



Swiss Re
Institute

Swiss Re SONAR
New emerging risk insights

May 2019



What shapes the insurance industry?

Past experience and, importantly, new, changing and not-yet envisioned risks.

We created this SONAR report to inform and inspire conversations about emerging risks, so we can continue to build resilience together, in these uncertain times.










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Overview









Emerging risk themes by potential impact and timeframe

0–3 years

<p>  Teaching an old dog new tricks – digital tech meets legacy hardware</p> <p>  Don't ask, don't tell – genetic testing and adverse selection</p>	<p> Getting the balance right – technology regulation affecting the insurance industry</p> <p>  Vaccination – a shot worth more than politics and profitability</p> <p>  Beggar thy neighbour? – Global trade reordered</p>	<p> Resilience at stake – forests' vital functions under threat</p> <p>  Wiggle room – Artificial Intelligence and healthcare</p> <p> Pervasive and toxic – chemicals in our bodies and environment</p> <p> Conflicting interests – the widening urban-rural divide</p>
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> 3 years

<p>  Off the leash – 5G mobile networks</p> <p> Limits to tinkering – the fiscal and monetary policy balance at risk</p> <p> It's existential – climate change and life & health (Special feature)</p>	<p>  Risky bets? Insurance demand in an age of shifting markets</p> <p>  Retirement skills gap – accidents waiting to happen</p>	<p> Concussion injuries in sport – head on to more widespread claims</p> <p> A celebrity body –the hazards of aesthetic surgery tourism</p>
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<p>Most affected business areas</p> <p> for Property  for Life & Health  for Operations</p> <p> for Casualty  for Financial markets</p>	<p>Potential impact</p> <p> High  Medium  Low</p>
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Foreword

In our annual SONAR report for 2019, we highlight the emerging risks we have identified and assessed through the course of the last year. The clash of new and legacy technologies, the fiscal and monetary imbalance, and the retirement skills gap are just some of the risks we feature in this study.

Many of these risks are entirely new, because they emerge from innovations not seen before, or new developments in society and/or in insurance framework conditions. The expected timeframe for the maturation of the risks into real-life events with significant loss-making potential is often short. However, we also cover “slow-burner” emerging risks, where evolution of the exposure to the point of potential for notable impact on the insurance industry will be long-running.

A classic example is climate change. Swiss Re and the insurance industry at large first flagged climate change as an emerging risk many decades ago. The risk has now “emerged” but associated (and challenging) uncertainties still remain. Such as, for example, the implications of climate change on Life & Health insurance. We devote a special feature chapter to this important topic in this report.

We hope this year’s SONAR report provokes new insights for you. We look forward to engaging with you to discuss your thoughts and the spectrum of emerging risks overall.

Patrick Raaflaub
Group Chief Risk Officer

Failure of key infrastructure like power distribution can significantly impact the insurance industry.








Introduction

We define emerging risks as newly developing or changing risks which are difficult to quantify. The loss potential of these risks is currently difficult to estimate, but they may have a major business impact on the insurance industry. Against the backdrop of macro trends identified by Swiss Re, which are synthesized in overarching perspectives (see macro trends environments and overarching topics, page 7), this year's SONAR report features 15 new emerging risk themes and five emerging trend spotlights. It also includes a special feature on the implication of climate change on Life&Health insurance.

To assess and underwrite risks, the insurance industry relies on experience (ie, historical data for identified and insurable risks). However, historical data alone cannot build understanding of the future risk landscape, which is forever changing and presents new and previously unforeseen risks. Here, the insurance industry needs to demonstrate foresight and make use of sound future intelligence. Knowledge sharing through different forms of risk dialogue with all stakeholders can help insurers manage emerging risks more effectively, for industry sustainability and to improve societal resilience. Swiss Re's SONAR report, which has been published annually since 2013, provides a forward-looking perspective, to further promote and engage with such risk dialogue.

Swiss Re identifies emerging risks, first and foremost, through its proprietary SONAR tool, an internal crowdsourcing platform that collects input and feedback from underwriters, client managers, risk experts and others across Swiss Re. 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, and with respect to the line of business (see figure page 2) where we expect the biggest exposure will rest.

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

-  for **Property:** Retirement skills gap – accidents waiting to happen
-  for **Casualty:** Teaching an old dog new tricks – digital tech meets legacy hardware
-  for **Life & Health:** Don't ask, don't tell – genetic testing and adverse selection
-  for **Financial Markets:** Limits to tinkering – the fiscal and monetary policy balance at risk
-  for **Operations:** Getting the balance right – technology regulation affecting the insurance industry

Some of the emerging risk themes and trends presented in this and previous SONAR reports may never materialise as exposures with loss-making potential. Others likely 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.

In an appendix, emerging risks with highest impact are listed from past reports dating back to 2015, with additional information about cross-cutting themes (see Appendix A: Key emerging risks from SONAR reports 2015–2019).

The low carbon economy calls for new solutions such as high speed trains or renewable energy installations.



Macro trends

Screening of interdependent macro trends

For today's and tomorrow's risk landscape, Swiss Re has identified and assessed 23 macro trends. This is central to understanding the risk landscape of the future, to make informed decisions and to create solutions for emerging risk pools. Swiss Re assesses these trends and their interdependencies through discussions with experts, in-depth reviews and by undertaking annual surveys.

The list of 23 macro trends for 2019 remains unchanged from the previous year, when "Data as an asset" was added. We deem these trends as having the potential to be decisive elements for the re/insurance industry within the next five to ten years. The trends fall into four, interlinked "environment" categories, namely (1) societal; (2) political; (3) competitive and business, and (4) technological and natural environments.

In this section, we provide insights into the four environments and the respective macro trends. We also highlight three overarching topics that feature strong interdependencies between certain macro trends, are reflected in today's reality, and are expected to shape the future of our industry.

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 and 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 and 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



Societal environment

The economic relevance of the middle class remains all pervasive but increasingly, the onus is shifting to the emerging economies, most notably Asia Pacific. A large number of households in emerging markets have escaped poverty over the past years, and growing household wealth has led to more consumption. Shift and overall growth of insurance markets are to be expected, but they cannot be taken for granted (see page 38 “Risky bets?”).

Escape from poverty has seen mass migration from rural areas to cities. The UN Department of Economic and Social Affairs estimates that by 2030, the number of people living in urban settings across the world will reach 5 billion, up from around 2.5 billion today. Over 90% of the increase will occur in high growth markets (HGM), and most in China and India. Migration and urbanisation concentrate risk. For one, large cities are more prone to health hazards, an important consideration for Life and Health (L&H) insurers. And also, with an associated accumulation of economic assets in urban areas, there is more potential for large financial losses in the event of a major natural disaster, an opportunity for property lines of business. Serving as powerhouses to national economies, cities also invite resentment from the rural periphery. A number of recent democratic elections and votes, e.g. Brexit, have shown signs for a growing divide between the populations of metropolitan centres and of rural peripheries (see page 24 “Conflicting interests”).

In the mature economies, the post-World War II baby-boomers have mostly reached retirement years (with regard to the skills gap opening and subsequent risk, see page 17 “Retirement skills gap”) with sufficient savings and asset gains accumulated from the prosperity of the 20th century. The next generation is still strong in numbers, but is accumulating less wealth and experiencing more pressure from globalisation and automation. The pension systems in many mature markets is becoming increasingly unsustainable for future retirees. This, and a shrinking middle class in some part of the developed world, may deepen social inequality. As more people feel left behind, a pool of dissatisfaction will likely build. In times of social media connectivity and of traditional political parties disrupted by political entrepreneurship, channeled resentment has become more decisive, and social unrest is on the rise. The “gilets jaunes” (yellow vests) movement in France is a case in point.

Currently, this is mostly a mature markets’ problem, but it may also provide signals for the fast changing demography of developing countries. For instance, China’s is grappling with unintended effects of its population policies. Small family units after decades of one-child policies will struggle to finance the retirement years of the country’s already rapidly aging population. Restrictions on mobility are further exacerbating inequality.

Political environment

Globalisation momentum has slowed over the past decade. Relative to world GDP, cross-border investment, trade, bank loans and supply chains have all been shrinking or stagnating. This started well before US Donald Trump's Presidency. His anti-globalisation campaign, which has been a political success for his administration, has since been copied around the world. Multilateralism is on the back foot and global governance of commerce embodied by the World Trade Organization (WTO) is at risk of collapse (see page 12 "Globalisation fragmented" and page 23 "Beggars thy neighbor").

Rules on privacy, data and espionage are splintering. Even accounting and anti-trust regulations are fragmenting. Tax systems are being bent to patriotic ends, including a strong trend of taxing corporates locally based on local revenues. In this regard, the US is pressuring firms to repatriate capital, while Europe is targeting Silicon Valley. Moreover, the US makes frequent use of the power it derives from running the world's dollar-payments system to curb the activities of foreign companies. The old powers cling to what they still command, while broader economic, political and cultural power continues to shift to Asia.

While the low yield environment persists, room for manoeuvre by central banks has become increasingly limited. Long-term accommodative monetary policy combined with weaker global coordination has led to growing inflation risk. Central banks may lack the tools and independence to address inflation, resulting in a new super-cycle dominated by fiscal policy (see page 22 "Limits to tinkering").

Aging populations in richer countries put public finances, including pension and health systems, under strain. As a consequence, public services and assets are being outsourced to the private sector. One example is Haven, a joint venture by Amazon, Berkshire and JP Morgan to improve access to primary care in the US, simplify insurance and make transcription drugs more affordable for employees.¹

¹ Amazon, Berkshire, JPMorgan healthcare company to be called Haven, Reuters, 6 March 2019.

Technological and natural environment

The world is undergoing a shift in terms of who owns data, especially in regards to individuals (see page 27 “The surveillance economy”). As social media and other companies which have “control” over data begin shifting their approach – either pre-actively or in response to regulatory pressure – data may increasingly come back into the hands of the individual. Data has been and will continue to be a key differentiator in business, including for re/insurers (see page 41 “Getting the balance right”).

Technologies like Big Data and cloud computing can greatly increase the efficiency of capturing, storing and computing data. The Fourth Industrial Revolution is progressing full steam ahead including, among others, process automation, Internet of Things (IoT) devices and digital analytics capable of rapid analysis of massive amounts of un-/structured data (regarding speed of data transmission through 5G also see page 29 “Off the leash”). The combination of more data and better analytics can lead to better insurability of previously difficult-to-price products, and also to new capabilities in fraud detection. All this, however, raises privacy issues and trust concerns, and thus regulatory involvement. For insurers, specifically, these developments also raise the spectre of adverse selection.

The rise of Artificial Intelligence (AI) will have a major impact on knowledge and human capital-intensive businesses (for the realm of healthcare see page 31 “Wiggle room”), transforming existing employees into an “augmented” workforce. This could lead to an increase in unemployment, initially among lesser-skilled professions, and trigger social unrest.

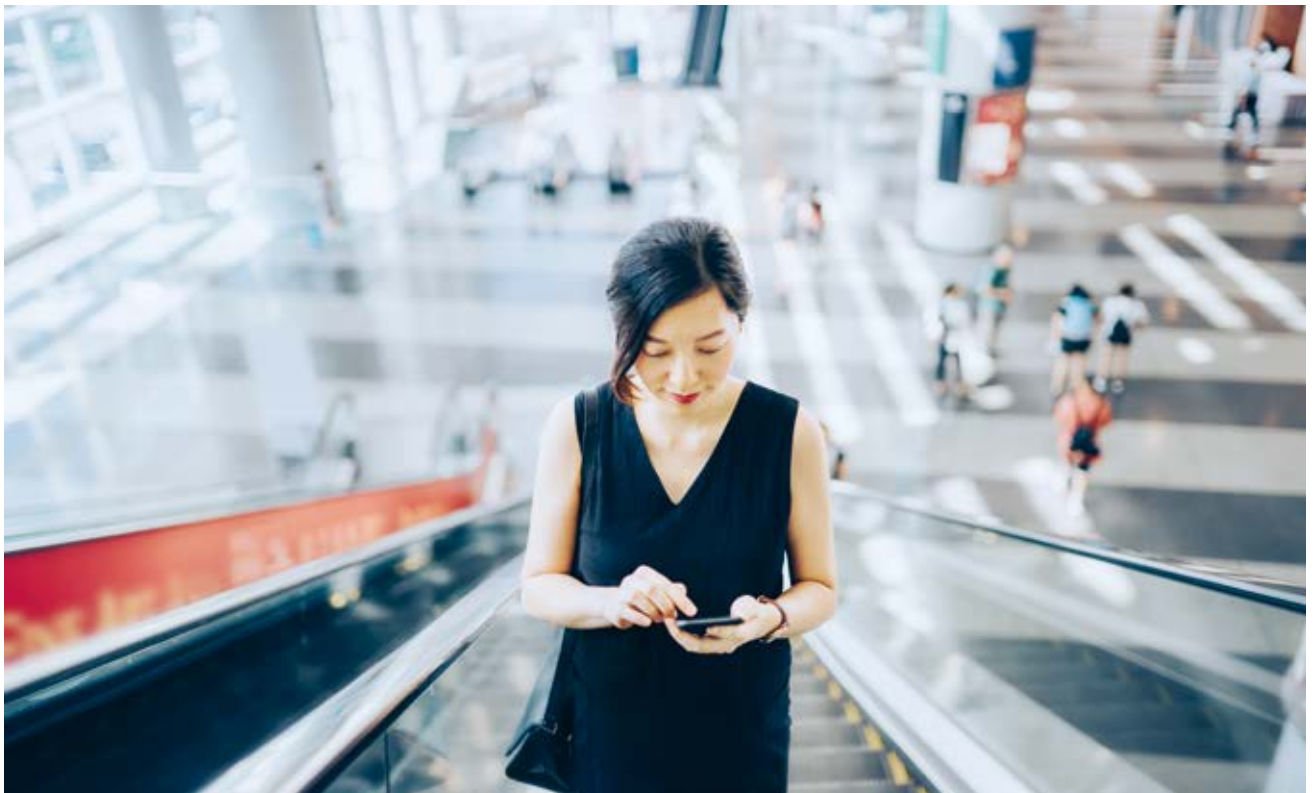
The frequency and severity of risks resulting from cyber-attacks are expected to grow significantly over the next years. Recent examples have revealed how unprepared companies and government agencies are for such attacks. The need for cyber resilience has become a main focus of attention among corporate clients and insurance companies, triggering insurance demand. Cyber risk presents one of the largest opportunities for the re/insurance industry, while simultaneously also posing one of the biggest challenges. Keeping up with the changes in the cyber and technology space, and developing solutions to cover the resulting and ever-evolving risks is no mean feat.

