Change remains the only constant in our highly interconnected world. Risks are emerging everywhere, with ripple effects across industries. Foresight information is the key to enabling fast, high-quality decision-making.
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The sooner we anticipate risk, the more effective we’ll be at prevention and preparation.
Welcome to the latest edition of Swiss Re SONAR, our annual emerging risk update.

In a future in which change seems to be the only constant, foresight information is crucial to prepare for tomorrow’s challenges. To this end Swiss Re has fully embedded foresight and emerging risk management in its enterprise risk management framework. It is our pleasure to share some of our latest findings to raise awareness of emerging risks and initiate a process of developing solutions together.

The report should not be understood as a forecast that accurately reflects what the future will bring. It rather seeks to provide an early indication of what might lie beyond the horizon and could become relevant going forward. While many of the topics presented might never materialise into significant risks, some definitely will — and the earlier we start adapting to these changes, the better prepared we will be for tomorrow’s challenges.

Patrick Raaflaub
Group Chief Risk Officer

Reto Schneider
Head Emerging Risk Management
Introduction

In an ever-changing risk landscape, the insurance industry is continuously confronted with new challenges. Key drivers of this changing risk landscape are new economic, technological, socio-political and environmental developments, as well as the growing interdependencies between them. These can change the dynamics of risks already known or even underwritten. This includes the perception of risks by consumers, regulators and policy holders as well as their legal treatment.

As a result, the insurance business as the commercial risk transfer industry needs to constantly monitor an evolving risk landscape and adapt its behaviour, market conduct and product portfolio. This poses significant and permanent challenges for our industry, which can no longer rely solely on historical data to assess tomorrow’s exposure.

All of this happens against a backdrop of global macro trends that are setting the cornerstones of tomorrow’s risk landscape. Through discussions with experts and surveys Swiss Re has identified 23 macro trends with high impact that could emerge within the next 5 to 10 years, covering the societal, political, technological & natural as well as the competitive & business environment. The macro trends are an important basis for Swiss Re to assemble a strategic view of the re/insurance world, to understand future threats and opportunities and to shape Swiss Re’s strategy going forward.

To minimise the number of surprises, we don’t only monitor the macro trends. Swiss Re has fully embedded foresight and emerging risk detection and analysis in its enterprise risk management framework. Even before the term came into use, Swiss Re had established an internal crowdsourcing tool to collect input and feedback from underwriters, client managers, risk experts and others. With the SONAR tool — standing for the Systematic Observation of Notions Associated with Risk — we have established a solid process for identifying, assessing and managing emerging risks.
2015 Macro Trends

**In the social environment**
- Growing middle class in High Growth Markets
- Longevity and chronic diseases
- Connected & collaborative society
- Radical medical innovation
- Urbanisation of global population
- The future of work & talent gaps

**In the competitive & business environment**
- Redistribution of risk along the re/insurance value chain
- Insourcing of reinsurance risks by primary insurers
- Increasing supply of alternative capital for reinsurance solutions
- Market entrance of non-insurance companies in primary market — “Primary Attackers”
- Cognitive computing
- Regional champions going global

**In the political environment**
- Public sector moving risk to private sector
- Increasing government influence and regulations — “Nationalisation”
- Emergence of new economic powers — “Shift to the East”
- Geopolitical instability & divergence

**In the technological & natural environment**
- Climate change
- Massive expansion of cyber risks
- Big data & smart analytics
- Internet of things
- Cognitive computing
- E-distribution as the dominant distribution channel
- Autonomous vehicles (including cars and drones)
Emerging risk insights and trends

This report highlights 21 emerging risk insights. It is meant to provide a first indication of what might lie beyond the horizon to allow readers to prepare for future challenges.

Topics were identified through Swiss Re’s SONAR process and have been reviewed by Swiss Re’s emerging risk management experts. They draw on all areas of insurance. Many could have cascading effects across areas and lines of business.

