



Swiss Re SONAR  
New emerging risk insights

June 2017



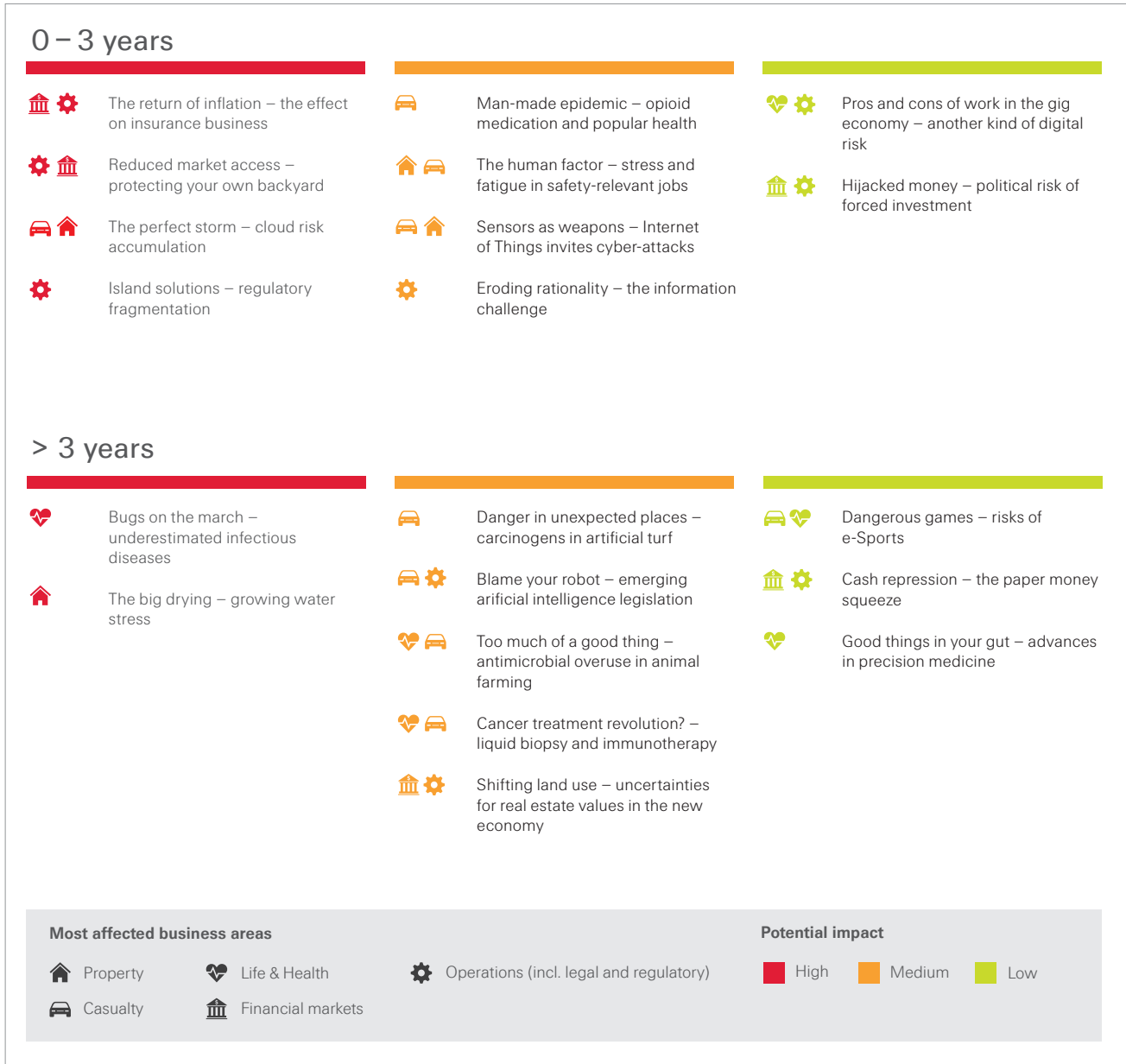
To navigate an ever changing risk landscape we must know our past and anticipate the future. Emerging risks keep us on our toes to be better prepared – even though some of them may not materialise.

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# Overview

## Emerging risk themes by potential impact and timeframe



## Foreword

Underestimated infectious diseases, growing water stress, the impact of future artificial intelligence legislation, cloud risk accumulation or precision farming: Do you want to know more about these topics? Welcome to the latest edition of Swiss Re SONAR, our update of the emerging risk landscape.

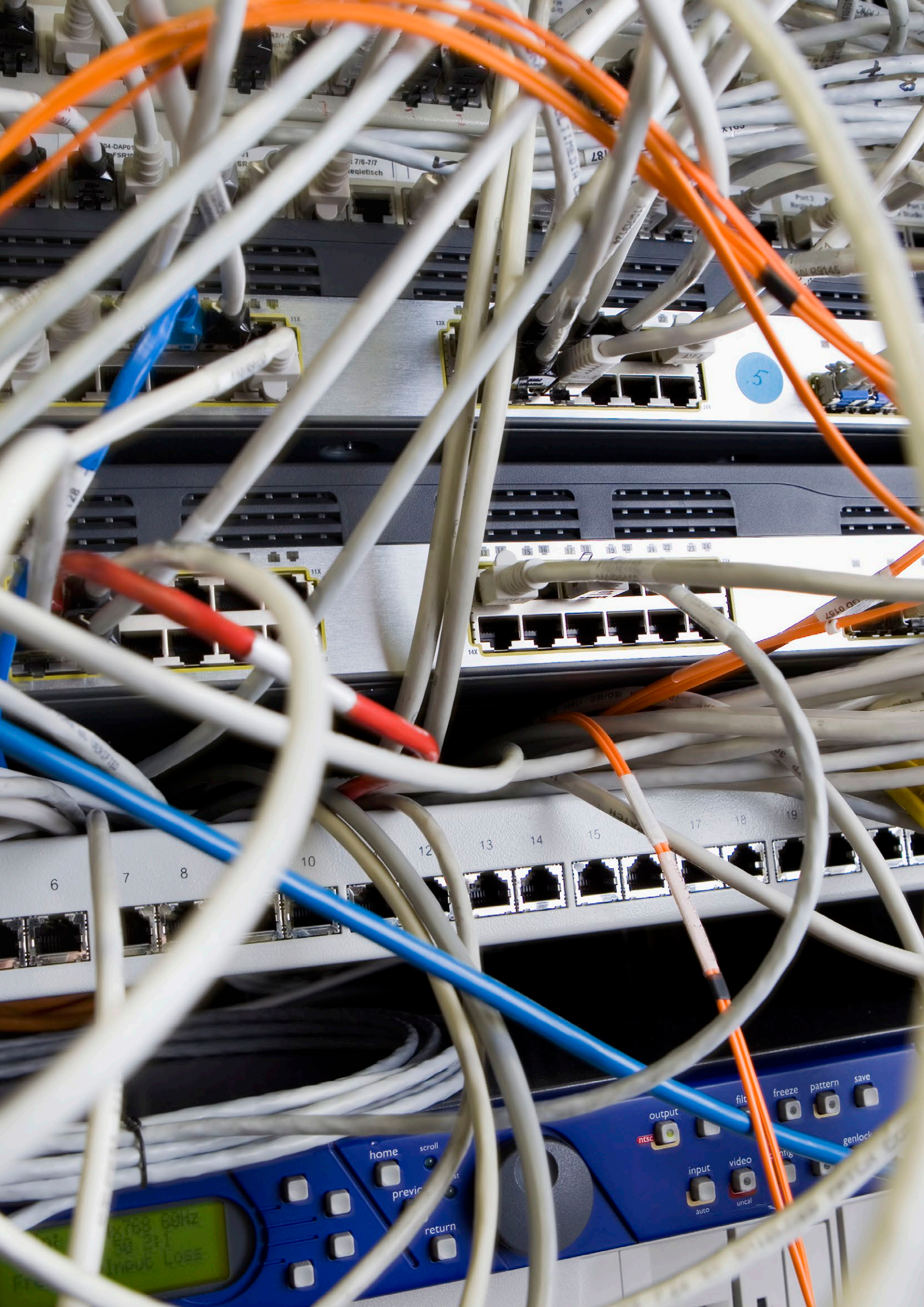
A few years ago, we started to share some of our insights gathered through our SONAR tool with our clients and the broader audience. The SONAR tool is an internal crowdsourcing platform to collect inputs and feedback from underwriters, client managers, risk experts and others.

Why are we sharing these insights? To look at today's risk landscape is really important since we see many imminent and remarkable game changers like the return of nationalism or protectionism. At the same time, we should not lose sight of the subtle underlying developments that can be of major importance to the insurance industry, its customers and to society at large.

The earlier we adapt to these changes, the better we believe we are prepared. Ignoring emerging risks is just not an option. We need to prepare for the risks of tomorrow – even though not all of them will materialise. Just remember: Nationalism and protectionism were once emerging risks. The risks emanating from these phenomena are a reality and were already flagged in different forms as emerging risks in the SONAR reports published in 2014, 2015 and 2016.

Working together and sharing knowledge across stakeholders can help the insurance industry to better prepare for and deal with emerging risks. We have launched this publication in this spirit and look forward to discussing further with you.

Patrick Raaflaub  
**Group Chief Risk Officer**



## Navigating an ever-changing risk landscape

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






This report features 20 new emerging risk themes and 6 emerging trend spotlights. They are meant to spark an informed dialogue of what might lie ahead for the insurance industry and society. We define emerging risks as newly developing or changing risks which are difficult to quantify and whose potential business impact cannot yet be fully estimated with any certainty, but may have a major business impact to the insurance industry.

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

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

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

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

-  for **Property**: The big drying – growing water stress
-  for **Casualty**: The perfect storm – cloud risk accumulation
-  for **Life & Health**: Bugs on the march – underestimated infectious diseases
-  for **Financial Markets**: The return of inflation – the effect on insurance business
-  for **Operations**: Island solutions – regulatory fragmentation

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

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

The disruptive quality of certain technologies is an overarching theme.





# Macro trends

## Screening of interdependent macro trends

In order to take strategic decisions and adjust product offerings, the industry needs to understand the macro trends and the risk landscape, and the impact they have on the re/insurance industry. Consequently, Swiss Re applies a structured, forward-looking trend identification process to assess tomorrow's exposures and potential new opportunities.

A web of interdependent macro trends provides the backdrop for tomorrow's risk landscape. At Swiss Re, we screen our external environment for these trends every year through roundtable discussions with experts and extensive surveys. For 2017, we identified 22 macro trends that are likely to have a high impact on the re/insurance industry within the next five to ten years. The trends cover the societal, political, technological & natural as well as the competitive & business environments.

Not all of these 22 macro trends are new. Many of them have been shaping the re/insurance industry for several years and will likely continue to do so in the foreseeable future. Over time, their interpretation, relevance, significance and interconnection to other trends may change.

In the next two pages, we provide more detailed insights into selected macro trends and their interdependencies. This overview is by no means exhaustive. Should you wish to discuss some of the macro trends, please reach out to your local Swiss Re representative.

### Societal environment

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

### Political environment

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

### Competitive & business environment

- Re/insurance value chain disaggregation
- Convergence of alternative & traditional capital
- Strategic partnerships with non-insurance companies & institutions
- Regional champions going global
- Increasing digital customer interaction

### Technological & natural environment

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



## Societal environment

Society is changing under the influence of shifting demographics and wealth distribution. The subsequent public debate around topics such as social and economic inequality, longevity, radical medical innovation and the future of work are additional influencing factors.

Acutely aware of these developments, the United Nations has already taken up the issue of inequality. Indeed, reducing inequality within and among countries is one of its Sustainable Development Goals. While inequality between countries may have been reduced, inequality within countries has risen. Growing inequality can have negative consequences for economic growth and poverty reduction, social cohesion, and the stability of economic and political systems. Economic inequality is also related to disparities in access to health and education.

