>73</sup> Current activities include the introduction of new liability regimes with mandatory financial securities/insurance requirements in China and Korea, or incentives to increase insurance penetration, for example in the Philippines.

#### Potential impact:

Changes to existing regulation worldwide are substantially altering the risk landscape for insurers:

- The introduction of new environmental liability schemes will mean new coverages and wordings in the affected markets – also to ensure that existing protection does not embrace fresh liabilities without securing appropriate premium increases.
- In respect to environmental liability, insurers must make sure that pre-existing conditions, gradual pollution and ecological or biodiversity damage are also addressed.
- The lack of relevant data makes the calculation of expected losses challenging.

71 <https://investingnews.com/daily/resource-investing/base-metals-investing/iron-investing/bhp-vale-sa-given-extension-on-settlements-for-samarco-disaster/>

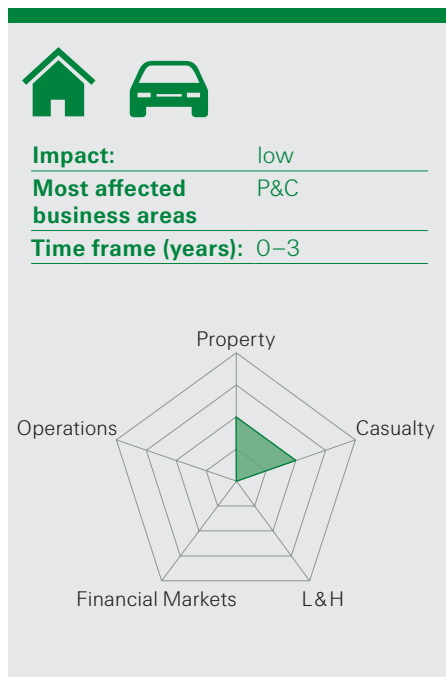
72 <https://www.911metallurgist.com/blog/europe-and-china-with-most-cases-of-dam-failure-in-mining-sites-after-2000>

73 <http://www3.asiainsurancereview.com/News/View-NewsLetter-Article/id/42062/Type/AIRPlus/The-slow-steady-push-for-sustainable-insurance>



Many developing nations have been late to the game in pushing for stringent environmental liability regulations.





### Who’s on watch – colliding ships

In its Safety and Shipping Review 2017 insurer Allianz points out that although ship collisions as a cause of loss have declined from 17 in 2007 to just one in 2016, there is no room for complacency on the part of insurers.<sup>74</sup> CEFOR reports that collisions account for 10% of all hull claims.<sup>75</sup> This concern is also reflected in the latest report by Lloyds, where a collision scenario between a cruise ship and a tanker is a key scenario.<sup>76</sup>

One of the most recent collisions happened in the East China Sea. The oil tanker Sanchi, with a full natural-gas condensate cargo of 136 000 tonnes (960 000 barrels), sailing from Iran to South Korea, collided with the Hong Kong-flagged cargo ship CF Crystal 160 nautical miles (300 km) off Shanghai. Sanchi caught fire and sank. None of Sanchi’s 32 crew members survived and a huge oil slick developed in rich fishing grounds.<sup>77</sup>

According to some insurers, one of the main underlying issues of concern is the economics of operating a vessel. The lowest possible number of crew members is good for the ship manager’s bottom line but can lead to undermanning at critical times. Inadequate training for those assigned to watch-keeping duties can add to the problem.

Actually, the International Maritime Organization (IMO) already acknowledged that fatigue might be a contributory factor to marine incidents; the (compulsory) ‘minimum hours of rest’ on board vessels are now ruled by the IMO’s Maritime Labour Convention MLC 2006 (and in the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW)) whereas the Minimum Safe Manning and the standards of training required for watch keeping are defined in the STCW 2010. The most significant issue arises from the poor standard of training centers, which in some cases, have been proved to be not adequate despite seafarers attending such centers obtained their certification. Other factors to be considered are inadequate vessel maintenance and geopolitical tensions, whether in the South China Sea or the Persian Gulf,

Tightly controlled shipping lanes such as those already in operation in the English Channel are one measure that would lessen the risk of collisions on the high sea. Since most marine accidents are attributable to human error, insurers are also calling for the introduction of more safety-enhancing technology into shipping. More rigorous crew training, also in the case of possible cyber attacks disabling a ship’s systems, would be another sensible course of action. The IMO issued guidelines which should improve cyber security for the maritime industry.<sup>78</sup>