Competitive and business environment

Primary insurers continue in their struggle to reshape their traditional systems and processes to serve the consumer base with next-generation insurance solutions (also see page 40 “Financial services and the digital revolution”). Reinsurers and intermediaries seek access to distribution channels and risks outside the traditional value chain. As international re/insurers face more restrictions with respect to data privacy and operational issues with legacy systems, innovative business models and digital eco-systems are likely to emerge, starting off in HGMs. These will significantly impact the global re/insurance value chain.

Digital ecosystems present a great opportunity for insurers to interact with potential customers. China is one of the fiercest Insurtech marketplaces in the world, and e-commerce is transforming the way the population interacts with industry. With the emergence of disruptive technology finding application in many industries, strategic partnerships seem to be a key component of the development of innovative insurance solutions. Investments in digital platforms by tech giants and Insurtech start-ups have been on a continual upward path since 2014.

With respect to the growing involvement of the emerging economies in global development, on the re/insurance side, many of the emerging markets remain dominated by national players. Some of these firms, for example from China and Korea, are developing global ambitions, and this will impact the dynamics of international re/insurance business in the years to come.



Low-carbon economy

The low-carbon economy model is rapidly gaining traction, as societies and enterprises explore and develop new solutions. The last decade has seen exponential growth of solar and wind power installations. This was mainly driven by large falls in production costs, initially due to innovation and then economies of scale. Similarly, there has been significant progress in battery storage technology, critical for the anticipated future dominance of the electric mobility. The official policy stance has become more supportive of the low-carbon ideal. For instance in motor, advanced countries' regulatory measures on combustion engine are becoming ever more demanding. And in China, the leadership has decided to clean up its cities. In 2018, the Ministry of Ecology and Environment was established with a mandate to invigorate enforcement and conduct local inspections. Policy innovation in transport means that today, China operates 99% of the world's electric buses.² The current policy priority is autonomous electric cars.

From an insurance perspective, the low-carbon economy is characterised by a range of often competing technologies and business models. The lack of performance history on these raises many uncertainties. A number of hypes in recent times turned out to be dead-ends: biofuels for cars and carbon capture for coal-fired power generation, to name a couple of examples. That's not say insurers should not remain alert of new developments. While low-carbon energy generation models contains inherently less property and casualty risk than high temperature/pressure generation, they also entail new risk factors and insurability potential, such as performance risk due to weather dependency. Insurers have already begun to address exposures like this with innovative parametric-based products.

Less optimistic, technological progress and shifts in regulation and in social norms are giving rise to the risk of stranded assets. These are unanticipated asset write-downs, devaluations or conversion to liabilities in high-carbon sectors such as oil and gas (including tar sands), utilities and basic materials. Nevertheless, despite such challenges, opportunities abound. The low-carbon economy is growing broadly and tangibly. Re/insurance can facilitate the introduction of low-carbon technologies by assessing and underwriting new risks as they emerge and by partnering with innovators across different industries, design new risk transfer solutions for the exposures of the future.

Globalisation, fragmented

After eight decades of expansion, trade globalisation is facing a major test. After World War II, the Western powers established an open and stable system of multinational trade – centred on the General Agreement on Tariffs and Trade (GATT), and the Soviets created an alternative trade network. After the end of the Cold War, the Western system prevailed, leading to a “golden age” of globalisation (1990–2007) powered by trade expansion, the rise of emerging markets and differentiation of value chains according to comparative advantage. This was facilitated by a period of (relative) US-led international political stability and embedded in global formats such as the G7, G20, and WTO.

The global financial crisis of 2008–09 brought globalisation momentum to a halt. In the decade before the financial crisis, world goods and services trade volumes doubled. In the decade after, volumes have grown by less than half the pre-crisis rate.³ Cross-border investment, trade, bank loans and supply chains have all been shrinking or stagnating relative to world GDP. The Trump administration enthusiastically engages in trade wars. Geopolitical rivalry is gripping the tech

² *Electric Buses in Cities*, Bloomberg New Energy Finance, March 2018

³ The International Monetary Fund's (IMF) *World Economic Outlook Database*

industry, which accounts for about 20% of world stock markets. Rules on privacy, data and espionage are splintering. Tax systems are being bent to patriotic ends. The US and EU have new regimes for vetting foreign investment, while China has only started to live up to its commitment to giving foreign firms a level-playing field.

All the while, the globalisation of world commerce continues, but patterns and governance have changed markedly.⁴ Global institutions have lost influence relative to assertive nation states, which in turn are catering to the louder and more idiosyncratic demands of their citizens. For multinationals, re/insurers included, this represents a more demanding landscape with less predictable stakeholders.

Demography and health

The world's population is growing. Average life expectancy at birth is expected to rise from 71 years in 2010–2015 to 77 years in 2045–2050.⁵ Demographic cohorts differ in age structures, wealth and health. While longer lives are a positive social outcome, they also pose a number of challenges.

First, the aging of societies, which we see in mature markets but also in emerging economies. China, which is now the world's second largest economy, is aging rapidly due to the one-child policy in place from 1979 to 2015. The average age of the Chinese population is increasing much faster than in other markets, the effects being not only a shrinking productive workforce, but also significant shifts in the old age dependency ratio. A resource gap widens quickly for the growing prevalence of age-correlated health issues, chronic diseases, dementia and other problems that require medical attention, caretakers and financial means. The accumulation of resource strain on health systems are common to many economies, but are dealt with quite differently. Immigration can be an important mitigating factor for healthcare labour shortages, but only in societies that are open to foreigners.

Another way to tackle increasing health costs is through technological innovation – from care robots to wearables monitoring health conditions. Face-to-face patient/physician interaction is being increasingly supported (or replaced) by telecommunications and digital means. Consequently, L&H insurance products are increasingly digitalised, from consulting through to claims handling. The number of digitally sold policies is growing exponentially, and the trend to more digital interaction reflects both customer demand and efficiency gains. Advances in diagnosis and testing hold equal promise and risks, including over-diagnosis and subsequent unwarranted treatments, as well as adverse selection risk from genetic tests cheaply available to consumers.

While medical innovation and the increasing awareness around lifestyle impacts has increased longevity and life quality for many, we see significant counter trends. In many emerging markets, with modernisation and changes in diets and physical activity levels, there is increased obesity and diabetes. But even mature markets show unexpected declines in mortality improvement. The longer trends and underlying reasons warrant deeper analysis.⁶ In the US opioid crisis, excessive subscriptions for addictive painkillers has fuelled a fire of pre-existing social, demographic and health problems that a struggling health system has failed to cope with. Interconnections between demographics and health will remain an important field to follow.

⁴ See risk theme "Beggars thy neighbour? - Global trade reordered"

⁵ *World Population Prospects: The 2017 Revision, Key Findings and Advance Tables*, United Nations Department of Economic and Social Affairs, June 2017

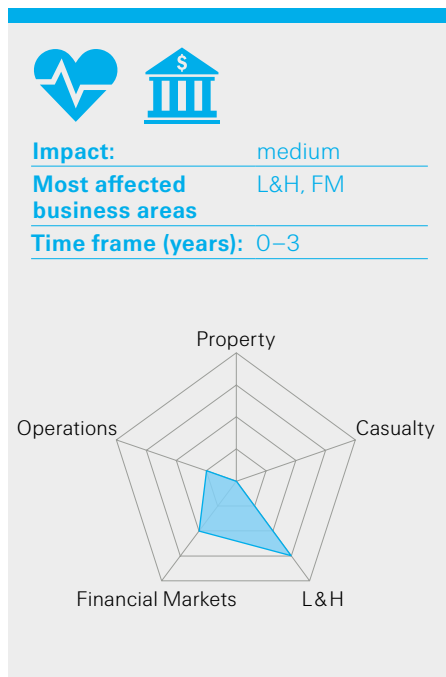
⁶ *sigma 6/2018 – Mortality improvement: understanding the past and framing the future*, Swiss Re Institute

15 Emerging risk themes and 5 Trend spotlights





Societal environment



Vaccination – a shot worth more than politics and profitability

One of the blessings of modern medicine is vaccination. Immunisation is a cost-effective way to keep many transmissible viral and bacterial diseases in check and, according to estimates of the World Health Organization (WHO), prevents 2–3 million deaths every year. But this achievement is under threat, due to questions around the economic viability of vaccine production and distribution and also what we see as weaponisation of vaccination in areas of conflict and with growing impacts of anti-vaccination campaigns. Vaccine shortages and refusal increase the likelihood of infection spread, which can potentially balloon to pandemic proportions, most notably for highly infectious diseases where herd immunity counts. The implications of a pandemic are most severe for life and health insurers. There are indirect implications for broader financial markets also.

For profitability reasons, the large pharmaceutical companies in the West are content to leave vaccine production to companies in new markets such as China. Globally, more vaccines are needed to fight diseases like hepatitis B or influenza and the supply chain has become increasingly based in the East. This results in new dependencies and the possibility of vaccine shortages in some locations, especially during periods of heightened political tension and national economic rivalry. Another danger we see is a lag in the development of new vaccines where the profit potential does not make for an attractive business case for pharmaceutical companies.

The WHO lists “vaccine hesitancy” among the “Ten threats to global health in 2019.”⁷ This “reluctance or refusal to vaccinate despite the availability of vaccines” is attributable, among others, to complacency, inconvenience in accessing vaccines and lack of confidence, the report says. Whatever the reasons, such attitudes risk the resurgence of otherwise avoidable dangerous diseases. A very recent case in point, in the US, there were 465 confirmed cases of measles across 19 states in the first quarter of 2019, the second largest outbreak since 2000 when measles were said to have been eliminated.⁸

The anti-vaccination movement derives legitimacy from cultural and/or philosophical rejection of vaccines as a force for good. However, in our view the politicisation of the anti-vaccination movement as a means of expressing dissent against domestic authorities and international organisations only heightens the risk of pandemics.

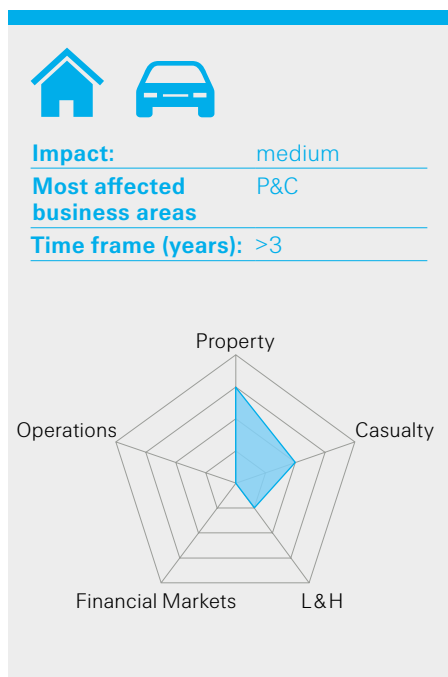
Potential impacts:

- Vaccines shortages and refusals increases the likelihood that infections will spread, increasing morbidity and mortality.
- Life insurers are exposed to higher claims in the case of a severe pandemic.
- A large pandemic can have significant impact on the health system and also mortality, with potential for large scale reduction of regional populations.
- A drop in productivity, due to many factors (eg, closed schools). Trade, travel and tourism will be subdued and economic output will be reduced.⁹ This affects financial markets and is therefore directly relevant for re/insurers’ balance sheets on both the asset and liability side.

⁷ *Ten threats to global health in 2019*, World Health Organisation, 2019

⁸ *Measles Cases and Outbreaks*, Center for Disease Control and Prevention

⁹ *Epidemics and Economics*, Finance and Development, Vol 55, No. 2, IMF, June 2018



Retirement skills gap – accidents waiting to happen

Almost one in five workers in the oil and gas industry is a baby boomer. This generation will retire in the next few years, which may lead to an expected shortage of 10 000 petro-technical professionals globally by 2025.¹⁰ Combined with current layoffs and fewer students enrolling in university courses as petro-technical professionals, this situation is threatening the safe operation of hazardous oil and gas installations. Such circumstances are troubling especially given that ageing facilities often run at peak capacity.

The same is true of healthcare. By 2030, there's likely to be a shortage of 15 million healthcare professionals globally.¹¹ This is worrying since the demand for healthcare services in developed markets will rise as the baby boomers retire. These two sector-specific scenarios can be extrapolated to developed economies as a whole. In all sectors, from manufacturing to engineering to financial services, many people will be retiring in the coming years, taking with them critical know-how and experience that technology can only in part replace.

Research shows that professional experience is a very important element for safety, and that an increase in workplace-related accidents in manufacturing industries can come as a result of outsourcing.¹² The safety of individuals at the workplace and general operational safety are closely related, and workplace safety records will be a sentinel for things to come.

What does this mean for insurance? An uptick in P&C, professional indemnity, medical malpractice as well as healthcare-related claims might be among the consequences.

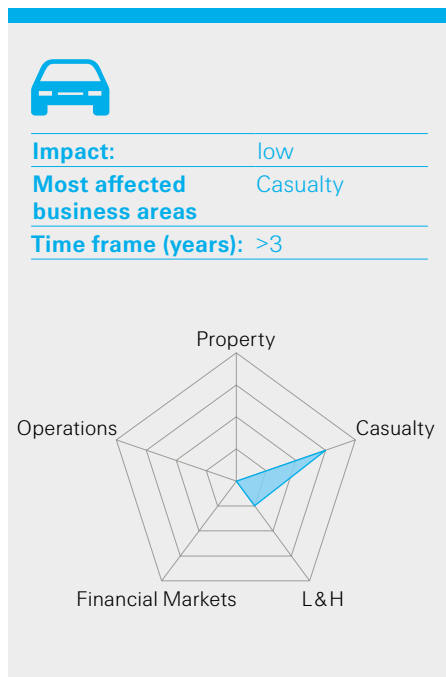
Potential impacts:

- A growing skills gap might cause more frequent occurrence of major accidents in hazardous industries and incidents in production and construction industry.
- Service industries could be exposed to more professional indemnity claims.
- A shortage of healthcare professionals might increase the risk of the healthcare industry to medical malpractice claims.
- A skills shortage in the healthcare sector will likely lead to increase costs in the provision of healthcare services, something that advances in technology will only in part offset.

¹⁰ *Retirement Wave and Digital Reinvention Prompt Urgent Talent Reassessment*, www.rigzone.com, 29 December 2017, and *The Talent Well Has Run Dry*, Accenture, 2017

¹¹ *Global Health Workforce Labor Market Projections for 2030*, World Bank Group, August 2016

¹² Sanna Nenonen, *Fatal workplace accidents in outsourced operations in the manufacturing industry*, Safety Science, Vol.49, Issue 10, December 2011



Concussion injuries in sport – head on to more widespread claims

Each year more than 42 million individuals are diagnosed with concussion, often resulting from sports or recreational activity.¹³ Millions more suffer sub-concussive blows, where the intensity of impact is not sufficient to result in a clinical diagnosis of concussion. Repetitive head trauma has been linked to many conditions that have latency periods of years or even decades, such as Parkinson’s disease, Amyotrophic Lateral Sclerosis (ALS), dementia and Chronic Traumatic Encephalopathy (CTE), a progressive neurodegenerative disease which currently can only be diagnosed post death. Researchers are getting closer to being able to identify CTE in the living and this is expected to significantly increase the number of diagnoses.¹⁴ There is also increasing evidence that even a single concussion experience may result in an increased risk of Parkinson’s disease and dementia, or have lasting impact on cognitive function.¹⁵

Head trauma is not only a concern for professional athletes. CTE has been discovered in individuals who only played youth or college sports, including athletes and (American) football, soccer, rugby, basketball and baseball players.