Economic growth alone is not sufficient to reduce inequality if it is not inclusive and does not cater to all three dimensions of sustainable development, i.e. economic, social and environmental. By providing affordable and innovative products to global society and by engaging in effective public-private partnerships, the re/insurance industry can do its part to counteract rising inequality.

Longevity is a positive, welcome trend. However, in most societies it is also accompanied by a relative increase in age-related illnesses. Moreover, a smaller working-age population has to support a larger retired population. At the same time, there is the financial risk arising from individuals' need to plan for a longer retirement period. The longevity trend also comes with higher public health cost (see page 19 trend spotlight on "Ageing in dignity") e.g. with increased expenditure on long-term care.

The health domain is being further reshaped by radical medical innovation in diagnostics and therapy (see page 17 risk theme on "Liquid biopsy and immunotherapy"; page 22 on "Advances in precision medicine"). Health monitoring including improved sensors, gene therapy and regenerative medicine, microbiome research and cancer treatment are just a few examples of current innovations and where further breakthroughs can be expected in the coming years. These developments may contribute to further longevity but also to an increased cost of living longer. Such developments, too, need to be funded.

## Competitive & business environment

The disaggregation of the value chain and rapidly advancing technologies, e.g. in increasing digital customer interaction, allow for new re/insurance products and require new business processes.

Roles along the (re)insurance value chain are shifting not just among existing players. New companies are offering products and services that cater only to specific parts of the value chain. Due to alternative capital and other factors, there is continuous oversupply of capital in the markets, with primary insurers retaining more risk on their balance sheets. At the same time, brokers are building more sophisticated service models to strengthen their hold over client relationships. Consequently, insurers are demanding new solutions from reinsurers beyond pure capacity provision, for example services that enhance customer experience or enable proactive risk management. The result is a more fragmented value chain where multiple players' offerings interact to provide policyholders with a convenient and personalised customer experience (see page 40 trend spotlight on "Prudence with risk pools").

Technology's impact on the industry opens up a wide range of new possibilities for re/insurance. While technologies like Blockchain (see Sonar 2016) provide options to automate processes and make them more efficient, others like Artificial Intelligence (AI) (see page 32 "Blame your robot") have the potential to disrupt underwriting, claims handling, and insurance distribution. Smart homes, autonomous vehicles, data analytics and robo chatbots are just a few technological applications that are influencing the industry (see page 34 "Sensors as weapons") and changing customer expectations. Insurtech start-ups have focused mainly on personal lines so far, but they are likely to move into commercial and specialty lines over time. A different skill set is required to execute on the innovative applications that technology offers and makes it crucial for re/insurance companies to attract talented employees. Strategic partnerships with non-insurance companies and institutional actors are also becoming increasingly valuable. Companies with a strong affinity for technology and data analytics, such as search engine companies, social media providers, online retailers and payment providers have access to superior data. This potentially creates opportunities to improve proactive risk management and mitigation that benefit policyholders. Moreover, partnerships with universities and think tanks can provide access to advanced technological knowledge to catalyse re/insurers' learning process on the road to digital transformation.

## Political environment

Various global socio-economic and political developments over the course of 2016 have highlighted the more pronounced polarisation of society. This was particularly apparent in developed markets. With the slow recovery of the economy after the last financial crisis, large sections of society felt they had not been benefiting from globalisation. The result has been increasing calls for the disruption of political establishments. Public resentment has fueled an upsurge in nationalist and populist forces. It has also increased scepticism and, even the rejection, of liberal democracy, as well as a trend towards authoritarian government.

It seems that in many instances, efforts to harmonise regulation at a global level has decreased with local regulations turning increasingly protectionist (see page 38 “Regulatory fragmentation”). International commitment to cooperation in terms of trade, security and the free movement of people is deteriorating. For example, Russia and South Africa have cancelled their participation in the International Criminal Court in 2016 and the US have already withdrawn from the Trans-Pacific Partnership. Undermining international cooperation and agreements can trigger more competition among leading powers, destabilise existing alliances and introduce unfamiliar geopolitical and economic alliances.

While the low yield environment is still continuing, central banks find increasingly limited room for monetary policy manoeuvres. The long-term laxness in monetary policies expressed through quantitative easing combined with protectionist policies could, in turn, lead to a heightened inflationary risk (see page 37 “The return of inflation”).

As a result of current trends in the political environment, it becomes increasingly difficult to take the stability of geopolitical and economic systems for granted. The public sector will therefore continue to move risk to the private sector. This could play to Swiss Re’s vision of making society more resilient by identifying relevant risk pools and helping to close the protection gap.

## Technological & natural environment

The disruptive quality of certain technologies is an overarching theme affecting the re/insurance industry. Technology’s impact on the efficiency gain in various industries has the potential to permanently change how we do business and support our clients. Technology, however, does not only affect the competitive and business environment, but also the social environment. Radical medical innovation improves life expectancy. Furthermore, social media has allowed society to collaborate and share information on a global level. Human-machine interaction in the personal and work space, e.g. in the form of smart platforms or the demand for digital experts in the labour market, will continue to increase and impact our understanding of community, consumer behaviour and the future of work (see page 30 “Cloud risk accumulation” and 32 “Blame your robot”). Technology can also put an additional strain on efforts to increase social and economic equality. More than 4 billion people still lack access to the internet<sup>1</sup> due to lack of infrastructure, costs of devices and connectivity, education and local adoption. In addition, technological change could disrupt labour markets and undermine people’s sense of economic security (see page 18 “Pros and cons of work in the gig economy”). Ultimately, this could lead to a backlash against technological change with potential negative socio-economic and geopolitical consequences.

Climate change is obviously a very long-term trend and one that increasingly affects the global population. Increasing migration, serious financial losses for the public and private sector and shortages in the food and water supply are just a few of the socio-economic consequences of climate change (see page 31 “The big drying – growing water stress”). Extreme weather events and major natural disasters were ranked among the top five global risks in terms of likelihood and impact by the 2017 WEF Risk Report. The UNHCR estimates that 21.5 million people have been forced to relocate on average every year since 2008 due to climate- or weather-related events. The growing global population, expected to grow to 9.7 billion by 2050<sup>2</sup>, and today’s models of production and consumption are putting an additional strain on our planet’s resources. Currently, we are consuming 1.6 planet’s worth of resources and this figure is projected to rise to two planets by 2030<sup>3</sup>. While there are some positive regulatory achievements like the Paris Agreement on climate change, it will most likely be technology that spurs the transformative shift towards a low-carbon economy. Low-carbon technologies like solar power and electrical vehicles as well as technological advancements in the area of smart meters and micro-grids – combined with declining prices of these technologies – are helping to drive changes in energy production, distribution and consumption.

<sup>1</sup> [http://www3.weforum.org/docs/GRR17\\_Report\\_web.pdf](http://www3.weforum.org/docs/GRR17_Report_web.pdf)

<sup>2</sup> [http://cdn.ey.com/echannel/gl/en/issues/business-environment/2016megatrends/001-056\\_EY\\_Megatrends\\_report.pdf](http://cdn.ey.com/echannel/gl/en/issues/business-environment/2016megatrends/001-056_EY_Megatrends_report.pdf)

<sup>3</sup> <http://www.footprintnetwork.org/our-work/ecological-footprint/#worldfootprint>

The question isn't whether another deadly infectious disease will appear, but when and how well we are prepared.





## Bugs on the march – underestimated infectious diseases

Mammals, alone, play host to 320 000 unknown viruses. And if just one of them jumps to humans, it could well touch off the next epidemic or pandemic. Another source could be organisms embedded in melting permafrost mostly in the Northern hemisphere, Russia, Canada and Alaska. This can result in the release of bacteria and pathogens into hitherto frozen soil. A case in point was in August 2016 when anthrax bacteria escaped into the soil of Russia’s far northern region. Among other possible consequences for the insurance industry, the permafrost thawing could become an additional risk factor in geographies with a high life & health (L&H) insurance penetration, such as Canada.

Pathogens could be distributed either through water, air (wind) or human traffic/travel, causing large-scale infection in more densely inhabited areas. Such pathogens may be unknown to people in these regions (or travelling through those regions) and may not have a natural barrier. The spreading of tropical weather conditions support so-called vector-borne diseases (e.g. West Nile virus in the US).

For emerging and re-emerging infectious diseases, it is necessary to understand the interactions between microbial pathogens and their hosts as well as the impact of environmental and social factors on these interactions. Many infectious diseases like Avian Flu, SARS, Ebola, Smallpox, Yellow Fever, Dengue and Zika are well known. However, their impact becomes less predictable probabilistically since the risk factors driving them are changing and becoming more complex. These risk factors include:

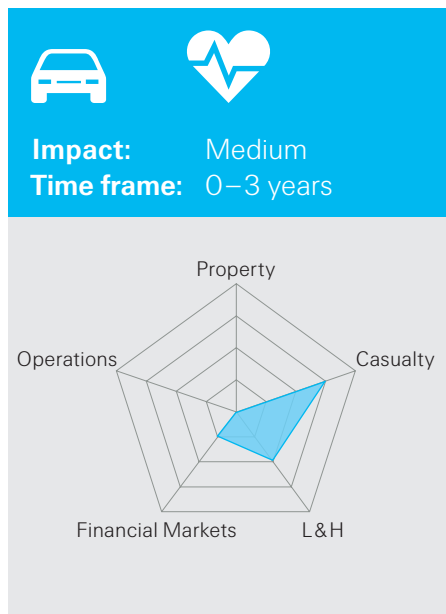
- Changes in land use or agricultural practices
- Changes in human demographics and society
- Poor population health (e.g. HIV, malnutrition) and failure of public health programmes
- Hospitals and medical procedures
- Contamination of food sources or water supplies
- International travel and trade
- Pathogen evolution (drug resistance, increased virulence)
- Climate change (e.g. vector-borne diseases)

The question isn’t whether another deadly infectious disease will appear, but when and how well society is prepared to cope with it. An additional aspect is bio-terrorism. This could become an increased threat as the increasing number of research labs dealing with lethal pathogens are not always well protected and controlled.

While certain factors increase the risks as described above, others can be mitigating influences. These include medical advances, generally improved sanitation and advanced modelling capabilities which can help the design of risk mitigation actions.

### Potential impact:

- Since pricing would not necessarily reflect the changing dynamic, there would be increased mortality and health costs for society in general and the insurance industry in particular.
- In an extreme scenario, a major epidemic or pandemic also has significant relevance for P&C-related lines and the financial markets.
- A bio-terrorism attack can most likely only be discovered with a significant time lag. This would make it very difficult to implement forceful risk mitigation action and could potentially lead to large L&H losses.



## Man-made epidemic – opioid medication and popular health

According to the U.S. Center for Disease Control and Prevention (CDC), the amount of prescription opioids sold in the country has nearly quadrupled since 1999. Opioids are pain-relieving drugs like oxycodone, hydrocodone, methadone and codeine and are the most expensive and most highly utilised for work-related injuries. In 2016, 13 of the top 25 workers’ compensation medications were opioids.<sup>4</sup> Costs for opioids have risen by 51% between 2003 and 2011 in workers’ compensation medical claims. Already today, opioid addiction is a serious problem in parts of the US. Almost 100 Americans die every day from an opioid overdose. The phenomenon impacts a wide range of professions, including sports. As early as 2011, a report was published accusing NFL team medics of overprescribing opioid pain killers. Now 1 800 former NFL players have sued the 32 NFL clubs for consequent drug dependence.<sup>5</sup> Other professional groups, however, are also impacted. The increasing use of opioids leads to abuse. The users of prescribed opioid have a strong tendency to start utilising illegal drugs as well, such as heroin. For long an urban phenomenon, opioid addiction is now firmly established in more rural areas as well, compounded by a mounting heroin addiction rate.<sup>6</sup> In McDowell county, West Virginia, there are now more drug-induced deaths than anywhere else in the United States.