#### Potential impact:

- Growing interconnectivity of shipping risk: The potential for higher losses is expanding as a result of vessels’ increasing size and the growing intensity of pollution monitoring. Apart from the environmental damage, the resulting exposure could range from wreck removal and passenger & crew liabilities, to property damage to the vessels and litigation costs.
- A major casualty is estimated to cost between USD 2 to 4 billion.<sup>79</sup>

74 Allianz Global Corporate & Speciality. Safety and Shipping Review 2017. Germany: 2017.

75 <http://www.cefor.no/Statistics/NOMIS/2017/>

76 <https://www.lloyds.com/news-and-risk-insight/risk-reports/library/understanding-risk/steering-the-course>

77 <http://insuranceasianews.com/insights/counting-the-cost-of-iranian-tanker-spill/>

78 [https://www.bimco.org/products/publications/free/cyber-security:https://www.imo.org/en/OurWork/Security/Guide\\_to\\_Maritime\\_Security/Documents/MSC-FAL.1-Circ.3 - Guidelines On Maritime Cyber Risk Management \(Secretariat\).pdf](https://www.bimco.org/products/publications/free/cyber-security:https://www.imo.org/en/OurWork/Security/Guide_to_Maritime_Security/Documents/MSC-FAL.1-Circ.3-Guidelines%20On%20Maritime%20Cyber%20Risk%20Management%20(Secretariat).pdf)

79 The AGCS Safety and Shipping Review.



Emerging trend  
spotlight

**The backbone of  
the 21st century:  
Supplies of metals  
and minerals**

The age of the steam engine was the age of coal. Coal was the force behind the railway age and early industrialisation. In the petroleum age of the 20th century, oil and gas became the drivers. What will be the game-changing resource of the 21st century? Some say it'll be big data. But what's big data without the computer? In essence, digitisation has a basis in tangible materials. It's founded on minerals and metals, as is the success of electric cars, or the trend from CO<sub>2</sub>-intensive fossils to renewables. Hence, when we talk about digitisation, new mobility and the energy transition, shouldn't we think about the scarcity of these materials? They do, after all, form the backbone of the 21st century.

Minerals and metals, vital ingredients in smartphones and other digital hardware are hard to collect and isolate. Often they're mined under unsustainable social, labour and environmental conditions. Cobalt, for example, is a vital ingredient in lithium batteries, used for example in electrical cars. And global supplies of this commodity, expected to run short in the future, are largely sourced from the politically unstable Democratic Republic of Congo, where about a fifth of it is mined by the hands of children.

The global demand for green-technology products places a huge burden on existing commodities. Electric cars and wind turbines are becoming more attractive as a sustainable option. However, we often overlook the strain this places on demand of so-called rare earth elements. Usage of magnetic rare earths in electric vehicles is expected to grow from about 2 000 metric tonnes last year to 7 000 tonnes by 2020 and 12 000 tonnes by 2024.<sup>80</sup> China is one of the few major countries to mine these materials: in 2016, it contributed 85% of the global rare earth element production.<sup>81</sup> This also means that control of market availability and pricing is concentrated.

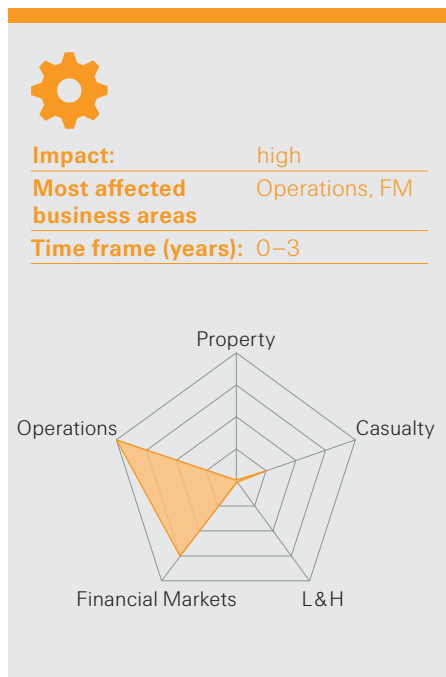
The increasing economic centrality of these commodities will make them even more valuable and increase the need for recycling scarce metals and minerals. But engagement in their extraction and trade may also raise reputational issues and corporate responsibility challenges. Can these materials be mined in more sustainable ways? Re/insurance can contribute to set standards with regard to sustainable insurance and responsible investments.