Top topics of overarching concern:
- De-globalisation (p.8)
- The great monetary experiment (p.9)
- Challenges of the Internet of Things (p.11)

Top topics for property:
- Challenges of the Internet of Things (p.11)
- Super nat cats (p.10)
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Top topics for casualty:
- Challenges of the Internet of Things (p.11)
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Top topics for life & health:
- The great monetary experiment (p.9)
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Top topics for financial markets:
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Top topics for operations:
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- The great monetary experiment (p.9)
- Office of the future (p.29)
Overview of emerging risk topics by timeframe and potential impact

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De-globalisation

**Description:**
Political conflicts have been intensifying over the last few years in many regions including Eastern Europe, the Middle East and East Asia. In some cases, sanctions and other interventionist policy tools have been implemented to stop the flow of capital, goods and people across borders (eg, sanctions against Russia). Simultaneously, economic distress has led to an upsurge in populist and nationalist parties, eventually intensifying the threat of more protectionist regulations and legislations in the near future. In Europe, these could trigger territorial separatism (eg, Scotland or Catalonia) and eventually undermine integration projects such as the European Union and the Euro area.

The post-Cold War consensus — ie, that the global economy works best and most efficiently when the political system limits itself to principle-based regulation while fostering cooperation and competition — is fraying. A preference for nationalist policy approaches, with strong interventionist tendencies, can be detected, though its strength varies across regions. Financial services have seen much more interventionism over the last years, and other markets — such as labour and communications — may be affected going forward.

**Potential impact:**
- Negative impact on the economic and investment environment, leading to lower premium volumes and return on investment
- Asset management becomes more challenging in a world where interventionist regulations and sanctions disrupt the free flow of capital, as well as the availability of investable assets
- An increasing compliance burden may also saddle the flow of premiums and claims payments
- Multinational corporations may increasingly be forced to recruit nationals in particular jurisdictions

Economic distress has lead to a upsurge in populist and nationalist parties. In Europe that could lead to more territorial separatism.
**The great monetary experiment**

**Description:**
In spite of some growth, many structural deficiencies of the global economy remain unaddressed. The Eurozone debt crisis lingers on, with only modest growth, high unemployment and unsustainable debt levels in some countries. Japan also continues to be mired in low growth, while China’s growth rates are decelerating.

Traditional policy measures, including expansionary fiscal policy and monetary easing, are either no longer feasible due to high debt burdens or have reached their limits, as interest rates have reached the zero lower bound in many markets. Nevertheless, extremely accommodative monetary policies continue and even intensify, resulting in competitive devaluation. Financial repression policies are set to continue. It also remains unclear how debt burdens can be reduced to more sustainable levels. More radical strategies, such as the use of “helicopter money” (ie, intentionally fuelling an inflationary cycle) are entering the policy debate.

The consequences of such policies are highly uncertain and could range from deflation to inflation or even both — one after the other. Short- to mid-term consequences include extremely low interest rates, profound distortions of risk-return profiles, potential asset price bubbles, an impaired credit intermediation channel and increasing economic inequality. Long-term unintended consequences include the potential for higher inflation, as well as reputational damage for central banks.

**Potential impact:**
- Continuous low interest rates strongly impact the balance sheet of conservative, large asset managers like insurers, particularly life insurers, whose business model and long-term profitability and survivability is fundamentally put into question
- Low growth hinders the growth prospects of insurers, while surplus capital is driven into the reinsurance market in the search of return, depressing reinsurance rates
- In case of an inflationary surge, insurers may be confronted with accelerating claims inflation

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**Emerging trend spotlight | Robotic care**

According to UN estimates, the number of people 65 or older will exceed the number of young people by 2050.¹ This means that there will be fewer and fewer younger people to care for more and more elderly which creates a large incentive to automate assistive work. Robotics is making rapid progress. Robots become cheaper, safer and more capable and robotic companies have begun to focus on elderly care as a huge potential market.

Robots could help care for the seniors in different ways. Robots can take over tedious tasks such as fetching a tray with medication. Robotic pets can provide companionship. Exoskeleton-like systems can support those who have a hard time walking or picking up objects. Applications are developing quickly, with several research institutions and private companies working on fully integrated nursing robots.