Numerous factors are influencing the steep upturn in opioid addiction, and there is no real consensus among the experts as to the causes. Quoting the National Survey on Drug Use and Health, the Scientific American publication recently pointed out that “75 percent of all opioid misuse starts with people using medication that wasn’t prescribed for them – obtained from a friend, family member or dealer.” So the roots of the problem, according to some, are not changes in injury patterns or methods of treatment such as alleged liberal prescription practices. Indeed, according to the Scientific American, the real risk factors are to be sought elsewhere, such as in mental illness, child trauma, unemployment and social marginalisation.

Whatever the actual causes of the epidemic, the potential impact for the insurance industry could be serious, not only within the USA, but also in Canada, faced with a similar opioid epidemic.<sup>7</sup> In both North American countries, the concern is growing. A recent ruling in West Virginia gives patients the right to sue physicians and pharmacies for enabling addiction. The rising cost of opioid use adds to workers’ compensation medical claim costs. Moreover opioids can heighten risks for users at their workplace and behind the wheel. And there have been recent lawsuits against distributors by states and other municipalities seeking damages for the economic impact these drugs have had in their jurisdictions.

### Potential impact:

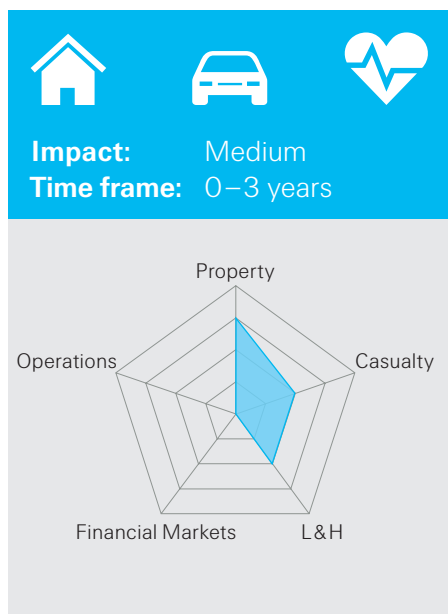
- With opioids as a major cost driver, Worker’s Compensation in the U.S. may face a serious medical claims inflation.
- An increase in medical malpractice claims may occur with doctors prescribing such drugs liberally.
- Liability law suits may also be launched against the manufacturers and distributors of opioids, including pharmacies, resulting in bigger claims exposure of pharmaceutical and related companies.

<sup>4</sup> <http://lab.express-scripts.com/lab/drug-trend-report/workers-compensation-drug-trend-report>

<sup>5</sup> <https://www.nzz.ch/sport/weiterer-sport/american-football-immun-gegen-schmerzen-ld.152062>

<sup>6</sup> [https://www.nytimes.com/2016/03/07/us/heroin-epidemic-increasingly-seeps-into-public-view.html?\\_r=1](https://www.nytimes.com/2016/03/07/us/heroin-epidemic-increasingly-seeps-into-public-view.html?_r=1)

<sup>7</sup> <https://www.thestar.com/news/canada/2017/04/25/an-epidemic-within-an-epidemic-why-opioid-use-in-canada-keeps-rising.html>



## The human factor – stress and fatigue in safety-relevant jobs

High-profile accidents such as Deepwater Horizon highlighted the role of the human factor in high-risk system vulnerability.<sup>8</sup> Human failure as such goes back to inadequate working environments. Aspects of particular importance in this respect are (a) not maintained, insufficient or not functioning equipment; (b) unclear and faulty working procedures; (c) no or inadequate training of staff; (d) information overload; (e) insecurity of working staff due to large organisational changes.

The last point was proven in a study published in the Journal of Organizational Change Management looking at 253 losses triggered by human failure. 155 of them – or nearly 2 out of 3 – happened in companies that underwent large organisational changes two years prior to the event.<sup>9</sup>

Industries where the problem of human failure is very well investigated include aviation and hospitals. Several studies have shown how the factors cited above contribute to pilots taking the wrong action in an environment that gave them no other choice.<sup>10</sup> A tragic example was the Air France flight 447 from Rio to Paris in 2009. The French Civil Aviation Safety Investigation Authority's final report concluded that the aircraft crashed after temporary inconsistencies of the airspeed measurements, after which the crew reacted incorrectly and caused the aircraft to enter an aerodynamic stall from which it did not recover.<sup>11</sup>

The medical industry is also well investigated. In the US alone, 250 000 deaths per year are attributed to human error.<sup>12</sup> Hospital staff are often not monitored for factors such as stress and exhaustion. Errors represent systemic problems, including poorly coordinated care, fragmented insurance networks, the absence or underuse of safety nets, and other protocols, in addition to unwarranted variation in physician practice patterns that lack accountability.

In summary, all research points to the fact that humans do not fail but their working environments do – by creating conditions where timely and appropriate reaction is impossible should an emergency arise.

The following list of important human factor elements is to be considered in identifying working environments that can lead to failure are the following<sup>13</sup>: Lack of communication, distraction, lack of resources, stress, complacency, lack of teamwork, pressure, lack of awareness, lack of knowledge, fatigue, lack of assertiveness, norms and large scale reorganisation.

### Potential impact:

- Studies show that the human factor plays a crucial role in insured large scale industrial losses, both in terms of likelihood and impact.
- As an example, some airlines have pushed for pilot payment according to actual flight hours. Compensation based on actual flight hours may lead to situations where pilots go to work even if they are not fit enough for flying an aircraft (e.g. due to illness).

<sup>8</sup> <http://www.csb.gov/macondo-blowout-and-explosion/>

<sup>9</sup> Mellert, et al (2015) "Examining the relationship between organizational change and financial loss", Journal of Organizational Change Management, 28: 1, 5971

<sup>10</sup> [https://www.faa.gov/about/initiatives/maintenance\\_hf/library/documents/media/human\\_factors\\_maintenance/human\\_error\\_and\\_general\\_aviation\\_accidents.a\\_comprehensive\\_fine-grained\\_analysis\\_using\\_hfacs.pdf](https://www.faa.gov/about/initiatives/maintenance_hf/library/documents/media/human_factors_maintenance/human_error_and_general_aviation_accidents.a_comprehensive_fine-grained_analysis_using_hfacs.pdf)

<sup>11</sup> <https://www.bea.aero/docspa/2009/f-cp090601.en/pdf/f-cp090601.en.pdf>

<sup>12</sup> [http://www.hopkinsmedicine.org/news/media/releases/study\\_suggests\\_medical\\_errors\\_now\\_third\\_leading\\_cause\\_of\\_death\\_in\\_the\\_us](http://www.hopkinsmedicine.org/news/media/releases/study_suggests_medical_errors_now_third_leading_cause_of_death_in_the_us)

<sup>13</sup> Transport Canada: Human Performance Factors for Elementary Work and Servicing <http://www.skybrary.aero/bookshelf/books/2038.pdf>

Antimicrobial resistance in animals  
is also a threat for humans.







### Too much of a good thing – antimicrobial overuse in animal farming

Apart from the abuse and overuse of antimicrobials in the treatment of human illnesses and infections, the proliferation of antimicrobials in the production of livestock and in aquaculture is a key factor in the spread of global antimicrobial resistance (AMR). Contamination of meat with antibiotic-resistant bacteria can produce a range of liability claims including product recalls in the food sector. Bacteria intentionally added during the processing of food (starter cultures, probiotics) or contamination during the food production may also be a cause of the problem. It is estimated that between 2010 and 2030, the global consumption of antimicrobials per kilogram of animal meat produced is to increase by 67 percent from 63 000 to 100 000 tons. In line with growing meat consumption in emerging markets, much of this growth will be in these areas of the planet. In Brazil, Russia, India, China and South Africa, the use of antimicrobials in animal production will double over the period. This development is amplified by the shift from extensive to more intensive livestock husbandry and aquafarming in these countries where antimicrobials are applied routinely.<sup>14</sup> The increased use of antimicrobials in agri- and aquaculture coincides with their equally prolific application in the treatment of human infections in these countries.

The UN declared the fight against AMR a priority in late 2016.<sup>15</sup> Since 2010, the Food and Agricultural Organisation (FAO), the World Health Organisation (WHO) and the World Organisation for Animal Health (OIE) have been cooperating against AMR and have declared it as one of the priorities of their joint “One Health” plan.<sup>16</sup> However, country policies approaching AMR vary widely, and an OIE survey has shown that 110 of 130 countries evaluated do not have appropriate legislation regarding the use of veterinary products including microbials. The problem is most pronounced with emerging and developing markets. But among OECD countries, too, the use of antimicrobials in agriculture remains a challenge. Farmers increasingly order antimicrobials online and apply them without proper instruction or education.<sup>17</sup>

The development of AMR in livestock make them more vulnerable to new types of infections and pathogens whose cross-country proliferation is facilitated by globalisation. There are also massive adverse consequences for human health, often in countries and areas where local health systems are still under development.<sup>18</sup>

#### Potential impact:

- The development of AMR in livestock and aquaculture may result in higher than expected losses from new animal diseases
- Contamination of meat with antibiotic-resistant bacteria increases the liability risk for the food industry and can produce a whole array of liability claims including product recalls in the food sector.
- The growth of the private health insurance markets, particularly in emerging regions, may be adversely affected by underestimating AMR in the underwriting processes, resulting in under-pricing.

<sup>14</sup> <http://www.pnas.org/content/112/18/5649.full.pdf>

<sup>15</sup> <http://www.un.org/pga/71/event-latest/high-level-meeting-on-antimicrobial-resistance/>

<sup>16</sup> [http://www.oie.int/fileadmin/Home/eng/Media\\_Center/docs/pdf/Fact\\_sheets/ANTIBIO\\_EN.pdf](http://www.oie.int/fileadmin/Home/eng/Media_Center/docs/pdf/Fact_sheets/ANTIBIO_EN.pdf)

<sup>17</sup> <http://www.oie.int/en/for-the-media/editorials/detail/article/risks-associated-with-the-use-of-antimicrobials-in-animals-worldwide/>

<sup>18</sup> <https://www.ncbi.nlm.nih.gov/pubmed/23812024>



### Danger in unexpected places – carcinogens in artificial turf?

Artificial turf in sport arenas has seen steady growth since the 1960s as a cost-efficient and allegedly ecological alternative to natural turf. The market is expected to grow by 11% until 2019. Some of the artificial turfs are manufactured using crumb rubber from recycled car tyres that some scientists say could cause cancer. If there is a provable link between artificial turf and cancer, it is likely there will be a casualty claims wave against manufacturers. Currently, however, the scientific community appears to be divided over whether there is a provable correlation between incidences of cancer and exposure to artificial playing surfaces. For example, in 2015 the public health authority for the city of Toronto published a detailed health impact assessment of the use of artificial turf on playing surfaces and parks. Summarising its findings, the report said: “Available evidence does not indicate that playing on ... artificial turf will result in exposure to contaminants at levels that pose a significant risk to human health ... provided users follow simple hygienic practices such as washing hands and avoiding eating on the artificial field.”<sup>19</sup> And at the beginning of 2017, health officials of the US state of Washington said that a comparison of cancer rates among footballers with rates among people in the same age group had revealed no evidence that playing on crumb rubber sports fields had caused players to develop cancer.<sup>20</sup>

Currently available studies on the issue have generally not found a causal link. However, still most of them call for further investigation. An article published by reinsurer GenRe in July 2016 pointed out that “in 2015, tests of ... artificial athletic fields that use crumb rubber found ... 12 known carcinogens. Among those substances were lead, cadmium, benzene and arsenic.”<sup>21</sup> While scientific evidence is still not hard-wired, the establishment of a causal link between crumb rubber and carcinogenic particles could pose a significant liability risk for producers of artificial turf, for schools, universities and municipalities providing artificial turf fields, as well as sports clubs, which have their athletes train and play on them.

#### Potential impact:

- If a causal link can be established between exposure to artificial turf and incidence of cancer, a casualty claims wave against artificial turf manufacturers, schools/universities and sports clubs/municipalities seems likely.
- Exposure to granulate via skin contact, inhalation etc. is more material for particular sports and team functions, e.g. for football players or soccer goalkeepers.
- Professional players may file claims analogous to concussion (see Swiss Re SONAR 2014)
- To establish a claim that it was the exposure to the turf, and not contact with other substances, that caused cancer or other illness will nevertheless remain a challenge.