The discovery of the long-term risks of head trauma has sparked high-profile litigations in the US, filed by athletes against professional sports organisations such as the National Football League (NFL). That lawsuit was settled for an uncapped amount, estimated to be well over USD 1 billion. Hundreds of other suits remain pending, against collegiate sports governing bodies, helmet manufacturers, youth sports organisations, and dozens of individual colleges and universities.

The number of people potentially affected, the increased attention on head trauma, and the size of the NFL settlement are just a few of the factors that make this a true emerging risk.

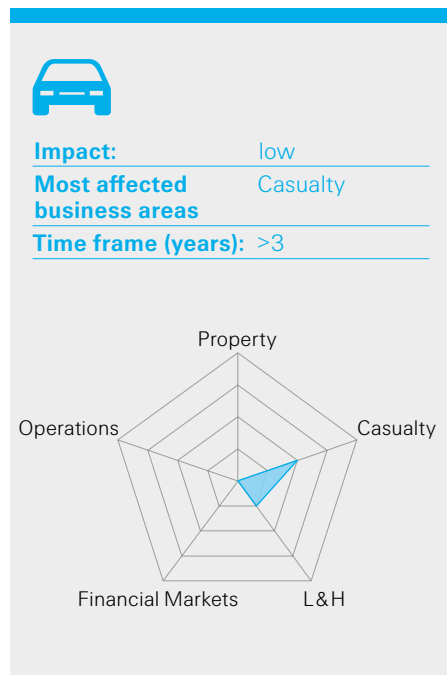
Potential impacts:

- Broader awareness of the issue will increase concussion diagnoses, as more people seek medical attention. This will trigger liability insurance, but also impact on life and health books.
- Additional litigations are to be expected due to the size of the NFL settlement and rising awareness of long-term risks increases.
- Enactment of youth concussion laws and revised rules/guidelines by sports organisations may increase requirements on standards of care and potential liabilities.

¹³ Kathryn L. Van Pelt et al., *A cohort study to identify and evaluate concussion risk factors across multiple injury settings: findings from the CARE Consortium*, Injury Epidemiology, Vol. 6, No.1, 2019

¹⁴ Nadia Kuonang, *A study of NFL players’ brains might help diagnose CTE in the living*, CNN, 10 April 2019, and *Study suggests path to detecting CTE in the living*, Associated Press, 11 April 2019

¹⁵ Barlow et al., *Investigation of the changes in oscillatory power during task switching after mild traumatic brain injury*, European Journal of Neuroscience, Vol. 48, No. 12, 2018; and Nina Bai, *With Dangers of Everyday Concussions Revealed, Scientists Race to Find Solutions*, UCSF Research, October 17, 2018



A celebrity body – the hazards of aesthetic surgery tourism

More people are travelling abroad for medical procedures such as plastic surgery and dentistry. The reasons include lower costs, no coverage for the treatment under home country healthcare plans, lack of access to required treatment in the home country, better quality of treatment and reduced waiting time. Travelling abroad for plastic surgery beauty enhancement treatments not covered by healthcare insurance policies is especially popular.

Experts have put the dramatic growth of plastic surgery down to a rise in the number of celebrities promoting cosmetic procedures, cultivating a consumer-base conditioned to desire new norms in body shapes and looks. Researchers at the Boston Medical Center have found the kinds of facial surgery people are requesting now include nasal and facial symmetry, rhinoplasties, hair transplants and eyelid surgical procedures.¹⁶

Cosmetic surgery poses pressing problems. A report by the Nuffield Council on Bioethics outline the risks of this lucrative market in the UK.¹⁷ The absence of a coherent regulatory framework means that often non-specialist or underqualified physicians perform aesthetic procedures without adequate infrastructure, sometimes with devastating consequences. When undertaking treatment abroad, the patient and physician may not speak the same language fluently. This increases the risk of misunderstandings, wrong treatments and undesired effects.

It's not always clear if health insurance in the home country covers the additional costs originating from planned procedures abroad. This relates to rules on medical malpractice and its insurance, for example, regarding whether insurers have to cover costs from unplanned procedures abroad and if these costs can be recovered. Moreover, given difference in regulatory practices by jurisdiction, it can be difficult to assign the weight of responsibility. Given the high growth of cosmetic plastic surgery both at home and abroad, it's likely that in the future answers to these questions will more often come out of the courtroom.

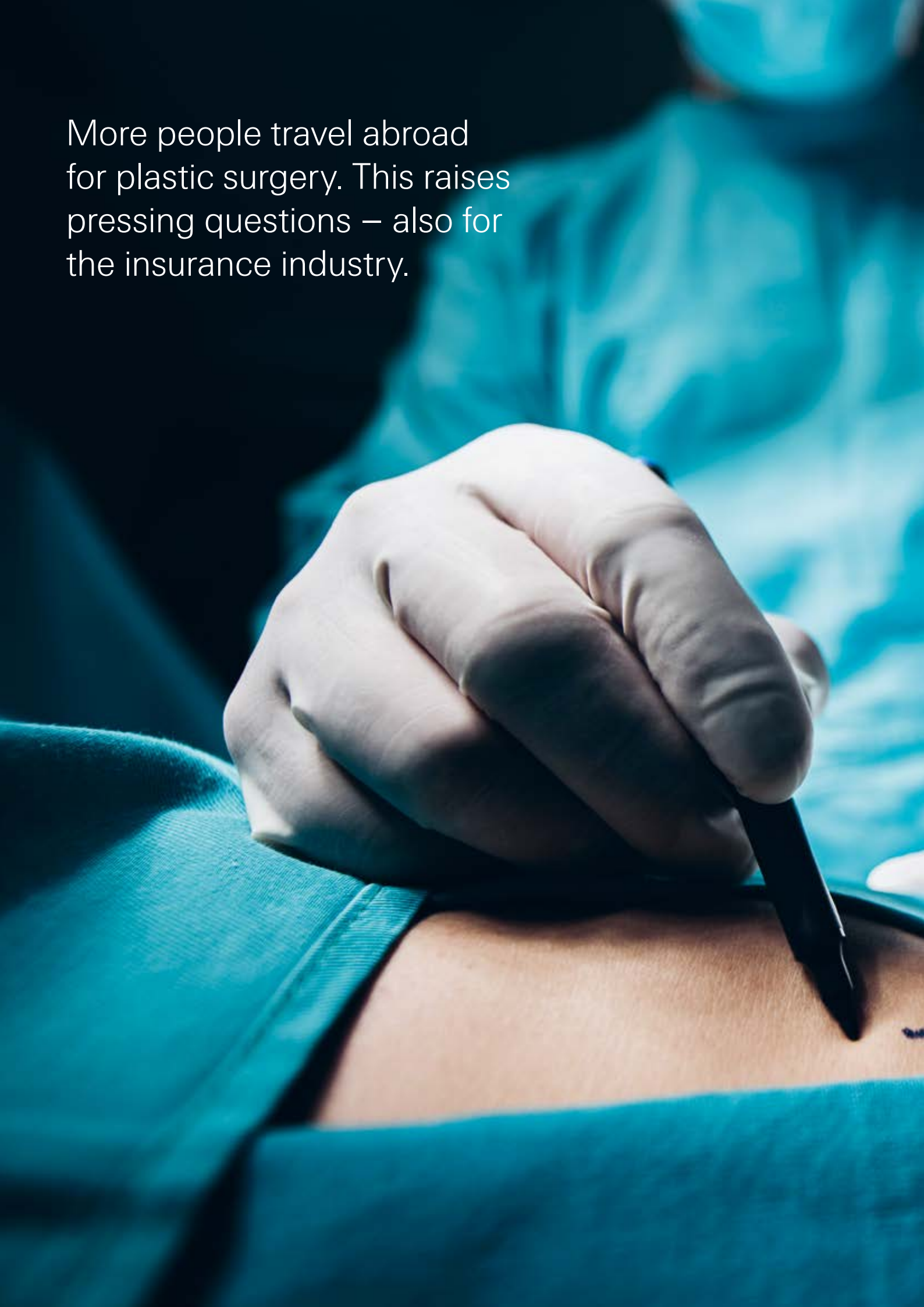
Potential impacts:

- An unclear situation about medical malpractice claims in this area could trigger defense costs and later even the claims themselves.
- Manufacturers of the products and equipment used in cosmetic procedures are competing in a lucrative market, with different approval and oversight processes in different jurisdictions. Product liability claims for related implants could become an issue.
- Medical standards – also for procedures and related care services – may be of poor quality in some countries. If medical travelers do not research their chosen medical centre, they may find themselves with unwanted and potentially dangerous results.
- Antibiotic resistance is a global problem. Resistant bacteria may be picked up in countries with a high prevalence of superbugs in hospitals.
- For operations abroad, flying after surgery can increase the risk of blood clotting.

¹⁶ Susruthi Rajanala, Mayra B.C. Maymone, Neelam A. Vashi, *Selfies – Living in the Era of Filtered Photographs*, JAMA Facial Plastic Surgery, Vol. 20, No. 6, 2018

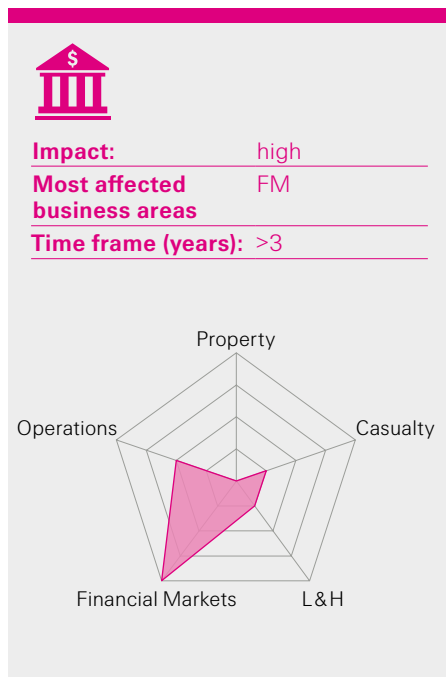
¹⁷ *Cosmetic procedures: ethical issues*, Nuffield Council on Bioethics, 2017

More people travel abroad for plastic surgery. This raises pressing questions – also for the insurance industry.





Political environment



Limits to tinkering – the fiscal and monetary policy balance at risk

Since the global financial crisis, the world's major central banks have engaged in extraordinary policy measures resulting in massive expansion of their balance sheets. With central banks running out of tools to stimulate the economy, the growing consensus is that another economic downturn will need a fiscal response. The key question is what form of fiscal activism we might see. One idea – similar to the case of Japan – is to combine increased fiscal spending with more ultra-accommodative monetary policy, such as quantitative easing (QE) or yield curve control.

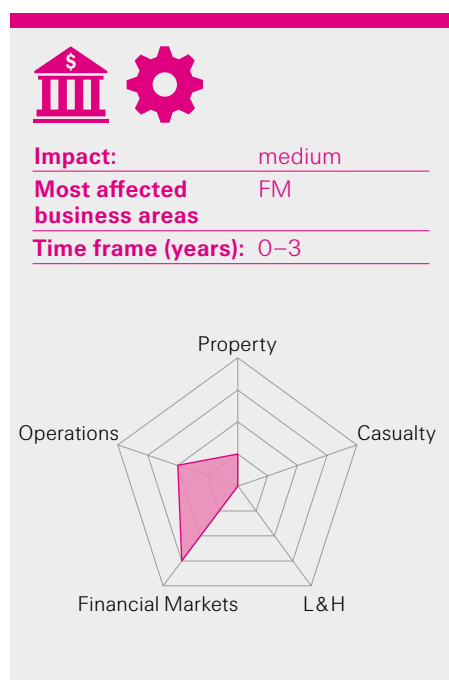
There are still more radical proposals. One example is outright “helicopter money”, where central banks use their balance sheets to absorb the increase in government borrowing. This would be different from QE in that central banks would pledge to keep government bonds on their balance sheets indefinitely. Another idea that has gained traction recently is Modern Monetary Theory (MMT), which some argue is neither modern, monetary nor a theory. Under MMT, fiscal rather than monetary policy acts as the main stabilisation tool for the economy, while low interest rates are used to keep public finances sustainable.

While officially central banks retain their independence, the closer coordination with government raises questions about how true that is. We think outright regime shift towards alternative monetary/fiscal frameworks such as MMT is unlikely in the near-term. That said, we do expect fiscal policy to play a significantly bigger role, this at a time when global leverage is already close to historic highs, both to stimulate economic growth and to reduce income and wealth inequality. The degree and design of fiscal dominance will be important to monitor as it could have significant consequences for the economy and financial markets, including the insurance sector.

In a fairly benign scenario of closer policy coordination amid low inflation, a prolonged period of low interest rates would be the most likely outcome. By contrast, an outright regime change in the fiscal and monetary policy framework, such as MMT, could notably increase uncertainty around the inflation outlook and financial market stability. In the long-run, this could result in much higher inflation and interest rates, with broad repercussions on financial markets.

Potential impacts:

- The economy and financial markets, including the re/insurance industry, could benefit if changes to fiscal and monetary policy stimulate growth and financial stability.
- On the flipside, a policy shift could lead to a notable rise in uncertainty, causing higher financial market volatility and significant declines in asset valuations.
- If central banks (are forced to) keep interest rates low to accommodate increased fiscal spending, the insurance industry would suffer, in particular life insurers.
- Meanwhile, an unexpected and sustained increase in inflation – also a potential consequence of a regime change – would be harmful for the re/insurance industry, in particular for inflation-sensitive liability lines of business. At the same time, however, life insurers would benefit from a potential increase in interest rates as their liabilities typically have a longer duration than their assets



Beggar thy neighbour? Global trade reordered

As with other multinational businesses, insurers have become used to basic global rules that made global commerce more predictable. But the rules-based trading system is now in crisis. The very existence of the World Trade Organization (WTO) – which governs a thriving global commerce – is being questioned, most notably by its architects. For international businesses, this fundamental challenge is aggravated by regulatory fragmentation and shifts to revenue-based local taxation.