Progress hinges on regulatory issues, but also on public acceptance. Close interaction between humans and robots requires sophisticated safety norms and standards. Furthermore, humans must accept robots as co-workers and caregivers. As the number of elderly people keeps increasing, perceptions will probably change to accommodate robots so that workloads remain at acceptable levels and human caregivers can devote more time to human interaction.

¹ UN 2002, http://tinyurl.com/o5pwxjd
Super nat cats

Description:
Large natural catastrophes represent major threats to the economy and society and create significant losses. Two cases in point are atmospheric river events and volcanic eruptions, both of which are not yet sufficiently taken into account as serious disruptors by a wide range of stakeholders.

Atmospheric rivers (AR) are narrow corridors of concentrated moisture in the atmosphere. One of these corridors runs along the US West Coast. Between 1997 and 2006, California experienced more than 40 AR events that, while providing a valuable water supply for the region, also posed a threat in terms of extreme flash flooding and heavy snowfall. The US Geological Service published a study on a winter storm scenario called ARk, looking at the impact of an AR event with a return period of 1,000 years. Findings indicate that flooding would overwhelm flood protections in many areas, resulting in the evacuation of more than a million residents, direct property damage of nearly USD 400 billion and business interruption costs of about USD 325 billion. Insured property claims would add up to about USD 20–30 billion. These numbers are higher than those associated with an earthquake in southern California with similar likelihood.

The risk of volcanic eruptions might also be underestimated as no large eruption has occurred since the 1815 Tambora eruption in Indonesia. It has been estimated that the effects of a medium-scale super eruption would be similar to those predicted for the impact of an asteroid with a diameter of 1 kilometre. Even for smaller eruptions, the economic consequences could be huge, particularly if they occurred close to population centres. Volcanic eruptions can also have a devastating impact on global travel, as vividly illustrated by the eruption of the Icelandic volcano Eyjafjallajökull in 2010.

Potential impact:
- Atmospheric river events may lead to extensive flooding with large-scale property damage and business interruption
- Volcanic eruptions may lead to significant property damage and business interruption and could have far-reaching repercussions throughout the economic system, interrupting global travel and supply chains and — in the case of super eruptions — even affecting global weather patterns
Challenges of the Internet of Things

Description:
The Internet of Things (IoT) will revolutionise consumer experience and behaviour as well as the management of organisations and societies. By 2025, it is estimated that a family of four could have more than 100 connected devices while individuals may be in daily contact with 3,000–5,000 connected things.

The IoT will become the true foundry of big data, but increased connectivity will raise questions about network and data security, resilience and long-term maintenance and software updates. Losses could occur from system malfunctions as well as malicious attacks from hackers and criminals. Concerns focus particularly on patching and ‘secure development’ because security is not the top priority of device developers. There may also be legal and compliance risks as new legislation and regulation on data use and privacy could also come into force in many jurisdictions, with the risk of little coordination and standardisation across countries.

The IoT has significant potential to challenge entire lines of insurance business. There will be many more ways to avoid losses while risk assessment can be improved thanks to the availability of additional data. This could make the physical world safer, reducing the need for risk management and risk transfer. However, other risks may increase in the digital world with people increasingly relying on data and digitally supported processes. In addition, other players such as large technology companies may consider entering the insurance market to capitalise on their enormous amount of data.

Potential impact:
- New data streams may introduce new sources of information asymmetry between insurers and consumers
- Hacking and malfunctions could have a significant impact on traditional P&C policies that have some coverage for cyber risks, as well as on ‘pure’ cyber products in both P&C and L&H
- Regulations addressing data availability, usability and privacy could limit the upside potential of big data and make claims handling more difficult
- Accumulation control will be a key challenge for insurers — as well as a key differentiator

By 2020 there will be nearly 7 times more networked devices than people in the world.

Figure 1
Number of connected devices

Source: “Living in a hyperconnected world”, Swiss Re
Drought in Brazil has pushed up the global price of Arabica coffee beans by almost one-half.
Brazilian drought

Description:
The ongoing drought in Brazil represents a serious threat to the country. Since 2014, levels of rainfall are far below average levels, leading to water shortage and extremely low levels in the water reservoirs. Some fresh water reservoirs close to São Paulo reached levels below 5% of their maximum capacity in early 2015. The problem is worsened by polluted rivers, deforestation and population growth.