80 [https://shp.swissre.com/sites/iRes/\\_layouts/15/WopiFrame.aspx?sourcedoc=%2Fsites%2FiRes%2FResearch%20Library%2FRare%20earth%20metals%2FRare%20earth%20metals%5FCV%20DIBs%5F18Sep2017%2Epdf&action=view](https://shp.swissre.com/sites/iRes/_layouts/15/WopiFrame.aspx?sourcedoc=%2Fsites%2FiRes%2FResearch%20Library%2FRare%20earth%20metals%2FRare%20earth%20metals%5FCV%20DIBs%5F18Sep2017%2Epdf&action=view)

81 Zhou, B., Li, Z. and Chen. (2017) "Global Potential of Rare Earth Resources and Rare Earth Demand from Clean Technologies," *Minerals*, 7, 203.



## Competitive & business environment



### A slow poison – the erosion of risk diversification

Re/insurance is a global business that provides financial protection from risks across the globe by deploying capital across geographic borders and lines of business. It needs balanced regulatory frameworks that support the free movement of risk and capital. Such regulatory frameworks recognise the benefits provided by the industry's need for broad diversification of risks across lines of business and geographies.

Without international diversification, the business model, especially for P&C primary and reinsurance, would be much less efficient and resilient than it is today. The greater need for capital in a geographically undiversified situation triggers higher capital costs, and some large risks could simply become uninsurable. Any erosion of the ability to diversify risk internationally is unwelcome for the industry and costly for society and economies. For example, without risk diversification provided by re/insurers operating globally, the cost of providing necessary protection from natural catastrophes could become prohibitive.

National protectionism and regulatory fragmentation are jeopardising the obvious benefits of international diversification. After a period of globalisation, trend reversal and backlash are threatening the re/insurance business model. The list of trade barriers and market access issues compiled by the Global Reinsurance Forum is growing<sup>82</sup>. This points towards an increased danger that regulators could once again favour local solutions despite the clear risks and costs imposed by a lack of diversification.

#### Potential impact:

- Without international diversification, the reinsurance business model would be much less efficient than it is today. To illustrate the economic value of international diversification, the higher need for capital in a geographically undiversified situation would lead to higher capital costs, constituting the lost benefit if international diversification were abolished. Diversification allows re/insurers to hold less capital to cover the same risks with the same certainty.
- Without any international diversification, reinsurers would be required to hold more capital, driving up premiums by at least 8%.
- The insolvency of Gerling Re in 2002 showed how risk concentration can contribute to insolvency or impairment. Already in trouble after an acquisition, a high loss due to the 9/11 terrorist attacks and claims for asbestos-related and environmental damage in the US led to one of the largest run-offs in the history of reinsurance. And in the primary insurance market, Hurricane Andrew in 1992 led to the insolvency of 11 non-life insurers. No large multinational insurer was among them, even though they were exposed to the same natural catastrophe. Their better geographical diversification helped them weather the losses.

82 Reinsurance Trade Barriers and Market Access Issues Worldwide, Global Reinsurance Forum (GRF), 9 February 2018: <http://www.grf.info/publications/barriers-to-trade>



Emerging trend  
spotlight

**Testing phase:  
InsurTech in Asia**

Asia is one of the most underpenetrated insurance markets in the world,<sup>83</sup> partly due to the fact that traditional distribution models are costly and inefficient in emerging Asia with its large geographically dispersed populations. Digital distribution might help to overcome these challenges as its reach is ubiquitous. Asia has a rapidly emerging tech-savvy middle class. Coupled with the low effectiveness of traditional insurance distribution<sup>84</sup>, this fact puts InsurTech in a unique position to flourish, which could potentially help close the protection gap.

Asia is tipped to be the region to benefit most from the InsurTech revolution, and its regulators are actively taking the lead to boost the FinTech economy by setting up regulatory sandboxes for FinTech start-ups. Regional regulatory sandboxes include Singapore, Malaysia, Hongkong, Thailand, Indonesia and Australia.<sup>85</sup>

Although China's Fintech industry has attracted the highest investment globally, its first FinTech sandbox was not launched until 2018 by fourth-tier city Ganzhou.<sup>86</sup>

China and India, by virtue of their sheer size and regulatory environments, are conducive to tech innovation. India already has the second highest FinTech adoption rate in the world.<sup>87</sup> In China, InsurTech is gathering momentum with new players vying for a place at the table. Companies such as CareVoice are following in the footsteps of ZhongAn (China's only internet-only insurer) and the larger, traditional insurers such as PingAn are investing massively into InsurTech R&D.<sup>88</sup>