The significance for re/insurers is that regulatory restrictions and capital requirements may threaten business models based on global risk diversification and efficient capital management¹⁸. The US – architect of the current global trade order – no longer regards trade as the “tide that lifts all boats”, but rather as a zero-sum game. The Trump administration questions the WTO’s dispute settlement system and favours new trade agreements, based on bilateral relationships. There is now real danger of open trade conflict between the world’s major trading blocs: the US, the European Union and China. The named three are all shaping their own trade networks. Further US disengagement from global geopolitical affairs and multilateral institutions for example, as well as the pursuit of trade policy through aggressive use of tariffs, withdrawal from existing agreements, and bilateral renegotiations, will significantly reduce the odds of bilateral deals.¹⁹

The Chinese approach differs, evolving around sweeping investments of billions of dollars into infrastructure projects in 60 countries under the umbrella of the Belt and Road Initiative. The goal is to create a network of trade routes connecting east and west. It has attracted many cheerleaders but also drawn harsh criticism. The European Commission now considers China both a strategic partner and an economic competitor. It in turn is showing a tendency to join the state mercantilist bandwagon by backing national champions, restricting foreign direct investment in sensitive sectors, and seeking trade deals in its favour.

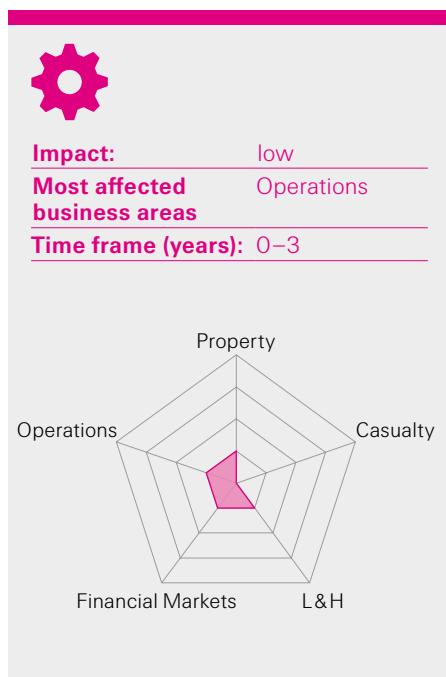
As a result, multilateral trade liberalisation – a significant driver of globalisation and prosperity during the past two decades – has come to a halt. Trade architecture is no longer dominated by a Western alliance, but by competing architects building their own systems and channels. These competing trading blocs negotiate and revise agreements, putting greater emphasis on immediate domestic priorities as well as special interests. Multinational re/insurers will discover new opportunities but must also navigate previously unseen risks.

Potential impacts:

- Multinationals, including re/insurers and banks, risk getting caught between competing spheres of power.
- Regulatory restrictions and capital requirements may reduce market access and threaten business models based on global risk diversification and efficient capital management.
- Local political events may have outsized consequences, including on financial markets, if amplified by geopolitical dynamics (eg. elections in the Maldives becoming a proxy contest between India and China)
- Higher infrastructure project risk resulting from lower standards and less scrutiny due to the absence of respected multilateral agencies
- (Over)-sized projects – partly driven by short-term political interests – increase the risks of unprofitable underwriting of white elephants, for instance railroads without passengers.
- Legal risk of any litigation in unchartered jurisdictions

¹⁸ OECD, *The Contribution of Reinsurance Markets to Managing Catastrophe Risk*, Dec. 2018.

¹⁹ B. Eichengreen, A Mehl and L Chițu, *Mars or Mercury Redux: The Geopolitics of Bilateral Trade Agreements*, ECB Working Paper No. 2246, February 2019



Conflicting interests – the widening urban-rural divide

The world is urbanising rapidly. More than 50% of world population already resides in cities. While Europe has 35 cities of a million people or more, China will have an estimated 225 by 2025.²⁰ Cities host many of the world’s top research institutions, and the presence of major international business makes them ideal locations to bring together university, government, and private R&D efforts. Capital, knowledge and creativity feed from one other and turn cities into engines of growth, wealth and opportunity.

The flipside is the relative status loss of semi-urban and rural regions. The widening gulf between empowered urban centres and disenfranchised rural peripheries translates into contrasting economic and social realities. In Latvia, for example, about half the country’s population lives in the metropolitan area of its capital, Riga, which generates about 70% of the country’s economic output. While Riga’s standard of living reaches the EU average, in the poorest rural regions, the standard of living is just a third of that average.²¹

Such socio-economic contrast polarises cultural values and political interests. It nurtures resentment and it divides public discourse. The growing political opposition between urban centres and rural periphery is not confined to Latvia. It reflects a broader global development: people who are outward-looking, embrace globalisation and share “progressive” cultural norms tend to live in cities; those rooted in local communities and uphold traditional values tend to live in the rural periphery.

The electoral landscape offers some evidence that a growing cultural divide and segregation between “city” and “countryside” can translate into different political preferences and create unexpected outcomes. Examples include the US presidential election of 2016 and the UK’s referendum to leave the EU. In both cases, the peripheral and rural areas outvoted the large cities and metropolitan areas. With persistent division and growing alienation between the poles, more “surprises” may well be forthcoming. For example in the EU, there is evidence that population density is a powerful driver of anti-system voting: regions and localities with lower density are more prone to support anti-European integration parties.²²

Potential impacts:

- The rapid growth of cities increases economic value concentration. This offers opportunities for the insurance sector, but also accentuates risk accumulation.
- Rural-urban antagonisms could increase market uncertainties, curb investments and endanger functioning supply chains. The cumulative negative impact on financial markets would present challenges for insurers.
- A growing gap between urban centres and the rural periphery could endanger the internal cohesion of territorial states, fan separatist tendencies and make finding policy solutions acceptable to all national socio-economic groups more challenging.
- Economic development could slow if electoral choices and social protests from rural communities prevent policies that enable cities to thrive.
- The (perceived) alienation of geographies and specific regions or localities could create resentments that bring more extremist parties into power, making political and regulatory framework conditions more volatile and detrimental for insurance business.

²⁰ *The Great Migration: Urban Aspirations*, Policy Research Working Paper 6879, The World Bank, 2014.

²¹ Rudolf Hermann, “Riga und der Rest des Landes”, *Neue Zürcher Zeitung*, 29 January 2019.

²² Lewis Dijkstra, Hugo Poelman, and Andrés Rodríguez-Pose, *The Geography of EU Discontent*, European Commission Working Papers, Directorate-General for Regional and Urban Policy, 2018



Emerging trend
spotlight
**Shifting litigation
regimes**

Litigation funding and class actions, especially prevalent in the US, are becoming increasingly popular in other parts of the world.

Litigation funding is the upfront payment by a third party of fees associated with a litigation case – such as the plaintiff’s own legal costs, or the Adverse Cost Order in case the plaintiff loses – in return for a slice of the compensation received as a result of the lawsuit filed. The ongoing low interest environment makes litigation funding more lucrative to investors and thus drives propensity to sue. In turn, this may lead to more successful – and expensive – insurance claims and ballooning defence costs for the insurer. Well-known in the US, recently the practice has become more prevalent in the APAC region, South Africa and the UK. A landmark decision by the UK court of appeal concerning Mastercard and its fees, greatly lowered the threshold for class actions to proceed. The court also explicitly welcomes third-party funding for litigation. While a further appeal is likely, it is an on-going case example that illustrates that companies in the UK will be needing to spend significant amounts of money to defend against an uptick of class actions. Some of the largest funders, in some cases publicly-traded companies, have significant activities outside the US.

For the insurance industry, the mechanism is a double-edged sword. On one hand, it boosts opportunities to provide products and services to clients facing growing need for liability and legal expenses covers. Stronger consumer protection laws also drive pressure on producers to manage their liability risks by way of product safety and adequate insurance cover. On the other hand, the increased use of third-party funding can result in claims proliferation, longer litigation, more exposure for insurers defending such claims and higher settlement costs. Another worrying trend is the potential of governments to sell its law enforcement authorities to private firms in exchange for a payout. An example is the recent recruitment of external legal counsels by the Office of Attorney General, D.C for climate change litigation. These external counsels will be paid through the contingency fee arrangements in the event of damages awarded by the court.

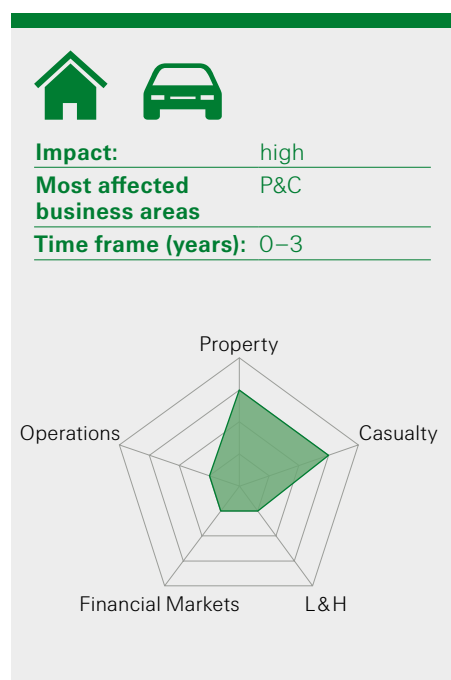
The other development – class actions – is focused in Europe. Influenced by scandals such as “Dieselgate”, the European Commission has proposed a “New Deal for Consumers.”²³ This would entail the introduction of a directive on representative actions for the protection of the collective interests of consumers. The core of the proposal is that a qualified entity would be able to bring a representative action before a Member State court or other administrative authority on behalf of classes of consumers. Where Member States do not already allow class actions, they would be required to introduce them. Nevertheless, while the above proposed directive provides progress, a deluge of litigation may not yet be in the inevitable trend due to adverse costs risks, as funders and insurers need to carry out significant due diligence on the cases they may invest in.

The European Commission considers only litigation-based class or representative actions, but these are not the only mechanisms for collective redress nor the most efficient. Conceivable alternatives include “regulatory redress” with regulatory authority intervention, which would be an agreement or order for redress to be paid. If coupled with an ombudsman scheme, such an alternative dispute resolution (ADR) could present a promising path.²⁴ The Commission’s “New deal” proposal is subject to political negotiations between the European Parliament and the Council. The outcome will have important consequences for the insurance industry.

²³ *Review of EU consumer law – New Deal for Consumers*, European Commission, 2017

²⁴ Christopher Hodges, *Collective Redress: The Need for New Technologies*, Journal of Consumer Policy, 2018

Technological and natural environment



Teaching an old dog new tricks – digital tech meets legacy hardware

Digital solutions and old hardware don't always harmonise. A prime and real example happened on 13 July 2017 when thousands of commuters were stranded during peak rush hour as the metro network in Melbourne went into meltdown.²⁵ The reason was that a 40-year-old interface board being used to connect to the new digitised software was not able to handle the input to the system's tracks and signals, which themselves were also outdated.

This example illustrates the existing challenge. Standard procedure is to seek to improve the operational efficiency of old assets with software enhancements. Technological improvements on software are made on an ongoing basis to keep pace with increasing capacity and complexity of demands. Much hardware, though, is still of yesteryear.

We see an increasing dovetailing of old and new structures, often in areas of critical infrastructure, including smart electric power grids or pipelines, hospitals or cash points. New technology as part of industry 4.0 – a term used to describe technologies like artificial intelligence, quantum computing, 3D printing and IoT in eg production processes – applied to legacy solutions changes the existing risk landscape. While it reduces some old exposures, it also gives rise to new risks. To this end, insurers need to continuously re-evaluate their risks assessments and adapt their underwriting approach to technological innovation as applied in complex, multi-stage, multi-party and sometimes multinational nature construction projects, as well as in legacy infrastructure.²⁶

Potential impacts:

- Large infrastructure breakdowns or accidents triggered by new software not working with old hardware can lead to property damage, bodily injury and business interruption claims. There are also new forms of cyber risks to date not priced for.
- Large failures of key infrastructure like power or communications can also impact operations of the insurance industry.
- As technology increases connectivity, insurers face higher risk accumulation and unexpected losses potential from the combination of new software with old hardware.
- While technological innovation can lead to reduced claims frequency in certain areas (eg, advanced driver-assistance systems for vehicles), it may also increase claims severity by introducing new exposures to an existing risk landscape.

²⁵ Andie Noonan, *Melbourne suffers peak-hour train delays after computer fault*

²⁶ *sigma 2/2018 – Constructing the future: recent developments in engineering insurance*, Swiss Re Institute



Emerging trend
spotlight
**The surveillance
economy**

Many of this publication's readers probably have a social media account. Whether used for professional purposes, to stay in touch with old friends, or exchange views and perspectives, participants benefit from a network of connections which they otherwise would not have access to. And all this for free.

But ... just as there's no such thing as a free lunch, there's no such thing as a free internet platform. So how do we pay for these services? We're told that they're funded by the ads that show next to the content we're consuming. We're not that interested in why and how the advertiser chooses to show us that particular commercial at that particular time of day or period in our lives. All the while, however, our online activity – our data – is being used to analyse patterns and predict behaviours, for sale on to the highest bidder. Monetising data is key for corporate profit. According to a recent study, a company is 2.6 times more likely to grow at more than 10% if it monetises data.²⁷

The most mundane activities may lead to surprising conclusions. For example, the type of music we listen to online can be analysed for signs of depression, and this information can be then sold for advertising purposes to a medical company. Data on sleep patterns and activity from wearables can be used to confirm the signs of depression gathered from the kind of music we listen to. All this happens without our conscious knowledge and without recourse because our cars, phones, and homes have an increasing number of sensors that link our online and offline lives. Once this knowledge about us has been created, there's no easy way to change it.

For corporates as well as for consumers, today's surveillance economy can generate advantages. Individuals' willingness to "pay" with their data instead of money may translate into competitive advantage and cheaper services. It also helps link consumers with products and services best suited to their needs. On the darker side, however, the surveillance economy can be construed as intrusive and even Orwellian. The constant collection of our data means we are constantly being observed, analysed, compared and rated. And, by knowing what motivates us and understanding our belief systems, corporates can manipulate us, distort the market economy with their asymmetrical knowledge and even the democratic processes by manipulating information flows.

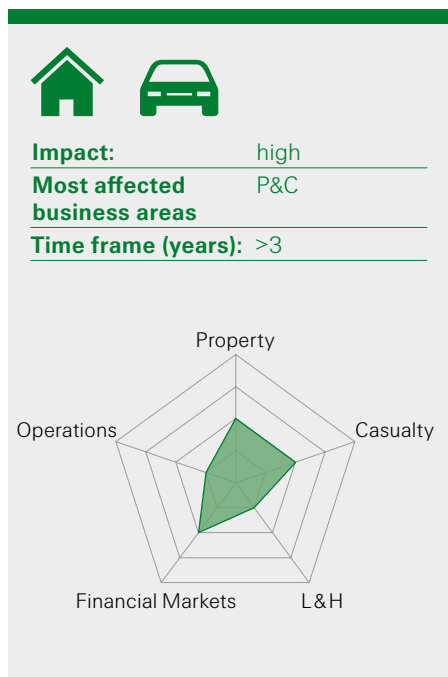
So what are the implications for insurance? According to a recent study on auto insurance, drivers participating in pay-as-you-drive programmes where their driving is monitored and their insurance premiums adjusted based on the data from the car, become 30% safer as a result.²⁸ This means that monitoring results in safer behaviour, improving the quality of life for the driver and lowering the claims for the insurance company. On the other hand, should an insurance company also receive data from music streaming services about our potential depression, it still may draw inadequate conclusions from correlations, end up reserving excessive amounts for our future medical treatment or face reputational risk and regulatory scrutiny.