Poor planning and politics further aggravate the situation, with critics alleging that state authorities have failed to respond quickly enough to the crisis. Furthermore, Brazil’s water infrastructure suffers from serious underinvestment and mismanagement, with more than 30% of São Paulo’s treated water lost due to leaks and pilfering.

Since Brazil is highly dependent on hydroelectric power, the drought is also impacting energy generation and supplies. At least six cities have been hit by blackouts due to weak hydroelectricity generation and high demand for air conditioning as temperatures soar over 35°C. In response, utilities are burning more fossil fuels, adding to the cost of energy and greenhouse gas emissions. Without major rainfall, power rationing is expected for the south-eastern region by latest in May 2015.

Brazil’s agricultural sector is also affected by the ongoing drought. Production of Arabica coffee beans, for instance, already fell 15% in 2014, pushing up the commodity’s global price by almost half.

Water specialists warn that the crisis could still be in its early stages. It is likely to have complex consequences for Brazil, further damaging the country’s troubled economy. It is estimated that the annual growth of Brazil’s GDP will be lowered by 0.7% due to the ongoing drought.

Potential impact:
- Weaker than expected economic growth in Brazil
- Increasing water and food prices, which may ultimately trigger social unrest
- Water and energy rationing in major Brazilian cities such as São Paulo
- Climate change liability claims against companies responsible for pollution and deforestation

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1 Watts 2015, http://tinyurl.com/ov9xx6x
2 Romero 2015, http://tinyurl.com/psmqd5v
3 Brazil: The Long Climb Back, Institute of International Finance, 2015
5 IIF 2015: Brazil – the long climb back
6 Latin America: The Year of Reckoning, Institute of International Finance, 2015
Lifestyle drugs

**Description:**
Several new or returning ‘lifestyle drugs’ are legally available and enjoy great popularity. For example, Shisha smoking (water pipe), a longstanding tradition in the Middle East, has become a recent trend in Western countries. Similar to e-cigarettes\(^7\), scientists are debating the health effects of these substances. They are also assessing whether the practice could encourage consumers who do not smoke to pick up the habit.

Some US states have recently legalised consumption of marijuana, with unknown consequences for public health and safety. Will use of synthetic pain killers decrease, while psychoses and traffic accidents increase? The arrival of the e-joint (a vaporiser for marijuana’s psychoactive compound, THC), and poorly regulated and abundant supply of drugs on the Internet are exacerbating the problem. We are also seeing increased diversity, complexity and uncertainty on the international regulatory map.

**Potential impact:**
- Proliferation of lifestyle drugs with unknown effects may increase uncertainty
- Regulatory diversity with partial legalisation of cannabis and other drugs may boost related regional industries and “drug tourism”

\(^7\) See Swiss Re SONAR 2014, http://tinyurl.com/q8xsqxq

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**Emerging trend spotlight | Autonomous vehicles**

Imagine a world free of car accidents, ship collisions, train and airplane crashes. That vision could be a reality if those systems were freed from human error.

Unmanned aerial systems/drones are already widely used\(^1\) (see also “Traffic jam in the skies,” p.30). Driverless trains are already in use in the London underground, autonomous submarines are mapping and exploring the seafloors while remote-controlled cargo vessels are operating at sea. The big prize — self-driving cars — might be next.

What started with driving assistance, ABS breaking and airbag systems, traction control, GPS routing and park distance control may soon become the fully autonomous self-driving car. Safety and efficiency gains are the most prominent argument for the development of self-driving cars, though a number of challenges remain. To begin with, different types of technology will be operated side by side during the uptake phase. How will autonomous cars interact with a human driver on board? Who will be liable in case an autonomous car crashes? Personal liability of the driver will probably shift to the product liability of the manufacturer. But questions still arise when self-driving cars become the norm: what if automated systems fail or stop? Do we expect that humans will take over control again? Additionally the new generation of vehicles will be loaded with sensors, allowing real time data collection. While there is a huge upside to the pay-as-you-behave, data protection and privacy issues still need to be solved. It is also possible that great numbers of people will reject this new technology, whether for privacy reasons or simple preference.