Nevertheless, the regulatory environment in Asia is fragmented as regional regulators are in different stages of development. This underscores the need for markets to collaborate and regulators to maintain and capitalise on open lines of communication with the industry, not least to prevent lower standards of governance in one country exposing another to unwanted risks. In the past, regulators and legislators in Asia have also quickly reacted on larger data breach cases with very restrictive requirements which can further limit the adoption of FinTech in the market across jurisdictions. This highlights the need for collaboration between regimes to harmonise regulations similar to what the GDPR tries to achieve across the European Union.

83 [https://www.static-ubs.com/global/en/wealth-management/chief-investment-office/key-topics/2017/insurtech-shifting-asia/\\_jcr\\_content/mainpar/toplevelgrid\\_371081937/col1/innergrid/xcol2/linklist/link.0639530830.file/bGluay9wYXRoPS9jb250ZW50L2RhbS9hc3NldHMvd20vZ2xvYmFsL2Npbj9kb2Mvc2hpZnRpbmctYXNpYS1pbmN1cnRlY2gtZXgtXMtZnAucGRm/shifting-asia-insurtech-ex-us-fp.pdf](https://www.static-ubs.com/global/en/wealth-management/chief-investment-office/key-topics/2017/insurtech-shifting-asia/_jcr_content/mainpar/toplevelgrid_371081937/col1/innergrid/xcol2/linklist/link.0639530830.file/bGluay9wYXRoPS9jb250ZW50L2RhbS9hc3NldHMvd20vZ2xvYmFsL2Npbj9kb2Mvc2hpZnRpbmctYXNpYS1pbmN1cnRlY2gtZXgtXMtZnAucGRm/shifting-asia-insurtech-ex-us-fp.pdf)

84 <https://www.finews.asia/finance/26393-asian-insurtech-a-rising-tide>

85 Singapore digital agenda ("Smart Nation Singapore") goes beyond, but also includes the sandbox. [www.smartnation.sg](http://www.smartnation.sg)

86 [http://www.ey.com/Publication/vwLUAssets/ey-the-rise-of-fintech-in-china/\\$FILE/ey-the-rise-of-fintech-in-china.pdf](http://www.ey.com/Publication/vwLUAssets/ey-the-rise-of-fintech-in-china/$FILE/ey-the-rise-of-fintech-in-china.pdf)

87 <http://www.ey.com/gl/en/industries/financial-services/ey-fintech-adoption-index>

88 <http://www.scmp.com/business/companies/article/2129911/insurtech-start-wants-compete-zhongan-ping-targeting-chinas>



### Funny money? – Do we need to worry about cryptocurrencies?

Bitcoin is the most prominent example of crypto- or virtual currencies, which have gained increasing popularity in recent years. Bitcoin is based on blockchain – a decentralised digital ledger system. But not all cryptocurrencies are based on this technology. Blockchain offers many other applications beyond digital currencies. These other applications can generate economic benefits and are largely in the focus of the re/insurance industry. Cryptocurrencies, however, are more problematic.

For almost a decade, cryptocurrencies were the preserve of those who wished to transact anonymously, in many cases for criminal purposes. In the last two years, countless corporate startups have raised money and issued virtual tokens using Initial Coin Offerings (ICOs). As a consequence, the market value of virtual currencies has ballooned. The market capitalisation for cryptocurrencies today is estimated at about USD 400 billion, down from above USD 800 billion in January, but up from about USD 130 billion at September 2017. However, compared to traditional currencies and assets, it remains negligible.<sup>89</sup>

Although there’s a concern that the rapid increase in the value of cryptocurrencies could turn into a bubble, which could very well burst, the impact would be limited to the relatively small group of people using these instruments as a medium of exchange. A more relevant concern for the insurance industry is the environmental impact. In January 2018, the “New York Times” pointed out that “there is nothing virtual about Bitcoin’s energy appetite.”<sup>90</sup> So, do we need to worry about this fact in the context of global warming? Perhaps we do.