<sup>19</sup> Toronto Public Health. Health Impact Assessment of the Use of Artificial Turf in Toronto. April 2015, p. 7

<sup>20</sup> Investigation of Reported Cancer among Soccer Players in Washington State [http://www.synturf.org/images/doh\\_210-091.pdf](http://www.synturf.org/images/doh_210-091.pdf)

<sup>21</sup> <http://www.genre.com/knowledge/blog/crumb-rubber-is-it-on-your-radar-en.html>



## Cancer treatment revolution? – liquid biopsy and immunotherapy

Imagine a society with half today's cancer deaths. This could lead to people living even longer. It is a fact that in middle and higher-income economies cancer is still one of the most important causes for deaths.<sup>22</sup> Research has made significant progress on both screening methodologies and immunotherapy treatments. That being said, as more people take advantage of successful screening methodologies, those with a negative test could defer or delay the purchase of insurance, leaving only those with higher risk to buy cancer cover. Moreover, while first positive signs are already there, these methodologies and drugs are still far from being mainstreamed.

Cancer screening methods evolve fast. They might help to detect cancerous developments in the body at an earlier stage. One of those methods is liquid biopsy which is a new molecular technology being explored for its use in helping treat and detect cancer. It is a minimally invasive technique that can identify genetic material from tumor cells shed into the blood from a primary tumor or metastatic site. Liquid biopsy is being tested for its use to monitor patients' response to treatment, to identify actionable genetic markers for targeted therapy, to support disease prognosis and to detect disease recurrence. For the foreseeable future however, histopathology will remain the standard for cancer diagnosis and staging.<sup>23</sup>

While the immune system can attack invading infections, it can't prevent the development and spread of cancer cells – i.e. mutated normal cells. Recent developments in immunotherapy attract increasing attention due to their potential for cancer drug treatments. Such treatment can stimulate the body's immune system to recognise and attack tumors. Skin and lung cancer are among the types of cancer that could most effectively be treated, albeit with only about 20% of patients gaining remission from their cancer and not without significant side effects. A new drug used for pancreatic cancer has so far not led to any significant side effects.<sup>24</sup>

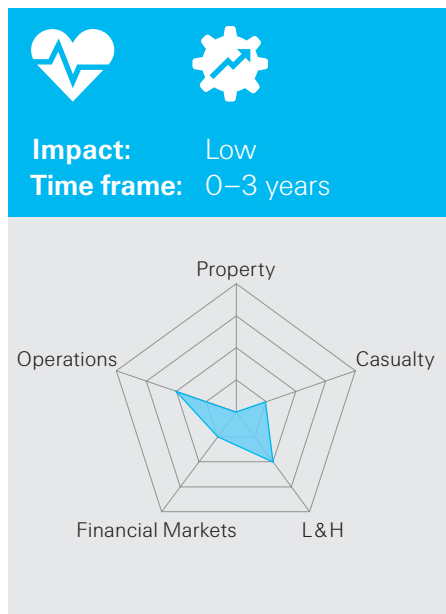
### Potential impact:

- While the new liquid biopsy test could ultimately benefit cancer patients and improve survival outcomes, it also creates new risks and exposures for life and health insurers, particularly for critical illness and cancer products.
- As more people access liquid biopsy tests, anti-selection risk may also increase. Those with a negative test could defer or delay the purchase of insurance, leaving only those with higher risk to buy cancer cover.
- The available drugs for immunotherapy with cancer drug treatment are promising but still at very early stages. While existing drugs show significant side effects, the newest drug with minimal side effect is not yet used broadly enough in order to show robust results.

<sup>22</sup> <http://www.who.int/mediacentre/factsheets/fs310/en/index1.html>

<sup>23</sup> [http://media.swissre.com/documents/ZRH-17-10652-P1\\_Factsheet+liquid+biopsy.pdf](http://media.swissre.com/documents/ZRH-17-10652-P1_Factsheet+liquid+biopsy.pdf)

<sup>24</sup> <https://www.theguardian.com/science/2016/sep/06/new-drug-wakes-up-immune-system-to-fight-one-of-deadliest-cancers>



### Pros and cons of work in the gig economy – another kind of digital risk

The digitisation and brokering of services increasingly disrupts all types of market segments, but it has become particularly visible in recent years in service sector industries such as delivery, transportation, and hospitality. Cases in point are digital platforms such as Deliveroo, Uber, Lyft and AirBnB, which are providing supplementary income for a growing number of households. Increasingly though, people are deriving their entire income from several smaller jobs, money which together may amount to that formerly provided by just one source of employment. The result is that some people have become increasingly dependent on juggling different jobs, with the employee of the past becoming more of the entrepreneur of the future. Work-related stress and adverse health effects could increase as a result.<sup>25</sup>

Increasing flexibility of work has been welcomed both by employees who can decide more freely over their schedule, and by companies which can ease market and shareholder pressures by relying on a contingent workforce. The use of robots, and automation in general will likely further accelerate this trend. In this context, the concept of zero-hour contracts may gain importance. These are contracts between an employer and a worker, where the employer is not obliged to provide any minimum working hours, while the worker is not obliged to accept any work offered.<sup>26</sup>

The latter no longer have the employer-provided benefits and the workplace protections of the employee of the past. In fact, the legal definitions and the regulatory framework for “employee” and “employer” are blurring.

If precarious working arrangements abound with negative effects on household incomes, frustration will grow among the workers, and can manifest in distrust of corporations and political pressure for respective regulations.

#### Potential impact:

- Social security systems will be underfunded if no ways are found to include the workforce in the sharing economy into social security schemes.<sup>27</sup>
- Insurance coverage for people switching between regular employment and self-employment on a daily or hourly basis may become more demanding, creating protection gaps and also increasing the risk for fraud. In addition, employee loyalty might decline in such an environment.
- Universal basic income is being more widely discussed, and basic income pilots have been implemented as a mitigation measure in some nations.

There are also benefits, such as rising labour-force participation, providing opportunities for the unemployed, as well as the general benefits enjoyed by everybody else, both consumers and corporations. Additionally, it leads to greater efficiency in the economy, by speeding up the matching processes (for which the 2010 and 2012 Nobel Prizes in Economics were awarded) but also rising social trust.<sup>28</sup>

<sup>25</sup> [https://www.nytimes.com/2015/07/13/business/rising-economic-insecurity-tied-to-decades-long-trend-in-employment-practices.html?\\_r=0](https://www.nytimes.com/2015/07/13/business/rising-economic-insecurity-tied-to-decades-long-trend-in-employment-practices.html?_r=0)

<sup>26</sup> [https://en.wikipedia.org/wiki/Zero-hour\\_contract](https://en.wikipedia.org/wiki/Zero-hour_contract)

<sup>27</sup> Seth Harris and Alan Krueger “A proposal for modernizing labor laws for 21st century work: The “independent worker”

<sup>28</sup> [http://www.europarl.europa.eu/RegData/etudes/IDAN/2016/587316/IPOL\\_IDA\(2016\)587316\\_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/IDAN/2016/587316/IPOL_IDA(2016)587316_EN.pdf)



## Emerging trend spotlight | Ageing in dignity – the pivotal role of re/insurance

We are living longer. We are having fewer children. And our society is growing older. By 2050, it is expected that almost a quarter of the world's population will be over 65. As the numbers of seniors increase, so does the challenge of making sure they are financially protected. However, just as older age is becoming the new norm, there is no norm for older age.<sup>32</sup>

Generally, longevity increases the burden for the younger generations. If pension systems exist, they will be put under strain by more spending and less income. In addition, healthcare costs for the elderly increase the burden on the young, thus emphasising intergenerational inequality.

In many markets, young people still in education or unemployed are often largely supported by their middle-aged parents, who in many cases also have to care for their own aged parents. While the baby-boomers may thus be the heaviest burden on the welfare systems, they are also under pressure to sustain both a younger and an older generation. Boomers in these circumstances have been dubbed the “sandwich generation.”

To lighten the burden of elderly care, one can support either the care giver or the care recipient or, indeed, both parties. As increasing numbers of people live longer lives, their desire to age with dignity most often coincides with a wish for continued autonomy, independence and self-care. To help them fulfil this wish can be a win for all.

An established but still improvable way to support life quality in old age is mitigating financial risks through insurance solutions. Enhanced financial protection may be sought not just for the individual but also inter-generationally, i.e. for the social environment supporting the elderly person.

Another promising avenue is the intensified and integrated use of smart technology to enable efficient support for elderly in their every-day life, and particularly in living longer in their own homes. “Assisted living” technology will become an important market for monitoring the household and its inhabitants, providing assistance with daily activities like medication and medical emergencies. Social robots can support humans in many ways, be it with strenuous work like lifting heavy weight, with cleaning and cooking, with entertainment or even companionship.

Apart from high-tech solutions, strategies may also include inter-generational housing, where the young inhabitants are incentivised to provide basic services of oversight, assistance and care to the elderly.

It is clearly a market that is ripe with opportunity for insurers. Developing financial solutions that stick means they need to be much more than one-size-fits-all. Successful solutions must begin with the hopes, fears and needs of each consumer.

<sup>32</sup> Who pays for aging? a Swiss Re study details and analyses spendings for people over 64 “to supply their income, provide for their health and social care, and cover the inheritance they aim to pass along” in six insurance markets (Australia, China, Germany, Japan, the UK and the US) [http://www.swissre.com/rethinking/longer\\_lives/#inline](http://www.swissre.com/rethinking/longer_lives/#inline)



### Dangerous games – risks of e-sports

E-sports – basically hardcore video gaming – sees the number of fans and amateur players increasing steadily. 2017 will see the number of fans in the world grow to 145 million, almost as many as the number of people who watch American football on a regular basis. And if one factors in those who actually play, this number is probably far higher. The biggest e-sports markets are the US and China with major tournaments attracting both online and live audiences in the hundreds of thousands. Two major characteristics of the e-sports boom are the involvement of major consumer brands in sponsoring events (e.g. Amex, Ford and Coca Cola) and the increasing demand for betting opportunities associated with this activity, both of the regulated and illegal kind.<sup>29</sup>

Another feature of the sport is the growing numbers of gamers suffering injuries. Health insurers may have to deal with injuries and mental disorders among younger people involved with the sport. According to the Berlin-based e-sports Observer, “wrist injuries, especially carpal tunnel syndrome, have become a performance-crippling, if not career-threatening issue for many pro-gamers. Medical treatment is costly and health benefits in players’ contracts aren’t common.” Though such injuries are minor in comparison to other sports, they do pose some accumulation potential.<sup>30</sup> Other impacts on health can be sleep deprivation or abnormal sleep behaviour patterns resulting in various diseases.

The world’s largest e-sports organisation (ESL), in collaboration with the anti-doping authorities, has already been trying to stamp out the use of performance-enhancing medication by gamers such as Ritalin and Adderall. Moreover with a view to curbing addiction and burn-out symptoms, especially among young people, the authorities in South Korea passed the so-called ‘Cinderella Act’ preventing kids under the age of 16 from using game sites between midnight and 6am.

#### Potential impact:

- Companies sponsoring e-sports events may face reputational risk issues if e-sports are increasingly perceived as socially harmful leading to addiction or mental problems among young people. However, some other research shows that this is just a new leisure time activity increasingly performed by young men who do not have a full time job.<sup>31</sup>
- Health insurers may be faced with a growing number of smaller injuries and mental disorders among younger people resulting in long-term adverse effects. Other impact on health can be through either sleep deprivation or abnormal sleep behaviour patterns resulting in various diseases.

<sup>29</sup> <http://www.telegraph.co.uk/investing/business-of-sport/online-gaming-professional/>

<sup>30</sup> <http://bigthink.com/ideafeed/esports-injuries-are-on-the-rise>

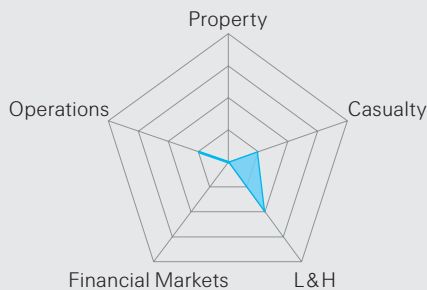
<sup>31</sup> <http://www.economist.com/blogs/economist-explains/2017/03/economist-explains-24>

A growing number of hardcore video gamers suffer from injuries or mental disorders.