Assuming public acceptance is high and the regulatory framework allows a wide use of autonomous vehicles, the speed of launching autonomous vehicles will largely depend on the production capacity of the industry and the process of decommissioning existing transport systems. We expect a gradual shift rather than a radical leap.

\(^1\) Swiss Re 2014: Insurance and the rise of drones, http://tinyurl.com/q7ga8jw
Predictive maintenance

**Description:**
With the rise of the Internet of Things (see p.11), more machines, devices and household appliances are equipped with sensors to monitor deterioration. They are already used in transformers, brake pads and turbines. Soon it will be possible to tailor the maintenance of machinery and equipment, exchanging single parts only when they are close to the end of their life cycle. Periodic maintenance cycles could be reduced, replaced by ad hoc interventions.

Yet, there is also a risk that many machines will no longer be maintained, checked and tested in their entirety, potentially undermining long-term safety and security. In addition, IoT-based remote maintenance entails cyber risks as the access used for maintenance could also be misused by hackers to attack systems connected to the same network.

**Potential impact:**
- Improved safety from better maintained machines and buildings may reduce losses and thus dampen insurance demand in the long term, ultimately shrinking the top line of insurers
- Insufficient, limited or inadequate predictive maintenance could lead to unexpected property and casualty losses (product liability); also in life and health and employers’ liability/workers’ compensation in case of human fatalities and injuries
- Liability claims may be levelled against the developers and vendors of predictive maintenance software

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Emerging trend spotlight | Analogue hermits and digital detoxing

Analogue hermits shun Facebook, Twitter and other forms of social networking. They deliberately withdraw from the digital world, renouncing electronic technology and digital communication. This disenchantment has quickly grown from a niche phenomenon to a mainstream position which could impact cultural and business practices based on networked electronic devices and internet services: How can companies reach those who deliberately disconnect in times when corporate communication is increasingly geared towards online channels? How can they provide appropriate goods and services to those who refuse to share their data?

Besides true analogue hermits who completely withdraw from all forms of digital communication, temporary “digital detoxing” is becoming ever more popular. It is defined as “a period of time during which a person refrains from using electronic connecting devices such as smartphones and computers”\(^1\). In the US, the digital detox movement already manifests itself in the form of a “National day of unplugging”\(^2\), ‘unplugged’ summer camps for adults and a thriving consulting and counselling industry focused on how to better deal with the digital communication overload. It seems we are witnessing the birth of a new industry, hatching from a growing feeling of uneasiness with the pervasive round-the-clock connectivity demanded by our modern world.

Motivations behind deliberate analogue hermitage and digital detoxing vary, but primarily focus on either efficiency or enlightenment: Those who seek efficiency want to live more productively and regulate their use of technology through programs or settings. Those who seek enlightenment want to abstain completely from technology in search of authenticity (which presumably arises from handwritten letters, face-to-face conversations and the like).\(^3\) The latter might indeed become the new ‘problem child’ for today’s service-based industries in a world in which data is the key currency and human contact points are increasingly replaced by online interfaces.

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\(^1\) Wikipedia 2015, http://tinyurl.com/oa277kg
\(^2\) Reboot 2015, http://tinyurl.com/pgjtsp8
\(^3\) Cep 2014, http://tinyurl.com/logtcbp
Rising pandemic risk

Description:
Viruses are extremely adaptable and constantly undergo changes to hide from the immune system of the infected organism. The number of hosts for virus reproduction is increasing: human population worldwide went from approximately 3.5 billion in 1967 to approximately 7 billion in 2010. Animal stocks have also increased massively. This represents a big reservoir for new severe pathogens that could lead to a global pandemic if an urban region with good intercontinental connections is affected. The recent Ebola epidemic is an example of an uncontrolled outbreak of a deadly virus, which fortunately did not develop into a global pandemic due to the poor international connections of the West African region.