²⁷ *The Dark Side of Data Commercialization*, Forrester Research, 19 April 2018

²⁸ Yizhou Jin, Shoshana Vasserman, *Buying Data from Consumers – The impact of monitoring programs in US auto insurance*, Harvard Business School, 21 January 2019

5G mobile networks will enable wireless connectivity in real time – a prerequisite for broad use of autonomous cars.





Off the leash – 5G mobile networks

5G – short for fifth generation – is the latest standard for cellular mobile communications. Providing ultrafast broadband connection with higher capacity and lower latency, 5G is not only heaven for your smartphone. It will enable wireless connectivity in real time for any device of the Internet of things (IoT), whether that be autonomous cars or sensor-steered factory. In doing so, it will allow decentralised seamless interconnectivity between devices.

To allow for a functional network coverage and increased capacity overall, more antennas will be needed, including acceptance of higher levels of electromagnetic radiation. In some jurisdictions, the rise of threshold values will require legal adaptation. Existing concerns regarding potential negative health effects from electromagnetic fields (EMF) are only likely to increase. An uptick in liability claims could be a potential long-term consequence.

Other concerns are focused on cyber exposures, which increase with the wider scope of 5G wireless attack surfaces. Traditionally IoT devices have poor security features. Moreover, hackers can also exploit 5G speed and volume, meaning that more data can be stolen much quicker. A large-scale breakthrough of autonomous cars and other IoT applications will mean that security features need to be enhanced at the same pace. Without, interruption and subversion of the 5G platform could trigger catastrophic, cumulative damage. With a change to more automation facilitated by new technology like 5G, we might see a further shift from motor to more general and product liability insurance.

There are also worries about privacy issues (leading to increased litigation risks), security breaches and espionage. The focus is not only on hacking by third parties, but also potential breaches from built-in hard- or software “backdoors.” In addition, the market for 5G infrastructure is currently focussed on a couple of firms, and that raises the spectre of concentration risk.

Potential impacts:

- Cyber exposures are significantly increased with 5G, as attacks become faster and higher in volume. This increases the challenge of defence.
- Growing concerns of the health implications of 5G may lead to political friction and delay of implementation, and to liability claims. The introductions of 3G and 4G faced similar challenges.
- Information security and national sovereignty concerns might delay implementation of 5G further, increasing uncertainty for planning authorities, investors, tech companies and insurers.
- Heated international dispute over 5G contractors and potential for espionage or sabotage could affect international cooperation, and impact financial markets negatively.
- As the biological effects of EMF in general and 5G in particular are still being debated, potential claims for health impairments may come with a long latency.



Emerging trend
spotlight
Smart construction

The building industry is under construction. Projects are getting more complex, costs are rising and pressure to build quickly is increasing. Driving this trend is growing populations, a global shift towards data-driven solutions, and the increased costs of natural disasters. The last two years were the costliest annual back-to-back period ever in terms of insurance industry losses resulting from natural disasters. The natural catastrophe losses for 2017 and 2018 combined were USD 219 billion.²⁹

The above factors are driving change in construction, with greater use of new technologies such as 3D printing, drones, wireless sensors, site automation and prefabricated components. In essence, smart construction is a drive to digitisation. From an insurance perspective, while more data can mean more accurate pricing, there are also challenges regarding data quality and security. Consequently, with increasing use of computer software and automation, associated risks may shift from human error to mechanical malfunction. Risks include cyber vulnerability, data corruption and loss, and inaccurate predictions due to defective modelling.

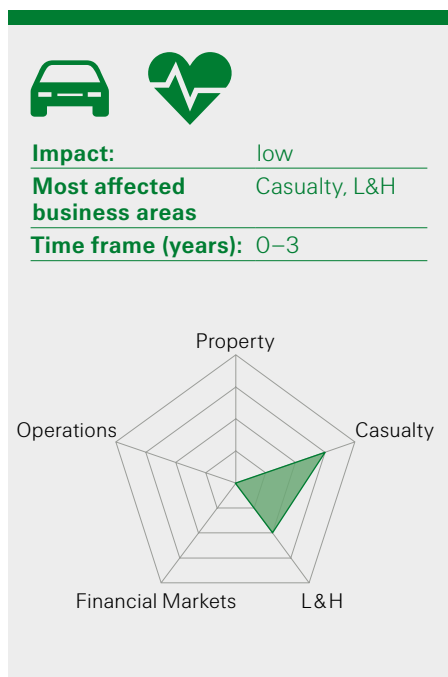
In 2016, the Dubai government launched its 3D Printing Strategy, with the aim of constructing 25% of buildings using 3D printing technology by 2030. In 2015, a Chinese construction company built the Mini Sky City, a 57-storey skyscraper in central China in 19 working days. The rapid build time was achieved by having 90% of the structure prefabricated in a factory. In Japan, machinery manufacturer Komatsu has been using smart construction technologies since 2015 in over 3 300 sites across the country. This entails using specialised drones to conduct survey work in under one hour, a process that could typically keep many workers busy for several days. An added benefit of such technology could be an increase in worker safety.

All told, traditionally the construction sector overall has been slow to innovate. One factor holding back adoption of new technologies is lack of sufficient data to substantiate the value of offsite manufactured assets across the construction lifecycle. A number of governments, including in the UK, Singapore and Finland, have been making steps towards a more data-driven approach to construction. For instance, they now mandate use of Building Information Modelling (BIM) for public projects to standardise the sharing and exchange of information concerning the construction and post-construction management of a building.³⁰ But BIM is far from being adopted by all players, especially smaller construction companies. Driving more universal shift to this technology remains a challenge.

As with many other trends in the digital age, to stay competitive insurers must develop new ways to locate, manage and analyse data. At the same time, of paramount importance is to strengthen industry oversight and not overestimate the impacts of innovation. In our view, this will be the only way to protect and advance the principles of sound construction methods.

²⁹ *sigma 2/2019* op. cit. Read more in *Natural catastrophes and man-made disasters in 2018: "secondary" perils on the frontline*, Swiss Re Institute, 10 April 2019

³⁰ *sigma 2/2018*, op. cit. Read more in *Digitalisation and its impact on the construction and insurance industries*, Swiss Re Institute, 4 October 2018



Wiggle room – Artificial Intelligence and healthcare

Medical imaging and related diagnostics are being enhanced by Artificial Intelligence (AI). The US Food and Drug Administration has already approved AI software to support the detection of strokes and fractures based on MRI images.³¹ More will follow soon, with many applications beyond imaging pending approval.

Investments in AI healthcare are surging globally. In places where healthcare provision is practically non-existent, affordable AI-driven systems can make treatments more accessible. And in developed countries, a shortage of healthcare workers and instant accessibility and cost efficiency will help build the value proposition and acceptance of AI-driven treatments.

A word of caution, however. Errors in healthcare can have big implications, and longer-term trust in AI-assisted treatments could suffer. Currently, the outcomes generated by AI lack a certain degree of transparency and, thus, accountability. While black-box AI may be fine for shopping, that’s unlikely to be the case where AI leads to a wrong decision being made in a healthcare treatment scenario. Patients and insurers alike will need to understand how AI is involved in a doctor’s action, and who can be held liable.³²

Insurers of health-related products should continue to engage with healthcare providers, regulators and customers to ensure proper review of risks of AI in healthcare. Other aims of such dialogue should be to reduce short-term costs and possible liabilities, create standards for explainability and transparency, and shape public perception of AI as being innately beneficial to the provision of healthcare services.

Premature adoption before issues around accuracy, explainability and privacy issues are solved may do more damage than good. A careful, progressive approach, adopting technology that is commensurate with the risks and needs, and that complements human capabilities, is in the longer term interest of patients, healthcare providers and insurers.

Potential impacts:

- In many cases, diagnostics can become more accurate, especially regarding medical imaging. The reverse is true if errors occur leading to catastrophic personal outcomes. In most situations, human interpretation of AI-assisted insights will be a key feature.
- Data used for machine learning may enhance rather than reduce bias, so explainability for ethical and regulatory purposes will be essential, as will be scrutiny of the algorithms used and the decisions taken.
- On the upside, AI in healthcare may enable around-the-clock availability and low cost, thus increasing accessibility to more people.
- Used in conjunction with devices, AI could monitor health 24/7, allowing more rapid identification of problems and better outcomes.
- AI applied to big and combined databases could enhance understanding of health issues, and enhance diagnostics and treatment strategies. However, issues around privacy, compatibility and security need to be overcome first.

³¹ *FDA permits marketing of artificial intelligence algorithm for aiding providers in detecting wrist fractures*, US Food & Drug Administration, 24 May 2018, and *FDA permits marketing of clinical decision support software for alerting providers of a potential stroke in patients*, US Food & Drug Administration, 13 February 2018

³² “Blame your robot – emerging artificial intelligence legislation”, *SONAR*, Swiss Re, 2017



Emerging trend
spotlight

The warehouse of the future

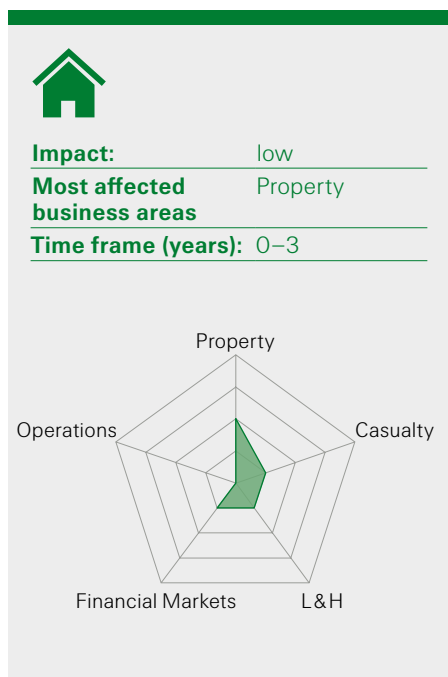
The warehouse is the backstage room in retail or department stores, where customers are handed the product they came to the store to buy. If it can't be found in the display, it may still sit in the warehouse. These repositories are the logistical link between increasingly globalised supply chains and consumers on the ground. Warehouses have been around for centuries, and now they are undergoing a revolution.

Being relatively closed and controllable systems, warehouses are hotbeds for automisation and robotics. In the warehouse of the future, robotic shelves will move around at high speed. They will feed batches that leave the warehouse, or feed from batches that restock it. Collaboration between humans and robots will continue to be important in the fully automated warehouse. But where humans are involved, they'll only interact from safe islands.

This system is already reality in retail, particularly in pharmacies. A pharmacist feeds the name of a certain drug into the registry system, which is then automatically retrieved from the repository without human involvement. The system also automatically re-orders products, and controls the warehouse according to demand and expiration dates. Informed by former sales, predictive analytics enables optimisation.

On-the-spot 3D printing will gain prominence for certain trades to accommodate demand for customisation and spare parts. Warehouse are set to become much more dynamic, with extended functionalities. Online trade has made front stores redundant: it's no wonder that companies like Amazon are at the forefront of warehouse innovation.

With respect to insurance, we see new risks and opportunities emerging from the more complex, automated and interdependent systems. First, the new warehouses represent a new fire hazard, with high-value concentration risk. If fire protection systems do not work, both the value of the content and the whole supply chain are at risk. With fewer humans and more technology, product liability and professional indemnity losses (for warehouse consultants and engineers), as well as property business interruption losses from flawed hardware and software will gain prominence, while single-loss events from human failure will become more rare. That said, the increasing interconnectivity could also mean a trend towards higher impact loss events, with just one (human or technology) failure having greater consequences.



Resilience at stake – forests’ vital functions under threat

Almost a third of our planet’s land surfaces is covered by forests. By storing carbon and water, and helping regulate our climate, forests are of enormous value to life.³³ Forests also provide important services like timber, drinking water, food, land slide and storm surge protection, pollinators for agriculture and with their biodiversity genetic resources for pharmacology.

Despite all this, survival of these natural resorts of resilience are coming under ever-increasing pressure. So much so that the destruction of the Amazon rainforest could reach a point where the ecosystem transforms irreversibly into a savannah-like state, with the loss of current benefits accumulating to USD 5 trillion.³⁴ The situation is just as bad in other parts of the world, such as the Philippines or Indonesia. Key drivers of the destruction of forests are land clearance for agriculture and illegal logging.