**Impact:** Low  
**Time frame:** >3 years



## Good things in your gut – advances in precision medicine

There are countless bacterial colonies within the human body, many of which help the digestive system function as it should. The action and composition of these colonies, known as the microbiome, change when a body is diseased or injured. This means that provided that the microbiome is well understood,<sup>33</sup> the microbes in question can potentially act as a system of biomarkers in disease diagnostics. Perfecting such precision medicine promises to improve preventative care, and reduce costs by enabling tailor-made individual treatment. Such a prospect could be of positive significance for the insurance industry.

In 2008, the Human Microbiome Project set out to generate resources that would enable the characterisation of the human microbiome and analysis of its role in human health and disease patterns.<sup>34</sup>

Recent studies on the significance of the gut microbiome have led to the understanding how small imbalances in our intestinal microbial populations can cause diseases. This new understanding could lead to better and more effective treatments that will kill only the harmful bacteria, unlike antibiotics which target both good and bad microbes. These studies also indicate that human gut flora also play an important role in the metabolism and efficacy of how pharmaceuticals are absorbed by our bodies.<sup>35</sup> Some of the conditions that are likely to be affected by our microbes include:<sup>36</sup>

- Asthma/Allergies – Researchers believe that the increase in asthma and hay fever rates in the U.S. has something to do with the environment and possibly our microbes. The use of hand sanitisers, air filters and anti-microbial cleaners could be responsible for this phenomenon.
- Autism – Research into what causes autism has revealed some weak genetic links and possible environmental triggers.
- Autoimmune diseases – These diseases arise when the immune system is confused and attacks one or more of the body's normal tissues/organs as if they were invaders, causing inflammation and damage.
- Cancer – Recent research also indicates that microbes have an indirect role in causing cancer.

### Potential impact:

- Microbiome can play an important role in personalised medicine and nutrition. As an example, experiments in mice show that a microbiome implanted from obese to thin animals made the thin mice obese.
- Advances in research and medical practices have made significant progress in the treatment of diseases at the patient level. This precision medicine promises to reduce adverse effects, improving preventative care, and reducing costs by tailoring individual treatment based on highly detailed diagnostics.<sup>37</sup>
- Privacy risks and concerns could arise.<sup>38</sup>
- As a broad screening methodology it could radically change how we look at medical inspections and treatment.

<sup>33</sup> Clinical Genomics 101, 2017 edition – An introduction to Clinical Genomics

<sup>34</sup> NIH Human Biome Project: <http://hmpdacc.org/overview/about.php>

<sup>35</sup> Jourova, L; Anzenbacher, P; Anzenbacherova, F. (September 2016). "Human gut microbiota plays a role in the metabolism of drugs." <http://www.ncbi.nlm.nih.gov/pubmed/27485182>

<sup>36</sup> "The Microbiome and Disease." <http://learn.genetics.utah.edu/content/microbiome/disease/>

<sup>37</sup> Introducing the Microbiome into Precision Medicine, Trends in Pharmacological Sciences, Jan 2017: [http://www.cell.com/trends/pharmacological-sciences/fulltext/S0165-6147\(16\)30131-6](http://www.cell.com/trends/pharmacological-sciences/fulltext/S0165-6147(16)30131-6)

<sup>38</sup> <http://www.npr.org/sections/health-shots/2013/11/04/240278593/getting-your-microbes-analyzed-raises-big-privacy-issues>





## Emerging trend spotlight | Citizen science – an opportunity for insurance?

Citizen science is the participation of amateurs in scientific knowledge production. Supported by government initiatives and hosted by universities and research institutions, crowd-sourced knowledge production is booming.

Under the supervision of experts, non-professional researchers can help with puzzle solving, pattern recognition and classification of data. While the research participation is rewarding, entertaining and educating to the involved amateurs, it allows research institutions to pursue otherwise overly time-consuming projects and share labour intensive tasks. Initiatives in the US and in Switzerland, for example, engage the public to map Mars and the human brain, collect weather and drought data, or analyse solar storm patterns.

The case of PatientsLikeMe illustrates the bottom-up creation of a knowledge network for patients with rare diseases. Starting out as an exchange of advice on how to improve personal conditions and life quality, this online community grew to half-a-million members, to a research institution, an advocacy group and also a business enterprise, offering data sets to support the development of new therapies.

The insurance industry has hardly tapped into public crowdsourcing, for example to receive feedback for product marketing. But the potential of a knowledge and data-driven industry to engage the public is vast, and obviously, re/insurance has a lot to offer. The internet connects large networks of people globally, and it allows to scale individual inputs. If given an opportunity, human curiosity and ambition, individual expertise and experience, is eager to collaborate to a greater good otherwise unachievable. If orchestrated with transparent rules and benefits to all involved, there is the possibility to build non-proprietary data platforms to improve health and wellbeing, the safety of roads and cities, to protect natural environments or to support sustainable farming. Loss prevention and improvements in safety and life quality are common gains to be envisioned. Collaborations may also be sought to develop insurance products, explore new distribution channels and improve risk modelling.

Citizen science could become an important channel for insurance to foster risk dialogue and risk understanding, customer engagement and public trust.



A period of globalisation and international coordination seems to be followed by protectionist trends, new trade barriers and regulatory fragmentation.





### Reduced market access – protecting your own backyard

Western countries that have historically promoted free trade and financial globalisation have recently experienced upturns in politically motivated nationalism and protectionism. Such developments may eventually lead to trade barriers and market access issues around the globe. The ultimate result could be a slowdown in economic growth and in the international expansion of multinational corporations, including large insurance companies. Regulatory controls are typically employed to build and support national champions based on market access restrictions. Historically, such controls have been limited to select emerging markets to advance local interests and to prevent the outflow of capital.

Recently, this trend has also spilled over to some developed markets. Normally, policies such as these are pitched to domestic political audiences as a legitimate defence of local industry. Protectionism gains momentum, especially if the debate is framed under the heading of protecting domestic employment. Moreover, this trend could also begin to affect other areas of international trade and investments, including capital flows.

Protectionism could eventually undermine the business models of international corporations. This would likely result in a slowdown of global trade over the medium to long term. In particular, industries which are dependent on large economies of scale or global diversification would be most affected.

#### Potential impact:

- In a world where nationalistic tendencies are strengthening, market access will become more difficult for all industries, including re/insurance. Consequently, there will be a negative impact on global trade and economic growth. Capital controls not only diminish the fungibility of capital but may also undermine contract certainty and even the ability to offer products in certain countries.
- In the long-run, diminished diversification effects will make insurance products more expensive, which will dampen insurance growth and hinder the industry’s efforts at bridging the protection gap.

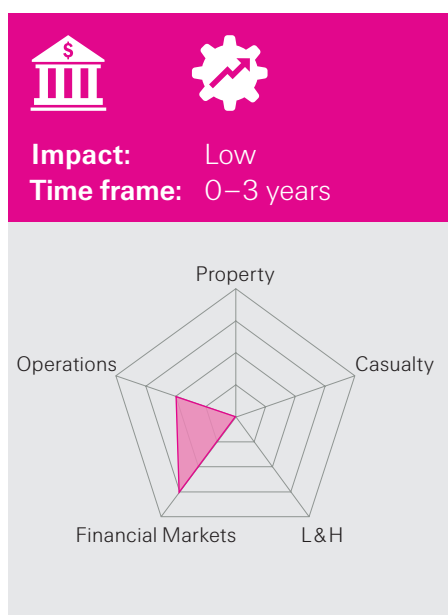


**Emerging trend spotlight | Data privacy – balancing personal rights and underwriting needs**

The generations that came of age before the appearance of the internet, smartphones and social media, express concern about privacy and ethical treatment of their digital data. It is their misgivings that have been largely driving current regulatory efforts in the area of data privacy and protection. The European Union’s General Data Protection Regulation (GDPR), designed to strengthen and unify data protection, is a case in point. The millennial generation however, the “digital natives” who have grown up with digital communication, appear to be less bothered about sharing their data. This is noteworthy given that data are traded as the “new oil” by ever larger parts of the economy, including insurance.

Insurance is an information-based business that needs to access and use data. Insurance products that reflect economic production costs and expected cost differences maintain the fairness, equity, and financial soundness of an insurance system. Overly conservative restrictions on data use can hinder the availability and affordability of insurance. For example, evidence requirements on the use of data for statistical purposes could hinder underwriting capabilities and perhaps undermine the effectiveness of products and markets. It is important that re/insurers engage in dialogue with consumers to hear their concerns and to explain the kind of data used, how and why this information is employed and how their personal information is protected. This will help give the public confidence in the benefits of data use and build trust that personal information is managed responsibly with clear accountability for any breach of privacy.





### Hijacked money – political risk of forced investments

Global re/insurance companies held assets of USD 32 trillion in 2015, 75% of which were invested in fixed income assets.<sup>39</sup> Many European governments try to kick-start economic growth in their countries, while being confronted with high levels of public sector debt, rising entitlements and enormous future liabilities. Pools of large managed assets are attracting their attention. So far, the focus has been on the assets saved in private pension schemes. Governments in Hungary and Poland have partially or fully nationalised such assets in recent years in order to direct them towards domestic industries.<sup>40</sup> Such nationalisations have also occurred in Argentina in the past.<sup>41</sup>

Now, other privately-held assets have also come under scrutiny of governments in order to spur growth and funding preferred industries. Many populist parties favour such programs.

Such policies would amount to a partial confiscation of insurers' assets. If more widespread, they would put the industry under threat. Limitation to "only small" percentages of total assets could erode over time, and an ever larger part of assets could then be sequestered. From an operational perspective, it would pose grievous problems to asset-liability management. Insurance companies may resort to capital flight if such policies become more commonplace. Also, demand for insurance in countries affected by such policies may be reduced, as the trust placed in insurers' ability to pay in the case of claims may be weakened.

#### Potential impact:

- Insurers could face significant balance sheet uncertainties over whether they can meet their liabilities, which would in turn undermine the trust in the industry.
- Legal and regulatory uncertainties will abound about the practical application of such policies (e.g., how to measure the assets impacted by these policies).
- Insurance multinationals will see fungibility of capital reduced.
- Politically selected industries for investments could be exposed to asset bubble risks.

<sup>39</sup> Swiss Re Institute

<sup>40</sup> <http://www.reuters.com/article/hungary-pensions-idUSL6N0TG2MP20141127>,  
<https://www.bloomberg.com/news/articles/2016-07-04/poland-to-overhaul-its-35-billion-private-pension-fund-industry>

<sup>41</sup> <http://www.nytimes.com/2008/10/22/business/worldbusiness/22argentina.html>



### Cash repression – the paper money squeeze

There is growing criticism of paper money and coins, and a small but increasing number of companies and service providers no longer allow for cash payment. Today, technology enables cashless payments beyond credit and debit cards, including mobile devices and a variety of payment services. Additional traction comes from the emergence of bitcoin and other cryptocurrencies. The insurance industry is investigating scenarios of cash repression, ranging from writing business digitally, to an entirely cashless economy. Cash repression poses a significant risk for insurers, because it deprives them of the option to store cash physically, and allows for even more pronounced negative interest rates.