However, it isn’t all bad news. Investors expect cryptocurrencies to offer stronger security against theft and during transactions. But are cryptocurrencies really safer? Recent history says no: Hackers, technical errors or simple fraud have made headline news lately. Additionally, there has been a substantial rise in regulatory scrutiny, and regulatory uncertainty regarding cryptocurrencies and ICOs remains high. There may be additional legal and regulatory implications such as financial crime, anti-money laundering, cybersecurity and litigation issues. The regulatory approach to cryptocurrencies and ICOs differs widely, ranging from banning trading in cryptocurrencies to actively supporting their adoption, representing challenges to their wider use.<sup>91</sup>

#### Potential impact:

- Litigation issues to date have centered on cryptocurrencies in the form of ICOs, cryptocurrency trading platforms and smart contracts. They are based on existing liability contentions, breaches of contract and claims made under consumer protection laws. Litigation actions have implications for insurance, be it with D&O policies or liability issues where the parties suffering financial loss seek remediating damages.
- Some insurers are already offering protection against cryptocurrency theft. Very little is known about the risks insurers are covering. The underlying technology is still very new and past data is lacking to price the risk and design the coverage.
- Given all this uncertainty, many firms just don’t have the underwriting expertise to start designing such cryptocurrency theft policies. Nevertheless, this may be a new risk pool that could benefit the insurers by creating new business, and helping this infant industry to mature.

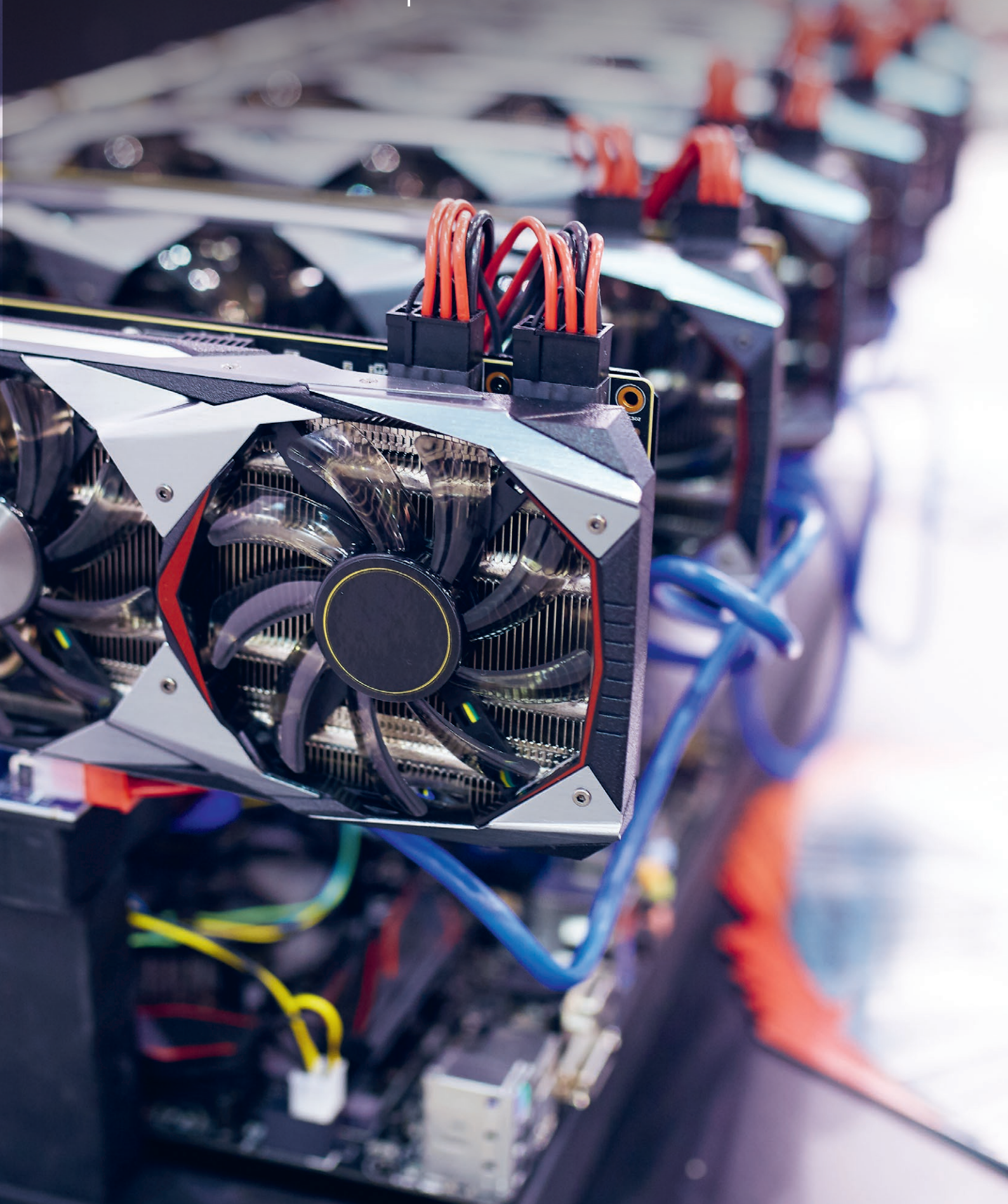
89 M2 quantity of USD. [https://www.snb.ch/de/mmr/speeches/id/ref\\_20180405\\_amr](https://www.snb.ch/de/mmr/speeches/id/ref_20180405_amr)