Another main concern is that deforestation is in itself a major contributor to climate change, accounting for nearly 20% of global greenhouse gas emissions, more than the whole global mobility sector.³⁵ This is a self-perpetuating disaster scenario, as under drier and warmer conditions, climate change has also led to increased frequency and intensity of forest fires in Canada, for example. Furthermore, monoculture tree plantations such as for paper are less resilient vis-à-vis natural perils like extreme weather conditions/storms that are occurring more frequently as climates change.³⁶

Potential impacts:

- The agriculture sector and associated insurance lines are impacted by water scarcity in deforested areas and by loss of protection from floods, landslides and avalanches.
- Life and health insurance may be impacted via the spread of diseases from cleared forests into cities, driven by increased road access to forests where epidemics can spread from animals to people.³⁷
- The biodiversity of forests is deteriorating, putting at risk the cheapest source of clean drinking water, and also undermining the role of forests in protecting us from landslides and storm surges.³⁸ The related economic activities provide an important basis for forestry and agricultural risk transfer to insurance companies.
- There is a vast potential for insurance as today’s commercial forests remain largely uninsured, while an increasing number of commercial forest companies are looking for risk protection/transfer solutions.
- Combined with effective forest management, forestry insurance can strengthen the resilience of forests and reduce emissions from degradation and deforestation.³⁹

³³ Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC, 2014

³⁴ Franklin, S and R Pindyck *Tropical forests, tipping points, and the social cost of deforestation*, Ecological Economics, Vol. 153, 2018

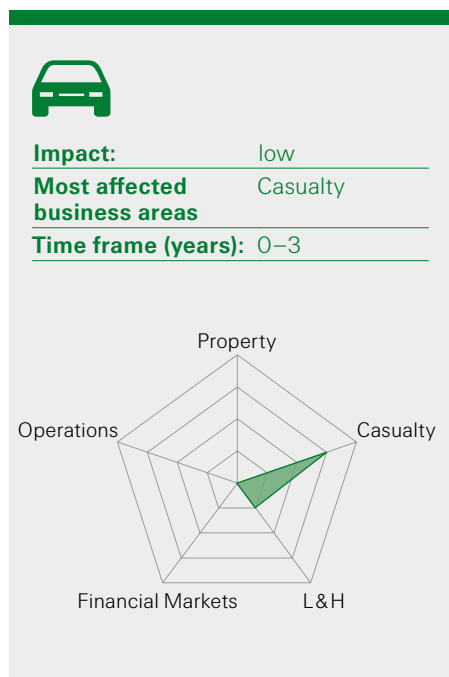
³⁵ https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf

³⁶ Adam Felton et al., *Replacing monocultures with mixed-species stands: Ecosystem service implications of two production forest alternatives in Sweden*, US National Library of Medicine and National Institutes of Health, February 2016

³⁷ Jim Robbins, *How Forest Loss Is Leading To a Rise in Human Disease*, Yale School of Forestry & Environmental Studies, 23 February 2016

³⁸ Winnie Hu, *A Billion-Dollar Investment in New York’s Water*, The New York Times, 18 January 2018; Brian Blankespoor, Susmita Dasgupta, Glenn-Marie Lange, *Mangroves as a protection from storm surges in a changing climate*, US National Library of Medicine and National Institutes of Health, May 2017; *The State of the World’s Forests*, Food and Agriculture Organisation of the United Nations, 2018

³⁹ *Forestry insurance; a largely untapped potential*, Swiss Re, 8 December 2015



Pervasive and toxic – chemicals in our bodies and environment

The chemicals behind Teflon and many other materials used in cookware, food packaging (food wrappers, pizza boxes etc), carpeting, upholstery, fire-fighting foam, apparel, floor wax, textiles and sealants belong to a family of substances known as PFAS (per- and polyfluoroalkyl substances).⁴⁰ They have achieved notoriety by showing up in the blood samples of 98% of all Americans, not surprising given their ubiquitous presence in the environment. It is equally not surprising that this finding has invited legal actions. The most notable case currently is a 2018 class action lawsuit brought against major producers on behalf of Americans who have been exposed to PFAS chemicals.⁴¹

PFAS are just one of a group of chemicals in widespread use and with resulting persistence in the environment where the time between application and first showing of potential negative side effects can be very long. Given the potential dangers that these chemicals pose, regulators across the globe are taking action. In 2007, the EU enacted the REACH legislation to improve the protection of human health and the environment from the risks posed by chemicals.⁴² The law requires companies to demonstrate how the substance can be used safely.

China, meanwhile, has introduced a similar law, and the US has overhauled its chemical regulation TSCA.⁴³ There are differences between how the laws regulate chemicals, but they all require more transparency with respect to ensuring the safety of human life and the environment. Such transparency will help make the world a safer place, but will also generate potential for new lawsuits.

Potential impacts:


- Product liability and recall claims are to be expected in case of known or potentially negative side effects on human health from exposure to chemicals.
- Environmental release on a gradual or accidental basis could impact environmental liability policies, including clean-up costs.
- Employers’ liability and workers compensation claims may be triggered where a connection between workplace-related diseases and certain chemicals is established.

⁴⁰ As according to *United States Environmental Protection Agency*.

⁴¹ Sharon Lerner, *Nationwide Class Action Lawsuit Targets Dupont, Chemours, 3M, and Other Makers of PFAS Chemicals*, The Intercept, 6 October 2018

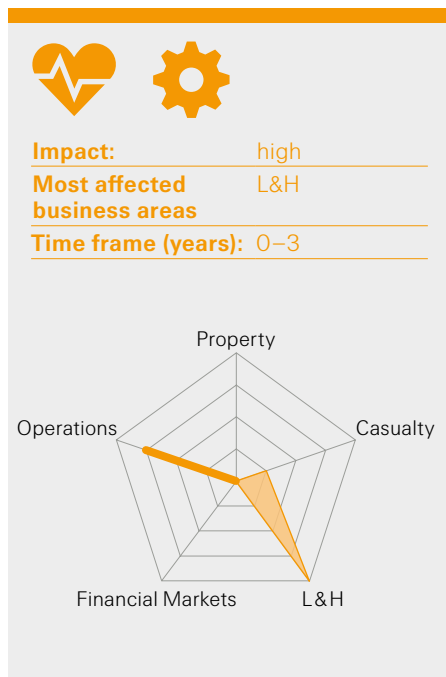
⁴² REACH stands for Registration, Evaluation, Authorisation and Restriction of Chemicals. See *Understanding REACH*, European Chemicals Agency

⁴³ TSCA stands for Toxic Substances Control Act. See *TSCA Inventory*, US Environmental Protection Agency. Also *China REACH (MEP 7)*, www.chemsafetypro.com, 30 December 2015



An often long time lag between application and the first signs of potential negative side effects of chemicals make protection challenging.

Competitive and business environment



Don't ask, don't tell – genetic testing and adverse selection

Since publication of our 2017 SONAR report on cancer screening and liquid biopsies, genetic testing has been widely adopted by public health systems and individuals. This has significant implications for life insurers, not least in respect to the regulatory constraints involved.⁴⁴

The major challenge for life insurers is to obtain adequate and risk-relevant information during the underwriting process, since existing regulation was mostly enacted before the widespread distribution of direct-to-consumer (DTC) genetic tests. Generally, regulation disallows the use of genetic information in underwriting life insurance. This raises the prospect of more customers at higher risk of disease or mortality applying for life insurance, leading to adverse selection. Customers in the know may also fear being denied life cover due to some genetic conditions, leading the insured to withhold such information from the insurer.⁴⁵

A new generation of predictive genetic tests based on polygenic risk scores (which attempt to quantify the cumulative effects of a number of genetic variants to display predisposition to a disease⁴⁶) promoted by companies such as 23andMe and YouSurance, is only likely to widen the information gap between insurer and insured. Nevertheless, some insurance groups have been looking at the upside potential.⁴⁷

Regulation that stimulates genetic information asymmetry will significantly impact insurers' ability to offer attractively priced coverage, and may challenge the way in which insurance risk is considered and managed. Insurers must be able to evaluate relevant consumer information when underwriting, and that includes risk-relevant data from genetic tests. Currently, there seem to be three broad regulatory approaches to access and use of genetic data for risk assessment: none/self-regulation, limitations by law, and outright legal ban. This lack of uniform approach shows the need for industry groups and regulators to work together to agree on reasonable self-regulation, one that balances the interests of consumers while maintaining the ability of insurers to underwrite sustainable products.⁴⁸

Potential impacts:

- Loss developments can be worse than expected if those at increased risk buy disproportionate insurance cover, while those not exposed to genetically-triggered diseases stay away.
- As with any new innovation, there will be a challenging transition period in which insurers will need to develop the know-how of capturing and managing the data, design systems to incorporate the data and implement new underwriting approaches.
- As the results yielded by genetic tests become more accurate and their use becomes more widespread, the way insurers traditionally pool risk to differentiate individual risks may no longer be suitable.
- Allowing access to an insured's genetic information would enable more accurate risk assessment.
- In addition, access to genetic information could improve customer engagement and services. New value-added products to cover specific diagnostics, or services tailored to the insured's health goals, could create an active partnership between life insurer and insured, vastly improving customer retention.

⁴⁴ See 2017 SONAR report, Swiss Re

⁴⁵ *Seeing the future? How genetic testing will impact life insurance*, Swiss Re Institute, 2017,

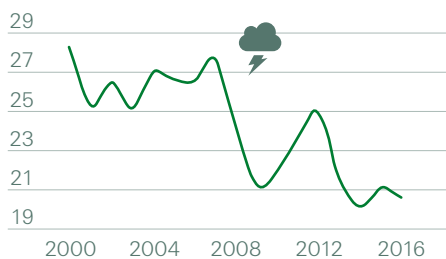
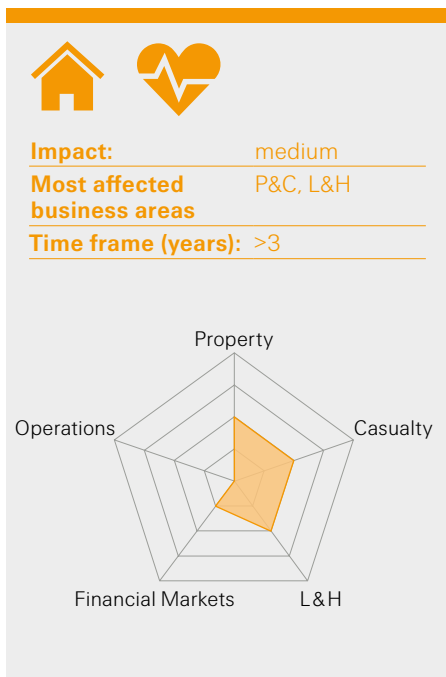
⁴⁶ *Polygenic risk scores: how useful are they?* Genomics Education Programme, 25 October 2018

⁴⁷ *The Risk of Anti-Selection in Protection Business from Advances in Statistical Genetics*, Reinsurance Group of America and Kings College London, August 2018

⁴⁸ *Can life insurance pass the genetic test?* Swiss Re Institute, 2019

Genetic testing can create an information asymmetry between customers and insurers.





Life insurance has not recovered since the financial crisis (life insurance in trillions USD)

Source: Swiss Re Institute, Life underinsurance in the US; bridging the USD 25 trillion mortality protection gap, September 2018

Risky bets? Insurance demand in an age of shifting markets

Globally, too many people are un- or underinsured and not protected when a catastrophe strikes. In 2018, the estimated worldwide protection gap for global catastrophe risks stood at around USD 80 billion.⁴⁹ The mortality protection gap is even larger. In the US alone, the mortality protection gap, a measure of life underinsurance, was close to USD 25 trillion in 2016.⁵⁰

These numbers should be seen against the backdrop of shrinking middle classes in developed markets, the primary target group for many insurance products. The OECD defines middle class income as being between 70% and up to 200% of the median income. While almost 70% of baby boomers were part of middle-income households in their twenties, only 60% of millennials are today.⁵¹ In all OECD countries – except Switzerland, Ireland and Spain – the income portion of the middle class is diminishing. According to McKinsey Global Institute, 98% of all households in 25 developed economies have seen their income rise between 1993 and 2005.⁵² The picture is very different for the years 2005 to 2014 when 70% of households experienced flat or even falling income. Moody’s paints a similar picture for the US, saying that rising prices and interest rates will erode disposable income. Shrinking disposable incomes may put willingness to pay for insurance coverage to the test. We already witnessed this in the US, after the global financial crisis of 2008–09. There was a significant widening of the mortality protection gap between 2007 and 2010 due to a large increase in joblessness and decrease in household asset values and increase in debt. When people were asked why they didn’t buy life insurance even though they knew about the gap, 61% said they have other financial priorities.⁵³

From an insurance industry standpoint, the hope – or wishful thinking – is that any shortfalls in the West can be offset by gains in the East, especially China. Indeed, China has already overtaken the US in respect to its global GDP contribution, and is projected to remain the growth engine of the world economy. But growth rates are slowing down. Although insurance potential continues to move East driven by demand from the thriving middle classes there, the risk of growing income inequality there is considerable, especially in the longer run.

Potential impacts:

- China has already overtaken the US in terms of contribution to global GDP and is projected to remain the growth engine of the world economy. Even so, its growth rates are slowing, and that could curb insurance demand.
- Insurance potential continues to move East. The thriving middle classes are to be found in Asia rather than in the West. However, there is risk in the longer run that the middle classes do not grow as expected, which could also lead to rising income inequality.
- Middle income households experiencing relative status loss and financial pressure tend to cut expenses deemed not essential, and insurance often falls into this basket.
- Whether real or just perceived – middle classes in the US and Europe are claiming status loss, which often translates into resentment towards “establishment” and “foreigners.” The populist behaviours at the ballot box and social unrest on the street bring more uncertainty and volatility to these market environments.

⁴⁹ *sigma* 2/2019 op. cit.

⁵⁰ *Life underinsurance in the US: bridging the USD 25 trillion mortality protection gap*, Swiss Re Institute, Expertise publication, Sept 2018

⁵¹ *Under pressure: the squeezed middle class*, OECD, April 2019

⁵² *Poorer than their parents? Flat or falling incomes in advanced economies*, McKinsey Global Institute, 2016

⁵³ *Life underinsurance in the US; bridging the USD 25 trillion mortality protection gap*, Swiss Re Institute, September 2018



Globally, too many people are un- or underinsured.



Emerging trend
spotlight

**Financial services
and the digital
revolution**

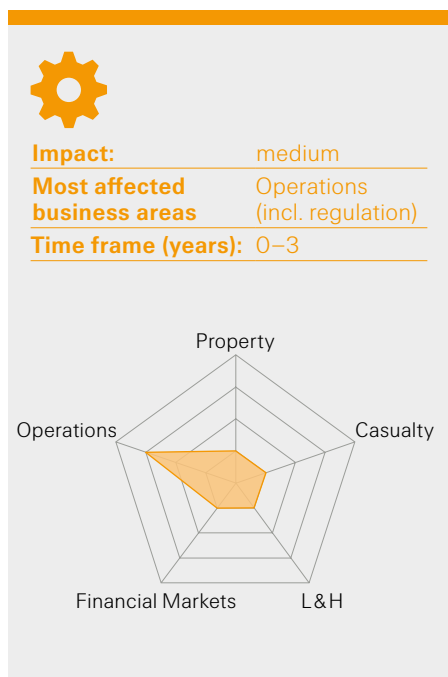
Digitisation is all the rage in financial services. This has been the case for a long time already and everybody agrees it's happening. Ironic, therefore, that there is little consensus about what it actually means, how it's changing the industry, or what actually needs to be done.

The expected bitcoin upheaval, which started a couple of years ago with calls to bring down the traditional banking system, failed to materialise. On the other hand, smart contracts and the underlying blockchain technology have been adopted by traditional players in banking and insurance, although some critics claim that blockchain itself still isn't living up to its promise.⁵⁴

Nevertheless, nervousness among large financial institutions about innovative start-ups persists, both with regards to potential competition and investment opportunities. There are daily reports about digital disruption and how to survive. The consulting companies in particular are eager to promote digital disruption, offering guidance and a helping hand. Everyone wants to be a winner, but nobody exactly knows what direction to take. Which element of the digital revolution needs to be prioritised? How quickly do we need to adopt new behaviours, and what skills are required? And for re/insurers, what does this all mean?