Meanwhile, Greece and Italy have introduced caps on cash payments, to curb the use of paper money and coins in order to fight tax evasion, Denmark has proposed a law that would no longer oblige restaurants, petrol stations and small shops from accepting coins and cash.<sup>42</sup>

A partial repression of cash occurs through limits on cash payments above a certain amount – currently in place in 12 EU countries – and the withdrawal of large denomination bills: For example, the European Central Bank has announced the phasing out of the 500 Euro bill.<sup>43</sup> Recently, India (a very cash-oriented society) and Venezuela abruptly withdrew and exchanged bills to fight financial crime and inflation respectively. However, those most hurt were the poor, who held their small amounts of savings in cash.<sup>44</sup>

However, cash remains popular in transactions, because people trust the cash in their hands: In Germany, over 80% of daily transactions continue to be in cash, and even in the US, it remains the most popular way of settling payments.<sup>45</sup>

#### Potential impact:

- An end of paper money could pave the way for even lower negative interest rates, with severe assets risks for insurers.
- Predominantly cashless transactions would increase efficiency of operations considerably.
- The withdrawal of paper money from circulation could lead to a further erosion of trust in governments and institutions in general, that could transiently also affect the insurance industry.
- As a benefit for governments, the fight against tax evasion could lead to a broader tax base and higher tax revenues.
- The positive impact on fighting terrorism, drug trafficking and other organised crime is likely to be small.
- Digital payment networks are highly dependent on security and stability, as they are more susceptible to cyber-attack, identity fraud etc.
- The recent case of India demonstrates that – if not properly executed – reforms to the payment system and the relative transition to digital payment systems can have detrimental effects on the poor and deepen the digital (and economic) divide between less and more digitally enabled regions (generally a rural-urban divide) with potential short-term drag on economic growth.

<sup>42</sup> <https://www.nzz.ch/finanzen/private-finanzen/sechs-gute-gruende-fuer-bargeld-1.18559816>

<sup>43</sup> <https://www.nzz.ch/finanzen/devisen-und-rohstoffe/devisen/beliebtes-zahlungsmittel-anhaltende-hexenjagd-auf-bargeld-ld.135999>

<sup>44</sup> <http://www.economist.com/news/leaders/21711040-narendra-modi-needs-take-measures-mitigate-damage-his-rupee-reform-has-done-indias>, <http://www.bbc.com/news/world-latin-america-38339479>

<sup>45</sup> [https://static.nzz.ch/files/7/5/8/bm\\_Anhaltende-Beliebtheit-von-Bargeld-Kopie\\_001\\_1.18775758.png](https://static.nzz.ch/files/7/5/8/bm_Anhaltende-Beliebtheit-von-Bargeld-Kopie_001_1.18775758.png)

Criticism of paper money  
and coins is growing.





### The perfect storm – cloud risk accumulation

Cloud services have become widespread, for businesses and consumers alike. The increase in data volumes, and the mobility of data access have been driving the adoption of cloud computing as well as lower costs. The cloud allows different users to access and share data. Clouds-of-clouds – integrated distributed cloud services – or super clouds, promise cloud services regardless of where you are and where the data you want to process is hosted. In theory, interconnected services like these can be set up as closed systems. Cloud service providers like Google, Microsoft or Amazon Web Services operate data centres through the internet, thus encompassing vast networks of data flow and management.

But as the cloud of cloud (super cloud) accumulates data-sets and services on an ever-increasing scale, it also generates a variety of risks that may accumulate to a “perfect storm”. Should an event bring down or severely impair a super cloud, whether through a technical failure, a cyberattack or a power blackout – possibly caused by a natural disaster –, and last a couple of days, the financial loss could be immense.

If a huge data storage provider like Amazon Web Services is disabled for 24 hours, it is going to cause business interruption for countless sub-providers and their clients. If webpages and business applications are not running and business data not accessible, business processes will discontinue, and the accumulated loss could be considerable. Since operations and supply chains will be inevitably affected, the longer the interruption persists, the wider-ranging the effects will be. And the indirect consequences for a third party can also be generated by a region geographically remote. The accumulative property of the super cloud consequently makes it a preferred target for hackers and cyber war strikes.

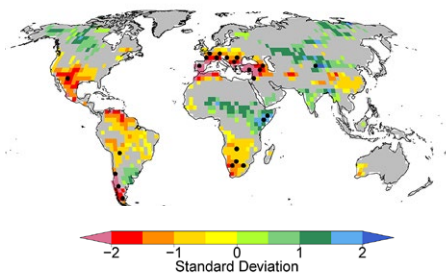
#### Potential impact:

- High severity of a single event due to the inherent accumulation potential
- Business Interruption (BI) and Contingent Business Interruption (CBI)
- Liability for data loss and privacy issues
- Loss scenario depends on location, concentration and redundancies of clouds-of-clouds service
- Regulatory complexities and uncertainties abound, affecting operations of global players





**Soil moisture anomalies**  
2081–2100 vs 1980–1999



Soil moisture anomalies refer to the water content of the entire soil column. Negative values show a decrease in soil moisture (and increase in drought risk). Positive values show a respective increase.

Source: Orłowsky B. and Seneviratne S.I. (2013) "Elusive drought: uncertainty in observed trends and short- and long-term CMIP5 projections", *Hydrol. Earth Syst. Sci.*, 17, 1769, Figure 1f

### The big drying – growing water stress

Most of California, the U.S. Southwest and Central states are obliged to deal with an on-going water crisis. Water (over-)use continues to be an issue in the U.S. Midwest with triple pressure from farming, industrial water uses, and household consumption. Similar situations can be found around the world, from the Mediterranean to Africa, parts of Asia and Latin America.

The World Resources Institute ranked future water stress (ratio of withdrawals to supply) in 167 countries and found that 33 countries will likely face extremely high water stress by 2040, with 14 countries in the Middle East alone.<sup>46</sup> Climate change is expected to play an increasing role as well. Detectable trends towards more frequent drought conditions before the end of the 21st century can be observed in particular in the Mediterranean, South Africa, and parts of the Americas.<sup>47</sup>

Water scarcity, drought and wildfires already lead to significant economic losses today. As population and economic values continues to grow in affected areas loss potentials will increase as well.

Regarding water consumption, the industries in strongest competition for decreasing water resources are the agricultural and beverage sectors as well as the energy and mining industries. Severe water stress in these areas could impact global food production and related commodity prices. In addition, the energy industry could see limits to their production if water is not readily available. Besides water availability, water quality is also often adversely impacted by the energy, mining and agricultural industries.

As a side effect of increased drought, forests generate less yield and at the same time contain more fuel for large scale wildfires. In some regions of the world, food security is the dominant risk factor and has just recently increased the famine risks for parts of Africa. If combined with conflict areas such situations can lead to humanitarian crisis and migration.

#### Potential impact:

- Losses in agricultural, energy and forestry sectors due to drought conditions will likely increase. At the same time, this is a chance to enhance water-efficient practices and to provide parametric insurance solutions.<sup>48</sup>
- The risk of large scale wildfires affecting wide areas remains a considerable long-term risk that is likely to increase.
- Drought-induced soil subsidence can create property damage from cracks in buildings and other infrastructure.<sup>49</sup>
- Water pollution events in the energy, mining and agricultural sectors could lead to environmental liability exposures, including clean-up costs.
- Weak water governance can create uncertainty as decisions on water use for energy, agriculture and further purposes are often lacking.
- Many water basins cross country borders which can lead to regional or even larger scale conflicts between nations.<sup>50</sup> Thus cross-border cooperation is a key issue.
- Mass migration (often in combination with humanitarian crisis) from drought affected areas to areas with sufficient water sources, putting additional pressure on water rich regions.

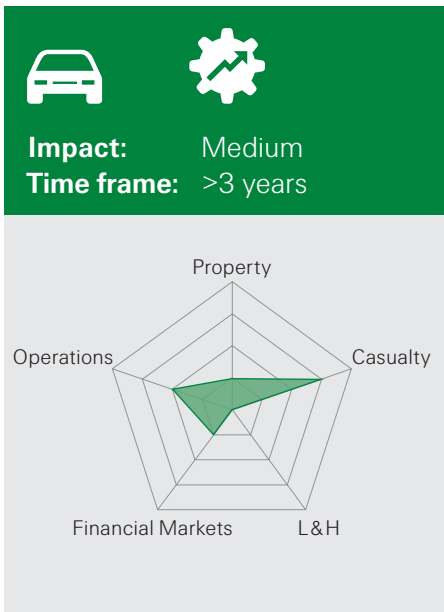
<sup>46</sup> <http://www.wri.org/blog/2015/08/ranking-world%E2%80%99s-most-water-stressed-countries-2040>

<sup>47</sup> Orłowsky B. and Seneviratne S.I. (2013) "Elusive drought: uncertainty in observed trends and short- and long-term CMIP5 projections", *Hydrol. Earth Syst. Sci.*, 17, 1765

<sup>48</sup> <https://www.worldenergy.org/publications/2016/the-road-to-resilience-managing-the-risks-of-the-energy-water-food-nexus/>

<sup>49</sup> [http://www.swissre.com/media/news\\_releases/nr\\_20110704\\_soil\\_subsidence.html](http://www.swissre.com/media/news_releases/nr_20110704_soil_subsidence.html)

<sup>50</sup> <http://worldwater.org/water-conflict/>



### Blame your robot – emerging artificial intelligence legislation

The rising importance and capability of robotics, artificial intelligence (AI) and self-learning machines pose questions about the changing status of intelligent machines. If the latter are able to assume increasing numbers of human tasks, if they can learn and adapt, and ultimately make decisions for human beings, should they still be treated as inanimate objects? Initially at least, could a robot manufacturer or a robot itself, or an autonomous car be held accountable for its decisions, and thus made liable for eventual damage caused? Is it reasonable to establish a new legal personality for autonomous systems like ‘electronic persons’ with specific rights and obligations, and make them liable for harm caused to third parties?<sup>51</sup> Should, in such a case, the manufacturers of these intelligent machines be freed of their responsibilities for injuries and damages caused by the machine’s autonomous decision?

Discussions about future liability regimes and financial security instruments tailored to respond to the liability risks associated with autonomous systems in general, and with robotics/AI/machine learning in particular, have gained momentum in the European Union. Indeed, the EU is one of the industrial champions in the development and production of such intelligent systems.

In the current EU product liability framework, product liability focuses on the strict liability of the manufacturer/importer for bodily injury and property damage caused by the defect of the product. The ongoing review of product liability might bring major shifts to the very concept of liability, and gaps in consumer protection.

The case illustrates the ambiguities raised by artificial intelligence. The uncertainties as to stringent future regulations are underlined by differing cultural attitudes toward machine intelligence and robotics in different parts of the world.

#### Potential impact:

- Discussions on future liability regimes gain importance with the take-off of autonomous systems and robotics in general, and with artificial intelligence and machine learning in particular.
- Shifts from the current liability regimes could leave consumers with more vulnerability.
- Implementation of mandatory financial security requirements may negatively impact the development of voluntary insurance solutions.
- AI and increased capabilities of robots highlight the questions regarding the role of human decision making in automated processes and the ways in which human ethical frameworks relate to non-humans.