90 “The New York Times”; January 21th, 2018; “There Is Nothing Virtual About Bitcoin’s Energy Appetite.” The electric power needed to generate each digital token is immense.

91 <https://hackernoon.com/global-cryptocurrency-regulation-update-march-2018-7a779733a407>



Each Bitcoin transaction  
needs 80 000 times more electricity to  
process than a credit card does.





Emerging trend  
spotlight

**Hamstrung?:  
The risks of heavy  
government debt**

USD 174 trillion in mature markets and USD 63 trillion in emerging markets<sup>92</sup> – 2017 continued to see the global debt stock rise to an all-time high of USD 237 trillion. This includes private and public debt. Ongoing low global rates have supported unprecedented levels of debt accumulation. Even though robust economic growth has pushed down debt-to-GDP ratios slightly, the high debt – especially government debt of USD 64 trillion – is too large to be ignored. This is because high debt puts a burden on the financial system and increases its fragility, limits growth potential and cuts the government's flexibility to react to crises.

But how can the heavy debt burden be reduced? Historically, we have seen five different ways. A growing economy helps lower the debt-to-GDP ratio and lets people pay back their loans. Substantive fiscal adjustments are another way to cut at least the public debt. Explicit default, debt restructuring or a surprising uptick in inflation are less desirable or likely options. The fifth option is the steady dosage of financial repression with a steady dosage of inflation. As these debt-reduction channels are not mutually exclusive we have indeed seen a combination of these channels in the past.<sup>93</sup>

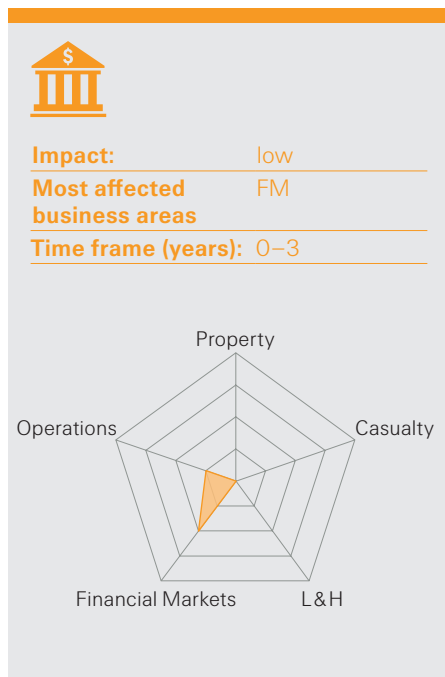
The risk of corporate or even sovereign defaults may increase along with rising debt. While Japan's 222% debt-to-GDP ratio still makes it one of the countries with the highest government debt burdens, the US continues to issue more debt from the current administration's fiscal stimulus package. The government's inability to tame its budget deficit could increase the – however remote – potential for a debt crisis. At some level, global investors may begin to be concerned about the US debt level. It may be that a possible debt crisis does not centre around a potential US default but more around how the government intends to manage the repayment of its debt and the impact this might have on the US economy. As US debt is mainly held abroad, what will happen if foreign creditors decide to use this situation to exert undue influence? US debt is therefore much more of a global issue than is the case in Japan where most of the debt is held domestically.

Given the high amount of debt, the economy and the financial markets are structurally more fragile than in the past. And we see very limited willingness by governments to address structural reforms. Therefore, financial markets could suffer from a domino-effect during the next severe downturn, with potentially higher government and corporate defaults than historically observed. Such default could wipe out lifelong savings of retail investors, potentially leading to strong political backlash.