The problem many institutions face is a clash of culture and hierarchy. Technologically affine youngsters come up against experienced and established caution, meaning their skills are not always deployed most effectively. On the other hand, experience and tradition is not necessarily a bad thing, not where it prevents companies from falling for the wrong technical innovation. Tension between old tradition and new ideas can be healthy. Smart digitisation strategies are not only about how to be ahead of everyone else, but also about the traps and risks to avoid. Too much haste may lead to costly mistakes, institutional memory loss, mispricing, increased cyber vulnerability and a generally bad risk culture. To consider trade-offs, to find the right balance, that's where the challenge lies. Finding a safe pathway through that digital challenge looks set to keep financial services firms busy for a while yet.

⁵⁴ *Blockchain's Occam problem*, McKinsey & Company, January 2019



Getting the balance right – technology regulation affecting the insurance industry

As technological innovation advances, regulation follows on its heels. We are now seeing a first wave of non-insurance tech regulation spilling over into the insurance industry. Much of this is about access to and use of customer data, such as the General Data Protection Regulation (GDPR) and ePrivacy Regulation coming out of the European Union. These have created momentum for similarly broad data protection regulation in other locations, which are both expansive in how businesses collect, store and use customer data, and come with cross-border implications. Even the passive storage of cloud-based data in an overseas jurisdiction entails regulatory, political and business risks. Microsoft's jurisdictional battle with US law enforcement over customer data stored in its Ireland data centre is a case in point.

Excessive data protection requirements like limitations on cross-border data sharing can hinder the ability of insurers to utilise data in meaningful ways, including developing more personalised solutions and more frequent and meaningful interactions with clients. To ensure fair treatment of end users and avoid discrimination, re/insurers have to take a responsible approach. Increasingly in the spotlight are the potential risks arising from the operational aspects of tech innovation such as cloud services, outsourcing and cybersecurity. The consequent general lack of global harmonisation means there's a risk of conflicting laws.

In addition, global fragmentation of cybersecurity laws could increase operational costs and compliance risks. This could impact companies' future use of data-linked technologies. Outsourcing IT infrastructure to the cloud offers access to innovative services in many areas such as robotics, mobility and Big Data. New regulatory requirements that limit the use of cloud computing could hinder the development of a compelling digital service portfolio for a customer base, one that's increasingly asking for digital experience in service delivery.

The lack of global harmonisation means risk of conflicting laws. For this reason, it is important that regulator efforts be well coordinated between jurisdictions. Technological development in an increasingly interconnected digital environment underscores the need for collaboration between regulators. Sound international standards are a prerequisite to optimise the insurance value chain from end-to-end.

Potential impacts:

- Laws and regulations relating to technological developments need to be well balanced and internationally coordinated. Otherwise, they could greatly increase a multinational insurers' legal, compliance and regulatory risks.
- Specific insurance regulation and general regulation eg data protection might not be aligned and cause friction.
- Legacy regulation and/or regulatory roadblocks limit timely utilisation of new technologies and hinder meaningful strategic partnerships.
- New data protection regulation might make the use of data for insurance purposes more difficult, thus obstructing fair risk assessment and forcing cross subsidisation.
- Digital transformation is necessary to stay competitive. Regulators should not restrict the use of cloud services but rather ensure that insurers have processes in place to identify, manage and mitigate the risks that cloud usage presents.




Special feature – Climate change in Life & Health

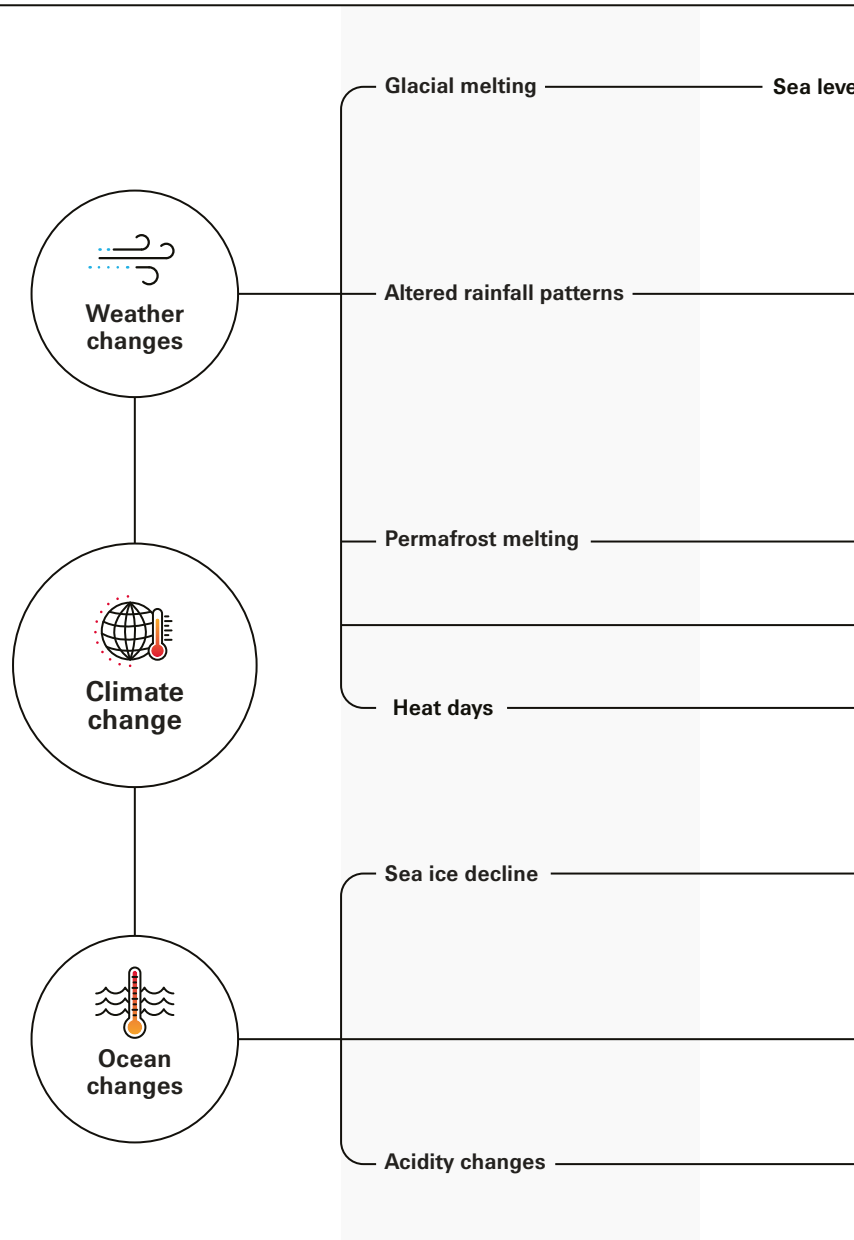
Climate change – from emerging risk to real-life danger

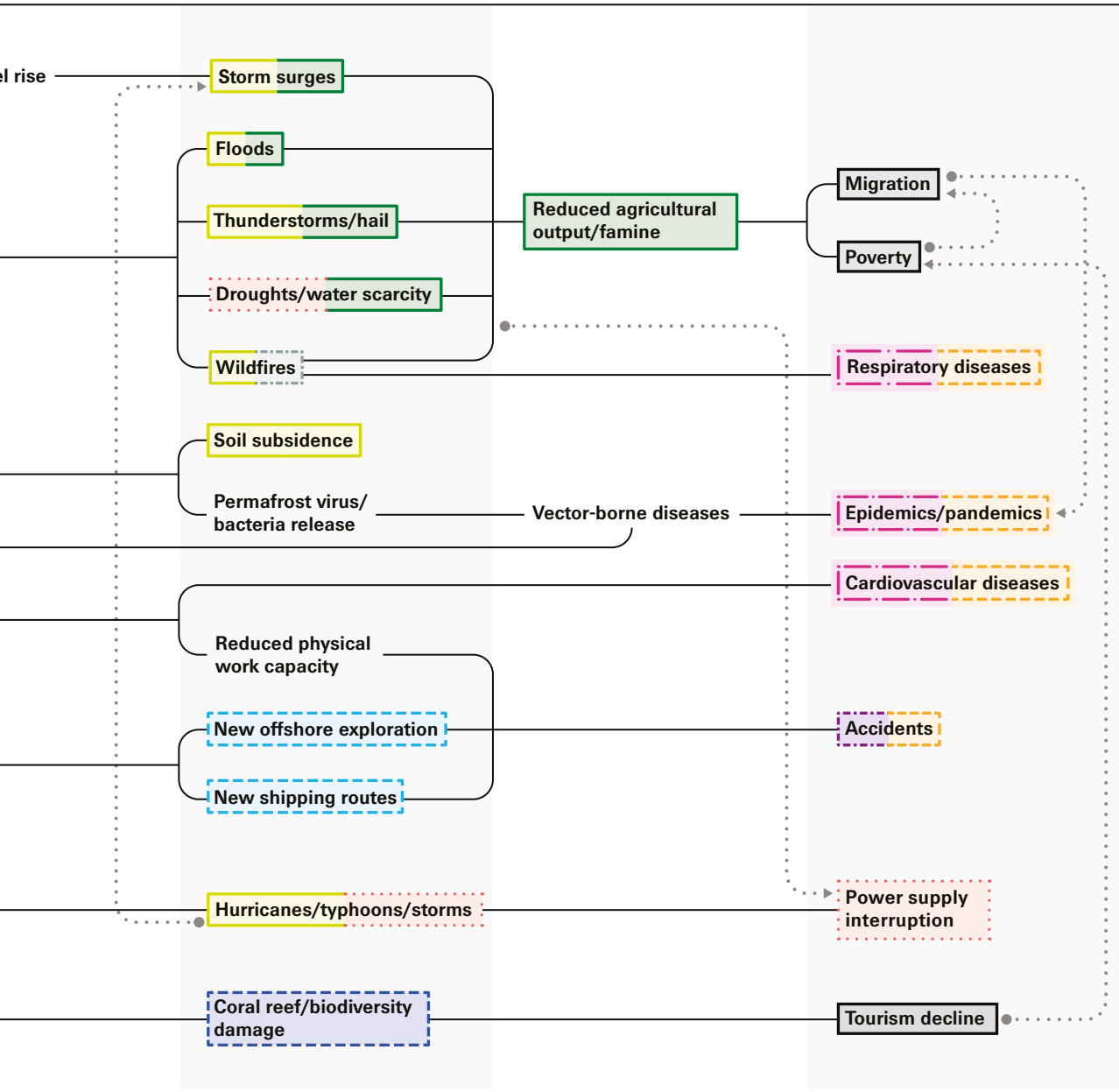
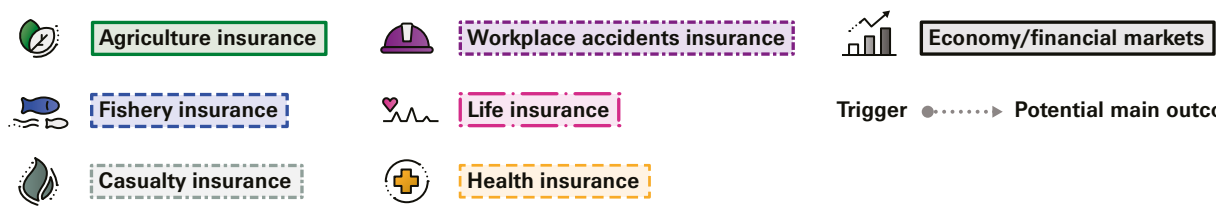
Climate change was on Swiss Re’s emerging risk agenda in 1989 already, long before the term “emerging risk” was coined. Since then, climate change has fully emerged as a real and present-day problem. First impacts such as the greater frequency and severity of wildfire events are already showing. As the following infographic depicts, however, climate change risks extend to a wide-reaching scope of threats that society, and the insurance industry, are exposed to today. While many areas of climate change have been researched extensively, one risk area that has not, to date, been afforded the same degree of investigation is the impact of climate change on human life and health. We expect the impacts here to also be significant and therefore in the following section, bring the focus to exploring how societies and healthcare systems will need to adapt to a warmer world.

This graphic is intended to foster the risk dialogue and tries to explain complex interactions and interconnections in a simplified way. The graphic does not pretend to be comprehensive or complete. Please also take a look at the interactive version on swissre.com/SONAR2019

Potential impacts of climate change

-  **Property insurance**
-  **Supply-chain interruption insurance**
-  **Marine insurance**





It's existential – climate change and life & health

While not all the threats of climate change are fully understood, it fully emerged as a present real life risk. The most pronounced risks from climate change affecting human health stem from heatwaves, floods, droughts, fires and vector-borne diseases. Millions of lives can be saved and the burden on healthcare services reduced if we pay more heed to changing climates. Without action, mortality rates and healthcare costs could soar,⁵⁵ and this would have significant consequences for the health, workers' compensation and life insurance lines of business.⁵⁶

Changes in mortality will be driven by several changes occurring simultaneously. First, we expect that heatwaves will become more severe and extend to areas previously not impacted. This includes in the temperate zone, where a large proportion of the world's population lives. The 2003 heat wave in France was a first taste of things to come. It caused 70 000 deaths – mainly among the elderly.⁵⁷ With no mitigation, and with rapidly ageing populations in many countries, a future event will have an even bigger impact because the share of vulnerable older populations in the affected regions is rising fast.⁵⁸

Increasing temperatures and high humidity due to climate change is another area of concern, in that this combination enables vector-borne diseases to conquer new ground. The West Nile and Zika epidemics were first warning signs.⁵⁹ Climate change will extend the transmission season and geographical range for many infectious diseases.⁶⁰ For example Lyme disease, avian influenza, meningitis, dengue fever and tropical bacterial and viral infections are projected to increase with climate warming, including potential shifts in their geographic range.⁶¹ Severe drought conditions can lead to increased wildfires, which in turn lead to air pollution. This is even in areas far away from any conflagration, as the California wildfires of 2018 showed.⁶²

Knock-on effects

The secondary impact of climate change will amplify the above. In focus here are migration, urbanisation, food security & nutrition, and water scarcity. Already today, more than 2 billion people live in areas of water stress,⁶³ areas where access to clean water for drinking, sanitation and personal hygiene – all pre-requisites for public health – is limited.⁶⁴ The number of regions affected by water stress will increase as temperatures rise. Public health could be further compromised by the expected increase of, for example, extreme heat, droughts and floods affecting agriculture. This will diminish or destroy the nutritional supply chains that help people withstand health threats.⁶⁵ Nor will fishery compensate because rising sea temperatures and ocean acidification will likely mean lower catches.⁶⁶

⁵⁵ *COP24 Special Report: Health and Climate Change*, World Health Organisation, 2018

⁵⁶ sigma 6/2018, op. cit.

⁵⁷ *Death toll exceeded 70 000 in Europe during the summer of 2003*, Comptes Rendus Biologies, Vol. 331, No. 2, February 2018

⁵⁸ *The 2018 report of the Lancet Countdown on health and climate change: shaping the health of nations for centuries to come*, The Lancet, 8 December 2018

⁵⁹ *Impacts of 1.5C of Global Warming on Natural and Human Systems*, IPCC, 2018

⁶⁰ *Human health and adaptation: understanding climate impacts on health and opportunities for action. Synthesis paper by the secretariat*, United Nations, March 2017

⁶¹ *Impacts of 1.5C of Global Warming on Natural and Human Systems*, op. cit.