<sup>51</sup> <http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+REPORT+A8-2017-0005+0+DOC+PDF+V0//EN>



## Emerging trend spotlight | Blue ocean economy

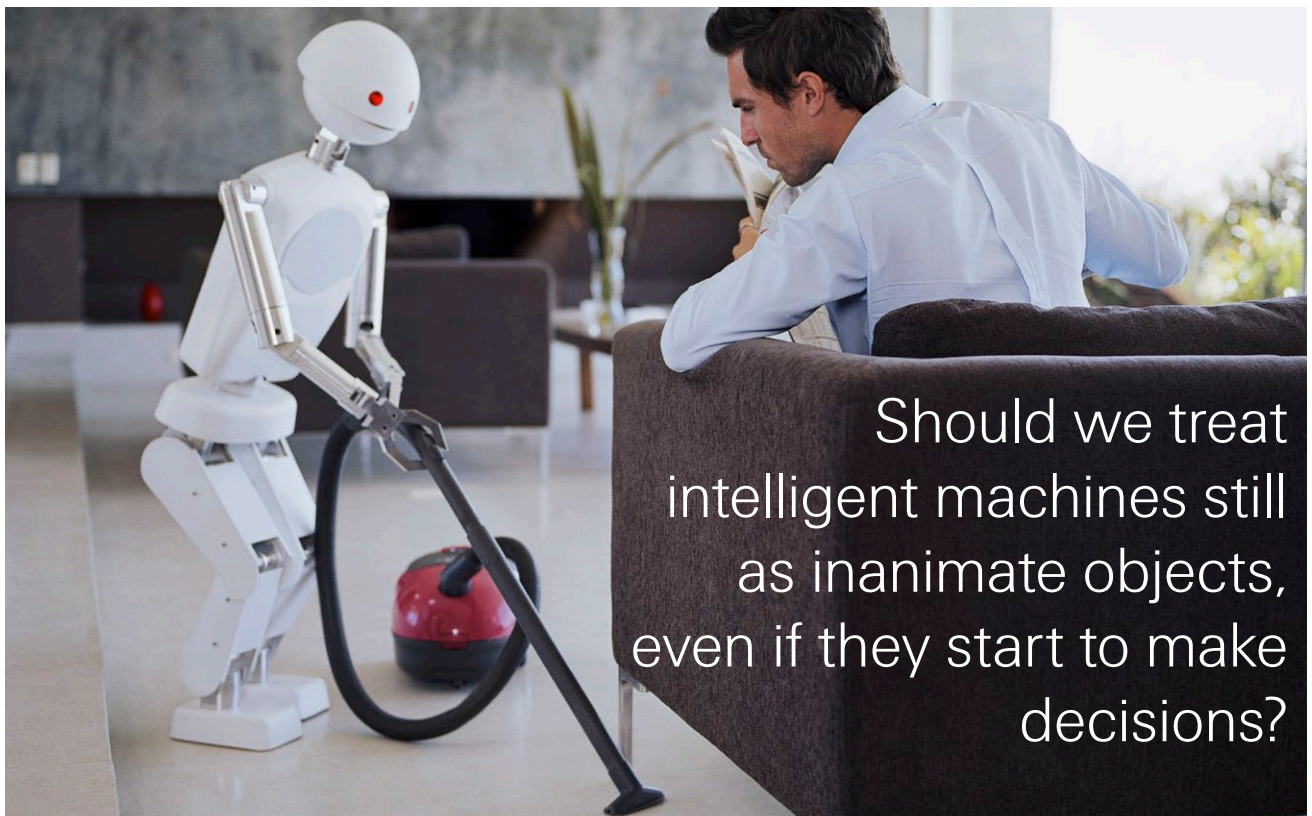
Over recent years, the ocean economy, including the exploitation of marine resources and related risks, has been gaining attention. The oceans provide a complex and little known economy with increasing wealth production, but also subject to increasing stress. Key drivers for this growing focus on oceans are the increasing knowledge and familiarity with the marine environment, new technologies allowing the exploitation of ocean resources, demographic trends, the need for food security and alternative sourcing of minerals and energy, as well as marine trade and coastal urbanisation.

Among the established ocean-oriented industries are fisheries, oil and gas exploration, seabed mining, shipping and tourism. Emerging industries include marine aquaculture, pharma and chemicals, marine biotechnology, deep seabed mining, renewables, habitat protection as well as ocean monitoring, control and surveillance. Based on a study by the OECD, marine industries contribute roughly USD 1.5 trillion (or 2.5% of global gross value added) based on 2010 estimates. These figures are rapidly growing and are estimated to be at USD 3 trillion by 2030. In the same time frame, employment is expected to grow in ocean-related industries from 31million to 40 million full-time jobs.

The blue (ocean) economy refers to the growing awareness of the importance of ocean ecosystems and the impacts of human activity on those sensitive ecosystems. A working definition offered by the Economist Intelligence Unit defines the blue ocean economy thus: "A sustainable ocean economy [is when] an economic activity is in balance with the long-term capacity of ocean ecosystems to support this activity and remain resilient and healthy."

Renewable resources like fish stocks have been collapsing due to overuse. Fossil resource extraction from the sea beds can significantly damage marine life (e.g. the Deepwater Horizon event in the Gulf of Mexico). Climate change can have an impact through, for example, coral reef bleaching. Political ambitions to claim international territories are also fired by economic interests. Last but not least, new ways of transportation through modern shipping fleets or routes (e.g. arctic opening during summers) could make marine transport faster and more attractive.

The insurance industry can help through risk transfer to reduce uncertainty as companies venture into uncharted waters. It is also interacting in many ways with the established and emerging marine industries. It will therefore be an ideal partner to develop a strong and resilient blue ocean economy.





### Sensors as weapons – Internet of Things invites cyber-attacks

The proliferation of the Internet of Things (IoT) continues unabated and is leading to an explosive spread of digitally enabled devices in public, home, manufacturing and commercial use. As early as 2018, it is expected there will be 22 billion IoT-enabled devices (sensors, chips etc.), way in excess of the 7 billion mobile handhelds. But security with many of these devices is generally poor and malware targeting the IoT has become sophisticated. For instance, the number of Distributed Denial of Service (DDoS) attacks using the IoT devices is growing rapidly.<sup>52</sup> Cyber risk exposure for re/insurers is therefore likely to increase, a fact requiring adjustments to their approach to such risks. A spectacular attack in October 2016 made massive use of unsecured internet-connected digital devices which were eventually forged into a centrally commanded and controlled network (botnet).<sup>53</sup>

With the IoT becoming the ‘new normal’, the predictions are that the short term benefits of digital investment will soon be outweighed by the costs for cyber security. That being said, the cumulative effects of cyber security investment over the years will still be worthwhile in the long term.<sup>54</sup> But the IoT as an attack multiplier may eventually undermine the culture of trust that (still) pervades the internet and could eventually dull the promise of beneficial digitisation.

That critical infrastructure is moving from stand-alone systems to those connected to the internet only makes the challenge more difficult, since this not only increases the number of available devices but also facilitates attacks on critical infrastructure.<sup>55</sup> It follows, then, that the latter’s resilience and protection become an ever more pertinent issue.

DDoS attacks are relatively simple and there remains some doubt how useful relatively primitive IoT devices like sensors could be for more sophisticated attack modes. However, the sheer proliferation of devices amplifies the risks significantly. For the insurance industry, this means that constant monitoring of the cyber risk landscape is a matter of some urgency.

#### Potential impact:

- Manipulated IoT may not only lead to property loss and business interruption, but could also cause fatalities.
- Cyber risk exposure for the industry is likely to increase with the exponential growth of the IoT and will require adjustments in risk identification, assessment and measurement.
- The lack, or insufficient level of protection and updates for IoT devices could increase the likelihood of liability claims against software producers and distributors as well as hardware providers.
- A massive hijacking of the IoT for cyber-attack purposes can raise fundamental issues around the insurability of cyber risks and could provoke public private partnerships to provide insurance capacity through pool solutions.

<sup>52</sup> <https://www.symantec.com/connect/blogs/iot-devices-being-increasingly-used-ddos-attacks>

<sup>53</sup> <https://www.theguardian.com/technology/2016/oct/26/ddos-attack-dyn-mirai-botnet>

<sup>54</sup> <http://publications.atlanticcouncil.org/cyberrisks/>

<sup>55</sup> <https://www.worldenergy.org/publications/2016/the-road-to-resilience-managing-cyber-risks/>



## Emerging trend spotlight | Precision farming

The technological revolution is not only transforming manufacturing – witness “the industrial internet of things” or “industry 4.0” – but is also modernising agriculture, through applying digitisation, robotics and other technologies to optimise production processes. Among other areas, precision agriculture integrates farming management to automatise, monitor and optimise resource use, fertilizer and pest control, animal husbandry and harvesting.

Modern farms not only hosts bees, but also drones. Equipped with sensors and GPS, these devices autonomously map out and monitor a field for aspects such as aridity, temperature, crop growth and pests. The generated data is immediately sent wirelessly to the farmer’s computer where it can be further analysed and lead to accurate interventions. A drone, or an autonomous tractor, or a smart irrigation system can then bring out water, fertilizer or pesticide at the exact amount and to the very point needed.

The benefits of the technological revolution happening in smart factories and smart farms are similar in many ways, as are the risk factors. The complexity of evermore interconnected services, increase not only vulnerabilities, but also the size of potential losses. And while industrial plants have been a preferred target for cyber-attacks for some time now, we may soon see the hacking of crop fields and piggeries as well.

Precision farming provides opportunities not only for large industrialised agriculture but also for small farms. The actual implementation still will vary considerably. The gains for productivity, environmental protection and resource economies are projected to be substantial. Precision or smart farming will also change agriculture insurance, as it offers opportunities, for example in loss prevention and efficient claims handling. Crops monitoring allows for more proactive care, and visually sensor equipped drones can easily and quickly document and verify a loss. As with other smart technology implementation, insurance may grow its consulting function also with precision farming.



Inflation has picked up again.





### The return of inflation – the effect on insurance business

After years of low inflation and fears of deflation, headline consumer prices have picked up again, primarily due to the oil price recovery.<sup>56</sup> However, the development is not uniform across OECD countries: while the United States, United Kingdom and Canada are approaching their central banks' respective inflation targets, or have already surpassed them, the Euro area and Japan still remain below theirs. It is also worth noting that central banks have indicated a willingness to tolerate a temporary overshooting of the inflation target, after years of inflation undershoots, as long as medium-term inflation expectations remain anchored around their target.

Inflation affects insurers in various ways: it influences investment returns, asset valuations and, particularly, future, longer-term insurance liabilities. For insurance liabilities medical and social cost escalation are of particular importance. Consumer price inflation (CPI) such as commodity or food inflation has a lower impact. The impact is strongest with P&C insurers, as inflation directly increases claims costs of long-tail legacy business. Life insurers, on the other hand, are mostly impacted through the asset side, that is potential changes in asset valuations and investment returns. For example, equities generally tend to perform well in an environment of higher inflation, but they could be negatively affected in the near-term by a more sudden increase in prices. Meanwhile, government and corporate credit bonds, particularly those with long-term maturities, will decline in value. An additional effect on life insurers may be where higher inflation results in rising interest rates, which increases the lapse risk of insurance policies. This is because policy holders of savings contracts promising low guarantees may be inclined to surrender their policies in exchange for new contracts offering higher interest rates, particularly if there is a sharp spike in the same.

Longer-term inflation expectations for most OECD countries remain moderate. However, accommodative central bank policies in Europe and Japan still harbour uncertainty while some analysts argue that the Federal Reserve has fallen behind the curve. From an insurance perspective, much also depends on the speed of inflation development. Spikes are much more difficult to manage than gradual increases in inflation, and elevated levels for longer time periods are a challenge for insurers as well.<sup>57</sup>

#### Potential impact:

- Inflation will add to pressure on insurers' profitability, already under stress from competition and regulatory requirements.
- While insurers can protect themselves through a number of measures against the potential effects of inflation (e.g., diversifying assets into commodities or real estate, premium increases to manage claims costs, contract clauses), circumstances warrant careful management and may not always be permissive to such measures.

<sup>56</sup> <http://www.cnbc.com/2017/02/14/global-inflation-reawakening-to-test-central-banks-and-markets.html>

<sup>57</sup> Sigma 4/2010, "The impact of inflation on insurers", p. 1



### Island solutions – regulatory fragmentation

After a prolonged period of coordination, local regulators have started to show a declining appetite for globally-aligned policy reforms. With recent political changes and protectionist trends, the chances of global standards being agreed and implemented have decreased, while territorial approaches to supervision are on the rise. For the re/insurance industry, this could threaten global diversification of risk pools and the efficient management of capital. This regulatory fragmentation is exacerbated by a trend towards extraterritorial application of domestic rules.

After the financial crisis of 2008, the G20 significantly heightened regulatory efforts to work towards global standards by founding the Financial Stability Board (FSB). The FSB initially focused its efforts on banking sector reforms, but eventually mandated the International Association of Insurance Supervisors (IAIS) to develop new international standards for the insurance industry. These included the development of a global insurance capital standard and the promotion of group supervision and supervisory cooperation.

However, rising popular discontent with the current economic and political order in the world's developed economies, which supply not only most of the insurer's sector premium income but also most of the financial assets, could lead governments to withdraw from international regulatory standard-setting efforts, and more generally adopt key tenets of economic nationalism.