92 Global Debt Monitor: Peering under the ice – IIF, 9 April 2018

93 <https://www.imf.org/external/pubs/ft/wp/2015/wp1507.pdf>





### The dangers of shiny objects – tech hypes, fails and fraud

The insurance industry participates in the current technology revolution not only by providing risk transfer, but also with investments and strategic partnerships. Although these avenues provide magnificent opportunities, they also come with risks.

Tech companies would have us believe that innovation is disrupting the world as we know it, and that the sky's the limit. It's true that Amazon, Facebook, Google and Uber have changed the world. And this story is by no means over. But all that said, the risk of falling for tech hypes is considerable. The rapid expansion in tech-led investments over recent years should remind us of the dot-com bubble of the 1990s. Back then, the volume and value of investments in the US internet and software sector rose sharply, only to unwind abruptly, as the bubble burst and many companies folded.<sup>94</sup>

A company may fold when it doesn't deliver on its promises. In the realm of consumer technology, failure may be the result of such mundane risks as low supply chain resilience, which cannot respond to market demand. Growth pains – which may be passing blips or turn out to be lethal – can arise despite, or indeed because of, a firm's success. Scaling up quickly from start-up to big global player is challenging for many. While playing the visionary, everyday operations management, compliance, due diligence and corporate responsibility can fall by the wayside. Delayed product delivery, reputational issues, data policies infringement, misbehaviour of executives, discrimination or harassment, are just some of the potential hot spots in this connection.<sup>95</sup> Just how big woes can become has been displayed with the recent Facebook case around the sharing of user data.

Over-promising can amount to a crime, as in the case of Theranos. This was a company advertising a supposedly revolutionary blood-testing technology, which was not as revolutionary as it was claimed to be. Theranos was recently charged with massive investor fraud.<sup>96</sup>

Insurance companies may be involved in such cases as investors, as insurers providing covers to respective tech companies, or as partners engaging in strategic partnerships with tech firms. The latter may be particularly relevant for the burgeoning InsurTech sector.<sup>97</sup>

#### Potential impact:

- For the insurance industry, such tech risks may mostly impact the investment side, but they could also arise from strategic partnerships with tech companies.
- The tech boom comes with an expectation for acceleration of speed to market. There is a risk that good governance will be trumped by this ever faster speed.
- Tech hype risk may not only relate to "start-ups," but can also extend to established companies, particularly if they have a history of quick and strong growth.
- Unexpected issues may arise in the form of operational, and/or reputational risk.
- Additional losses may incur for D&O covers provided to executives in tech companies.
- Misbehaviours can lead to restrictive regulations as preventive measures.

<sup>94</sup> Technology and insurance: themes and challenges, Swiss Re Institute (June 2017), p. 18.

<sup>95</sup> <https://www.nytimes.com/2017/07/04/insider/technology-sexual-harassment.html>; <https://www.recode.net/2018/3/27/17170154/uber-discrimination-lawsuit-10-million>

<sup>96</sup> <https://www.theguardian.com/technology/2018/mar/14/theranos-founder-elizabeth-holmes-fraud-charge>

<sup>97</sup> Technology and insurance: themes and challenges, Swiss Re Institute (June 2017), p. 4. [http://media.swissre.com/documents/expertise\\_publication\\_technology\\_and\\_insurance\\_themes\\_and\\_challenges.pdf](http://media.swissre.com/documents/expertise_publication_technology_and_insurance_themes_and_challenges.pdf)



Macro trends and emerging risks  
will shape tomorrow's world.





## Appendix: Terms and definitions

### What is SONAR?

SONAR stands for Systematic Observation of Notions Associated with Risk. It is Swiss Re's tool 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 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, i.e. topics covered in previous editions are not listed again. You can retrieve prior reports from our webpage: <http://tinyurl.com/ny9zje2>

### What is meant by overall impact?

The overall impact is an indicator of the potential financial, reputational and/or regulatory impact associated with an emerging risk topic. It is assessed on a scale from high to low:

<b>HIGH</b>	Potentially high financial, reputational and/or regulatory impact or significant stakeholder concern
<b>MEDIUM</b>	Potentially medium financial, reputational and/or regulatory impact or moderate stakeholder concern
<b>LOW</b>	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 3 years and those likely to occur with 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 business areas on a scale from 0 (= no impact) to 4 (=significant impact).