⁶² *'No fresh air': wildfire smoke sets apocalyptic haze over San Francisco*, The Guardian, 13 November 2018

⁶³ *SDG 6 Synthesis Report 2018 on Water and Sanitation*, United Nations, 28 June 2018

⁶⁴ *Human health and adaptation: understanding climate impacts on health and opportunities for action. Synthesis paper by the secretariat*, op. cit.

⁶⁵ *The State of Food Security and Nutrition in the World*, Food and Agriculture Organisation of the United Nations, 2018

⁶⁶ *Heatwaves take their toll on the high seas*, Nature: international journal of science, 4 March 2019

Extreme weather events will not only impact agriculture. With continued sea level rise,⁶⁷ storm surges may reach further inland. With increased value concentration in mega-cities exposed to storm surges, economic and insured losses are likely to increase further. So too will the risk of epidemics. Migration to urban centres is concentrating an ever larger share of the world's population in a small areas. As has happened many times before, storms and floods that destroy infrastructure can trigger significant epidemics. And, once the flood water recedes, toxic mould may remain in buildings, posing yet another threat to public health.

In polar and other regions where permafrost has long been the environment norm, another possible consequence of warmer temperatures could be the release of older bacteria and viruses as ice thaws. Having not been exposed to these strains for thousands of years, the immunity of the world's population to such threats will be low. The building of new harbours to accommodate increasing marine traffic with the opening up of the arctic sea route, will make it more likely viruses or bacteria will be able to travel to far distant locations, triggering an epidemic or pandemic. Such outbreaks could be especially serious if the bacteria prove resistant to antibiotics (see section in the 2017 SONAR report on antibiotic resistance).

Becoming climate resilient in public health

The world community has acknowledged the imperative with the "Paris agreement on climate change" which aims to keep global warming well below 2 degrees Celsius in the long-term. In addition, it outlined in the WHO COP 24 special report on Health & Climate change what to do to save lives, reduce epidemics and make public health climate resilient.⁶⁸

The immediate public health activities necessary to meet the challenge of climate change are to strengthen the prevention of climate-sensitive health risks and to build an adaptive skill set to absorb the changing, increasing risks presented by climate change described before. This also involves related sectors like food security and safety or sanitation. Additionally, however, there are other specific risks the health sector must address to achieve resilience in the face of climate change.

Health care facilities are the operational heart of service delivery, protecting health and treating patients, both during and after weather and climate-related events (such as heat stroke during heatwaves and injuries during cyclones) and in response to other environmental risks to health (such as asthma due to poor air quality). Health care facilities in poor and rich countries alike must be able to deliver in changing climate conditions, such as during extreme weather events. Cooling systems during heat days, flood security, emergency power and water supplies must become standard in health care facilities worldwide.

⁶⁷ *Impacts of 1.5C of Global Warming on Natural and Human Systems*, op. cit.

⁶⁸ *COP24 Special Report: Health and Climate Change*, op. cit.

Many workers in the oil and gas industry will retire in the next few years: This will create a skills gap.



Appendix A: High impact emerging risk themes, 2015–2019

Every year Swiss Re publishes new emerging risks in its SONAR report. Occasionally, an emerging risk is reported again in a later report in case new aspects emerge or if the risk persists with increased urgency. Some overarching themes and common aspects are usually reflected in every report, often in the list of emerging risks ranked with highest impacts. For 2015–2019, here we list the top risks of each year and discuss how the overarching concerns regarding market dynamics, cyber risks and climate change have been profiled in specific high impact emerging risk themes over the years.

Market dynamics

As a key sector of the financial industry, the insurance industry is exposed to market dynamics. In 2015, the euro zone crises and expansive monetary policies were in the foreground, as were concerns over domestic populist movements fostering de-globalisation. While uncertainties from central bank quantitative easing continued in 2016, a potential slow-down of emerging market growth was added to the top emerging risks list. International regulatory fragmentation and protective trade barriers were each flagged as top risks in 2017, next to a return of inflation. Then, in 2018 national protectionism and regulatory fragmentation to hamper diversification for international re/insurers were synthesised into a top risk under the theme “A brave new world?” Heightened geopolitical tensions and trade conflicts are further confirming ongoing concern about the volatile global business environment for insurers.

Cyber risks

Cyber risk presents one of the largest opportunities for the re/insurance industry, while simultaneously presenting one of the largest challenges. The frequency and severity of risks resulting from cyber-attacks and their changing nature, are expected to grow significantly over the next years. The need for cyber resilience has become a main focus of attention among corporate clients and insurance companies, triggering insurance demand. The SONAR report has flagged the evolving aspects of technological change and uncertainty in a series of cyber risk themes over the past years. This includes a focus on vulnerabilities from the IoT (2015), the challenges from increased internet fragmentation (2016), accumulation risks from cloud solutions (2017) and lurking cyber risk from end-of-life software and hardware still in use (2018). In this year’s report, we focus on exposures from 5G mobile and where software enhancements are applied to existing legacy hardware, particularly in the case of large infrastructure facilities.

Climate change

Swiss Re identified climate change as an emerging risk 30 years ago. Three decades on, we continue to flag the impact of climate change on specific risk factors and pools. For example, in 2015 we highlighted the associated theme of potential super natural catastrophes from “atmospheric rivers” affecting the US West Coast. We then raised a closer connection to climate change in the form of growing water stress and drought potential in our 2017 SONAR report, in our exposé on “The big drying”. Today, climate change has become a fully-emerged risk, and in this year’s report we have a dedicated section on its impact on life & health insurance.

Appendix A: High impact emerging risk themes, 2015–2019

2015	2016	2017	2018	2019
De-globalisation	The great monetary experiment (cont.)	Bugs on the march – underestimated infectious diseases	Asbestos reloaded – USD 100 billion in losses and counting	Limits to tinkering – the fiscal and monetary policy balance at risk
The great monetary experiment	Internet fragmentation	Reduced market access – protecting your own backyard	A brave new world? – emerging geopolitical risk	Teaching an old dog new tricks – digital tech meets legacy hardware
Super nat cats	Emerging market crises 2.0	The perfect storm – cloud risk accumulation	Algorithms are only human too – opaque, biased, misled	Off the leash – 5G mobile networks
Challenges of the Internet of Things		The big drying – growing water stress	Coming back to bite us – lurking cyber risks	It's existential – climate change and life & health (Special feature)
		The return of inflation – the effect on insurance business	A slow poison – the erosion of risk diversification	Don't ask, don't tell – genetic testing and adverse selection
		Island solutions – regulatory fragmentation		

- **Societal environment**
- **Political environment**
- **Technological and natural environment**
- **Competitive and business environment**

Listed above are our risk themes from the SONAR reports 2015–2019 with high impact potential. Risks with medium and low impact potentials are not listed. These high impact risks are colour-coded according to their respective macro trend environments. Together with the following descriptions per risk, the synopsis reflects a “high priority portfolio” of emerging risk, as it develops over time. It also allows “to keep track” of older emerging risks and reflect that some of the risks are reported once only, others reappear, and some overarching concerns (see page 47) are monitored throughout the years.

Summary of high impact emerging risk themes (2015–2019)

2015

De-globalisation: Political conflicts have been intensifying over the last few years in many regions including Eastern Europe, the Middle East and East Asia. Sanctions and other interventionist policy tools have led to economic distress, driving an upsurge in populist and nationalist sentiment. In Europe, this could trigger territorial separatism (eg, Scotland or Catalonia) and eventually undermine integration projects such as the European Union.

The great monetary experiment: The euro area debt crisis lingers on, with only modest growth, high unemployment and unsustainable debt levels in some countries. Traditional policy tools, including expansionary fiscal policy and monetary easing, are no longer feasible. Nevertheless, extremely accommodative monetary policies continue and even intensify. Short- to mid-term consequences include extremely low interest rates, distortions of risk-return profiles, potential asset price bubbles, and increasing economic inequality. Longer-term consequences include potential for higher inflation and reputational damage for central banks.

Super nat cats: The US Geological Service published a study on a winter storm scenario, looking at the impact of an “atmospheric river” event with a return period of 1 000 years. Findings indicate that flooding would overwhelm flood protections in many areas, resulting in the evacuation of more than a million residents, direct property damage of nearly USD 400 billion and business interruption costs of about USD 325 billion. The risk of volcanic eruptions might also be underestimated as no large eruption has occurred since 1815. However, eruptions can have a devastating impact if they occur close to population centres. They can also impact global travel, as illustrated by the eruption of Iceland’s Eyjafjallajökull volcano in 2010.

Challenges of the Internet of Things: The IoT will revolutionise the digital world. Increased connectivity and reliance on digital processes raises questions about network and data security, resilience and long-term maintenance and software updates. Losses could occur from system malfunction and malicious attacks from hackers and criminals. There may also be legal and compliance risks due to the lack of consistent regulatory standards across countries.

2016

The great monetary experiment (cont.): Quantitative easing continues, resulting in a low to negative interest rate environment. Economic growth and inflation remains tepid in the euro area and Japan, triggering discussions about additional monetary policy stimulus. Negative interest rates will further undermine the conventional insurance business model, particularly for life insurers and pension funds.

Internet fragmentation: Cyber crime and espionage have grown strongly, making the internet less safe. Governments urge more effective protection of online assets and consider isolating critical IT infrastructure from global networks. Disconnected national/regional nets will become more common. Technology companies risk disruption to their business model and might face liability suits if no longer able to access data stored on cross-border servers.

Emerging market crises 2.0 – Amid rising US interest rates, economic growth in China has continued to slow, with knock-on impact on commodity prices leading to net capital outflows from emerging markets. Emerging market turmoil could hurt insurers’ balance sheets and may trigger detrimental regulatory consequences.

2017

Bugs on the march – underestimated infectious diseases: The risk factors associated with infectious diseases, even known ones, are changing (eg. climate change, animal husbandry, land use, and poor health in areas connected with the world economy). These factors could facilitate outbreak and proliferation of infectious diseases.

Reduced market access – protecting your own backyard: Free trade, open markets and globalisation are coming under increasing pressure, with governments favouring local markets and national champions. Protectionism is no longer an emerging market phenomenon.

The perfect storm – cloud risk accumulation: Ever more widespread use of cloud and cloud-of-clouds solutions comes with a variety of risks: cyber attack, technical failure, prolonged outage and data inaccessibility. The data volumes involved and service interruption potential pose significant and catastrophic risk to system resilience.

The big drying – growing water stress: Farming, industrial use and household consumption are exacerbating water shortages in a growing number of regions (eg. California, US mid-West, southern Europe, the Mediterranean, South Africa). Severe water shortages also have an adverse impact on food production and can undercut oil and gas production.

The return of inflation – the effect on insurance business: Inflation is picking up in US and UK (not yet Europe and Japan). A sudden increase in inflation can adversely impact insurer profits. The long-term effect of accommodative monetary policy of recent years remain unclear.

Island solutions – regulatory fragmentation: International regulatory coordination activities among G20 are increasingly stalling, diminishing the chance for international standards and norms, and leaving an uneven playing field. Regulatory island solutions increase coordination and operational costs, and compliance burden to multinational insurers.

2018

Asbestos reloaded – USD 100 billion in losses and counting: Millions of metric tons of asbestos are still being processed in many countries. A UN report showed that over 300 million people in Europe and Central Asia are potentially exposed. Latin America and other regions are at risk also.

A brave new world? – emerging geopolitical risk: The global political and economic balance has become multi-polar. Global institutions lack mitigating power in circumstances of conflict. Aggressive propaganda, cyber-attacks and other means of “hybrid war” between nation states increase uncertainty.

Algorithms are only human too – opaque, biased, misled: Algorithms are susceptible to discriminatory bias. Black-boxed workings of algorithmic calculations can conceal and perpetuate mistakes. What’s lacking is governance around development and application of algorithms.

Coming back to bite us – lurking cyber risks: Flaws and vulnerabilities in hardware (chips) and software may remain undetected for a long time (eg. “sleepers” cyber risk played out in recent WannaCry-attack). The risk is mispricing in cyber-covers, which may in turn impact operations.

A slow poison – the erosion of risk diversification: Re/insurance provides financial protection from risks by deploying capital across borders and lines of business. National protectionism and regulatory fragmentation are jeopardizing the benefits of international diversification.

2019

Limits to tinkering – the fiscal and monetary policy balance at risk: There is a growing consensus that another economic downturn will need a fiscal response. Potential responses include quantitative easing, “helicopter money” or modern monetary theory. The re/insurance industry could benefit if changes to policy bring growth and financial stability. The possible flipside is a rise in uncertainty, causing higher financial market volatility and declines in asset valuations.

Teaching an old dog new tricks – digital tech meets legacy hardware:

Technological improvements are ongoing. Hardware in areas of critical infrastructure, including smart electric power grids or pipelines, hospitals or cash points, however, is often out dated. As a consequence, insurers face higher risk accumulation unexpected loss potential in the areas of property damage, bodily injury, business interruption and cyber risk.

Off the leash – 5G mobile networks: 5G will enable wireless connectivity in real time for any device of the IoT, such as autonomous cars or sensor-steered factory. Current concerns regarding potential negative health effects from electromagnetic fields are likely to increase. Hackers can also exploit 5G speed and volume to acquire (or steal) more data faster. Major concerns are possible privacy and security breaches, and espionage.

It’s existential – climate change and life&health: The most pronounced risks from climate change affecting human health stem from heatwaves, floods, droughts, fires and vector-borne diseases. Millions of lives and healthcare services could be at risk. Without action, mortality rates and healthcare costs could soar, and this would have significant consequences for the health, workers’ compensation and life insurance lines of business.

Don’t ask, don’t tell – genetic testing and adverse selection: Over the past years, the cost of genetic testing has declined significantly and, with direct-to-consumer (DTC) testing kits, genetic tests are now available and affordable for individual use. It has been widely adopted by public health systems and individuals. This has significant implications for life insurers, not least in respect to the regulatory constraints involved.





Appendix B: 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 (ie, topics covered in previous editions are not listed again). You can retrieve prior reports from our webpage: www.swissre.com/sonar

What is meant by overall impact?

The overall impact 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:

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

What is meant by time frame?

We divide themes into those likely to occur in less than 3 years and those likely to occur over a longer time horizon. This assessment should not be used as an indicator of when action is needed, as some themes likely to occur in the more distant future may, nonetheless, require immediate action to prepare.

What is meant by impact per business area?

Spider graph indicating the potential impact on major insurance 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. 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 5 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.

Title

Swiss Re SONAR – New emerging risk insights
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