Since it may potentially impede insurers' ability to engage in cross-border capital management, regulatory fragmentation is a particular concern for international insurers who seek to support the benefits of diversification by pooling capital centrally.

#### Potential impact:

- In a fragmented regulatory world there is much less opportunity to efficiently pool risks. It therefore increases the operational costs due to two main factors: (a) reduced diversification possibilities, and (b) operational costs to implement local, regional and global regulatory rules.
- Uncoordinated regulatory approaches will be less effective in promoting financial stability and could undermine re/insurers' ability to support economic activity and closing the protection gap.





### Eroding rationality – the information challenge

The foundation of the re/insurance business model is based on the one hand on rationality, i.e., a common and mutually intelligible understanding and assessment of risks, and on the other hand on trust, i.e., the trust of the customer that the insurers will pay in future in case of a legitimate claim. The advent of digitisation and the spread of social media have multiplied and “democratised” the supply of information. So have the quality standards of many of these new information sources and suppliers. It has also provided a platform for conspiracy theories and the spread of fake news, alternative facts and blatant lies.

In the click-economy of the internet, the advertisement industry loves large audiences and bloggers can get rich by generating a large amount of ad-views and/or clicks. Indeed some bloggers may be incentivised to invent sensational falsehoods just to cash in on the ads. Additionally, as the professional “fake news”-inventor knows, the more outrageous the “news” the more attention it gets.

Another way to manipulate opinions on the web is by triggering feedback from virtual robots hosted by service companies to chat with real people (“chatbots”). Microsoft had to abort a public experiment with its chatbot Tay within hours, after user feedback triggered the chatbot to turn into a hate-speech troll.<sup>58</sup> It is not only rogue interventions that play an important role, but also self-amplification and the associated reinforcement of biases and disinformation. This effect is heightened even more by search engines (google e.g.), where one’s findings are filtered according to prior searches. Social media, too, which facilitates the formation of like-minded friends and followers reinforce a particular set of preferences for information and attention.<sup>59</sup>

People do not act upon mere reality, but upon what they perceive to be real. A client is not going to take out cover for the increased likelihood and severity of storms caused by climate change if he or she doesn’t believe in climate change as a phenomenon or, even worse, deems it to be another example of a global conspiracy. The troubling part of such conspiracy theories is not that they exist, but that ever more people believe them to be true.

This can have significant impact on the insurance industry. If customers do not trust insurance to behave fairly, and assuming that customers do not only rely on facts and rationality, the insurance industry could very well lose business. At the same time, it becomes increasingly difficult for re/insurers to know which data sources they can tap into are reliable. So new information asymmetries are emerging which could influence the relationship between insurers and insureds.

#### Potential impact:

- Growing distrust in established political institutions is spreading to corporate players, many of which are already held in low esteem by important sections of the population. This will have a particular impact on the insurance industry whose business model is highly dependent on clients’ trust.
- Social media are an ever more important channel to spread stories, rumours and false information. Simultaneously, the service of bulk social media are increasingly sold not only for commercial, but also for illegal purposes.
- The rapid spread of overly biased and fake news poses a major reputational risk and communication challenge to insurance companies in high-profile claims situations.
- Will a retreat from evermore services, transactions and communication based on the internet be likely? Or are people inextricably locked in with the web?

<sup>58</sup> <https://www.theguardian.com/world/2016/mar/29/microsoft-tay-tweets-antisemitic-racism>

<sup>59</sup> Quattricocchi, Walter: Social Media and the Distortion of Information, WEF Global Risks Report 2017, p. 25.



### Emerging trend spotlight | Prudence with risk pools

Enabled by technological innovations, insurance is becoming evermore differentiated and dynamic. In personal lines, tailor-made and pay-as-you drive products are proliferating. Good risk behaviour is rewarded and bad habits penalised. Telematics in the motor sector, wearables and the Internet of Things in life & health and smart homes in the property space are all examples where this principle can be applied.

Big Data and Smart Analytics offer the prospect of increasingly individualised risk assessments, products and pricing. This begs the question whether the insurance industry still has to rely on large risk pools as a key element of its business.

What sounds like a natural opportunity and win-win, also entails pitfalls and open questions. Insurers generally form groups of insureds that are similarly exposed and charge a premium accordingly. The new insurance world does the same but with more detailed individual insight and selection. This system is founded on the collection, measurement and storage of personal information and is enabled by technological advances in data gathering and processing. The individual risk disposition, behaviour and adjustment is highlighted and monitored. Consequently, the need to ensure data quality and safety, but also to prevent adverse selection, becomes ever more complex and urgent.

While the small tailored risk pool may look attractive, it may not necessarily be profitable. Even if operational costs can be cut down radically through digitisation of the business model, a single small risk pool may not generate sufficient premium volume. On the other hand, if it is bundled with others to achieve a significant portfolio, there could be a re-emergence of risk accumulation in the form of the possible correlation between the smaller risk pools making up the portfolio. To carry out robust statistical estimates, the minimal size of these smaller risk pools will still be defined by the need for a sufficiently large and stable number of risks.

Finally, there is the challenge of societal acceptance. The shrinking of risk pool size, and the potential exclusion of individuals from coverage, could 'politicise' the public debate about availability and access to coverage. This, in turn, could trigger a discussions about the differences and relationship between public and private sector insurance schemes. The result could be regulatory pressure on the industry to keep risk pools larger or more inclusive. Reputational risk might consequently increase.



### Shifting land use – uncertainties for real estate values in the new economy

Recent decades in the developed markets have witnessed rising real estate values in the centres of prosperous cities. So-called flagship stores have been willing to pay ever higher rents to front downtown properties, in locations characterised by service industry offices and urban infrastructure hubs. The trend among insurance companies to invest in central urban real estate is ongoing. It is reinforced by the low interest rate environment, but also reflects expectations that real estate in urban cores will continue to be in high demand with both commercial and residential users, thereby resulting in continued positive price development in the long term.

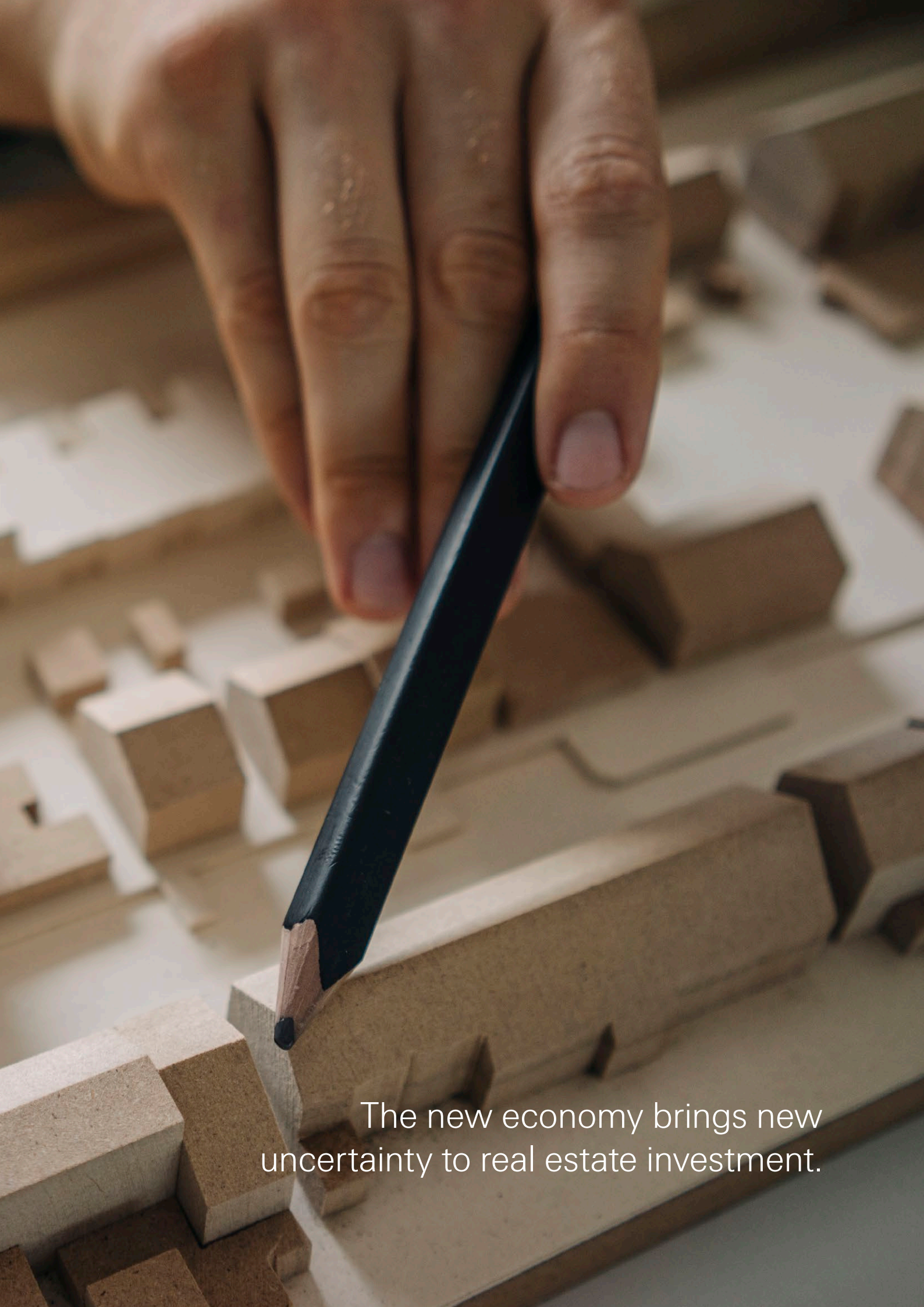
However, demand for certain types of real estate may moderate over time. The recent trend towards sharing cars and apartments, may result in lower demand for parking and residential space. This trend could be further reinforced by autonomous vehicles being able to park themselves in confined spaces when not needed in the connected ride-sharing service network. Additionally, there would be the impact of drone deliveries, teleworking and virtual business meetings. These combined shifts could result in lower demand for commercial real estate, therefore putting downward pressure on land values. Finally, if online shopping continues to gain market share, certain the flagship stores may no longer maintain a presence in the traditional city-centre.

On the other hand, inner city housing may see a new wave, taking advantage of the liberated space. Middle classes could return from the suburbs with new business development fuelling a real estate boom and attendant investment opportunities for the financial services sector.

These multidirectional trends result in uncertainty around the valuation trends for investment in real estate in the long run.

#### Potential impact:

- Real estate investment portfolios may be subject to increased volatility going forward. Therefore, when managing these investments, future trends need to be carefully monitored, particularly in inner cities where the property use might change over time.
- In the context of the low interest rate environment, insurance companies are attracted to investing into centrally located urban property, with expectations of rising rent revenues and asset values being widely maintained globally. Nevertheless, longer-term demand for retail space, offices and particularly for parking and storage units could experience a decline.
- This could be offset by increased demand for residential units in the urban cores. Furthermore, urban planning policy actions seeking to rebalance supply and demand may be supportive of land and property values. As such, the opportunity set for institutional investors may still be maintained even in the context of higher market volatility and considerable secular shifts.



The new economy brings new uncertainty to real estate investment.

## Appendix: Terms and definitions

### What is SONAR?

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

### What are emerging risks?

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

### What are emerging risk themes?

Emerging risk themes illustrate potential new or changing risk developments for the insurance industry. They are mainly derived from SONAR but also draw on other sources. All themes have been assessed and edited by Swiss Re's emerging risk management experts. This report only features new emerging risk themes, i.e. topics covered in previous editions are not listed again. You can retrieve prior reports from our webpage: <http://tinyurl.com/ny9zje2>

### What is meant by overall impact?

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

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

### What is meant by time frame?

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

### What is meant by impact per business area?

Spider graph indicating the potential impact on major insurance business areas on a scale from 0 (= no impact) to 4 (=significant impact)

### What are trend spotlights?

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

### What are macro trends

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

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