### What are trend spotlights?

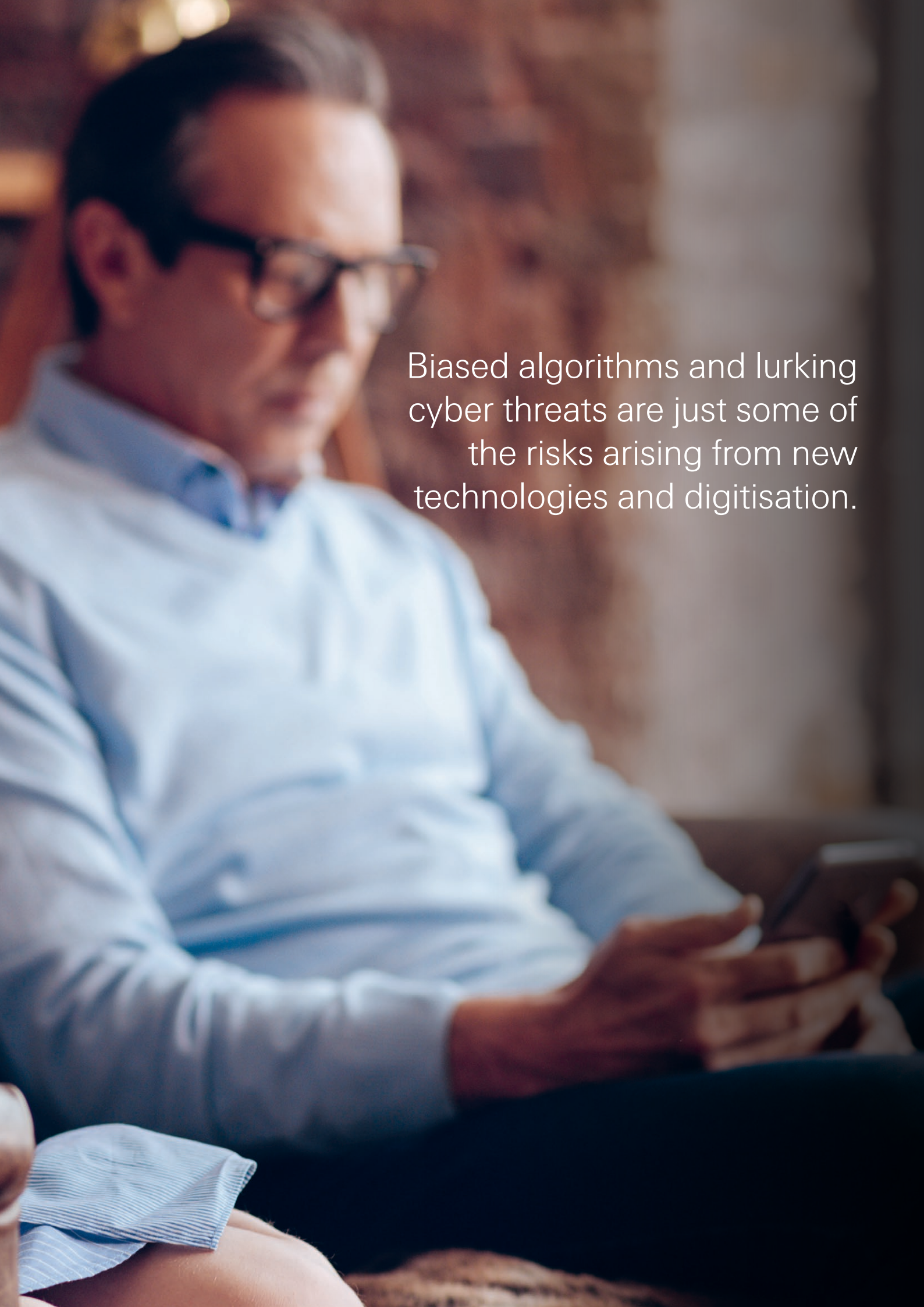
Boxes throughout the text provide selective spotlights on emerging trends which could become relevant for the (re)insurance industry and its clients going forward. The selection of topics is non-exhaustive, and descriptions are intended as food for thought and discussion starters rather than comprehensive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

### What are macro trends?

Swiss Re has identified a set of macro trends assumed to have a high impact on the re/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.





A man with short dark hair and glasses, wearing a light blue button-down shirt, is sitting on a dark-colored couch. He is looking down at a smartphone held in his hands. The background is a warm, textured wall, possibly stone or brick, with soft lighting. The overall mood is calm and focused.

Biased algorithms and lurking  
cyber threats are just some of  
the risks arising from new  
technologies and digitisation.

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