In addition, more people in some western have started to refuse vaccination against known and controllable pathogens, thus increasing the risk for an epidemic or even pandemic. The measles outbreaks in the United States just before Christmas 2014 or in Germany in early 2015 have shown how unvaccinated children can increase the epidemiological risk.

Potential impact:
- Life and health covers in regions with high life insurance penetration (e.g., North America, Japan, Europe) would significantly be affected due to payouts for medical treatment or life insurance payouts.
- Property and casualty issues could arise from general liability claims if the public is contaminated due to a misdiagnosis; professional liability claims could lead to large losses if sickness or death is blamed on medical malpractice; employers’ liability/workers’ compensation could arise when medical staff are infected because of workplace negligence.
- A global pandemic would affect supply chains and might ultimately also impact financial markets.

Impact: Medium
Time frame: 0–3 years

Emerging trend spotlight | Death by design

With life expectancy already at all-time highs, medical innovations continue to prolong life without necessarily alleviating suffering. This raises the question of choice in when to end one’s life, whether that choice is made by the patient or his or her family. Suicide assistance organisations are flourishing; Switzerland, for example, has become a focus destination of “suicide tourism” thanks to its liberal legal climate in this area.

Differences in ethnic background, religious beliefs, personal values and lifestyles are also driving a greater variety in funeral and commemoration needs. Cemeteries face competition by private companies offering alternative procedures, such as launching cremated remains into orbit or burying them in a forest. Initiatives like the “Urban Death Project” propose to link sustainability concerns with new forms of spiritualism by composting human remains.

Dying and death are becoming occasions for personal creativity and to a certain extent even status symbols. By and large, the insurance industry has not yet embraced this new trend, but life and health insurance could take a more active role in meeting customers’ needs regarding the end of life. New products could be centred on desired ways to die and be memorialised. Insurers could tend to customers’ digital presence and profiles on social media platforms and transfer them to a digital memorial and may ultimately contribute to removing taboos regarding death and suicide. However, difficult legal and ethical issues will undoubtedly be raised, and insurers’ mortality models may be challenged.

1 Beck 2014, http://tinyurl.com/oueshbq. Between 2008 and 2012 the number of foreigners who came to Switzerland to commit suicide doubled to a total of 611.
3 Gammon 2015, http://tinyurl.com/ofykn6t
The world’s population rose from 3.5 billion in 1967 to 7 billion in 2010, doubling the number of potential human hosts for virus reproduction.
Wildfires

Description:
According to Lloyd’s, wildfires accounted for USD 7.9 billion in insured losses in the US between 2002 and 2011, an increase from USD 1.7 billion in the previous decade. Up to 90% of all wildfires in the US are caused by humans, while the rest are started by lightning or lava.

Wildfire losses materialise 52% in casualty covers, 40% in property and 9% in marine. There is also a marked increase in frequency and severity of these losses in the last decade. A review of losses at Swiss Re showed that globally 90% of insurance losses due to wildfires occurred since 2002. This is in line with projections from the Intergovernmental Panel on Climate Change (IPCC) which states in its Fifth Assessment Report that fire frequency is expected to increase with human-induced climate change, especially where precipitation remains the same or is reduced.

From a re/insurance perspective this implies that wildfires have a high potential to be underestimated with respect to frequency and severity in the coming years.

If wildfires are caused by human negligence, they not only impact property covers, but may also affect casualty policies. A recent case in point is Australia: In July 2014, survivors of one of the country’s worst bushfires won a pay-out of almost AUD 500 million (USD 470 million) in the country’s largest class action settlement. About 10,000 plaintiffs sued a power company for negligence over the 2009 Black Saturday fire in Victoria. A report had previously found that the fire began when an electricity line between two poles failed and contact between the live conductor and a cable stay supporting the pole caused arcing that set vegetation on fire. The plaintiffs then accused the power company and the line maintenance contractor of failing to adequately maintain the power lines, as well as the Department of Sustainability and Environment of failing to take adequate prevention measures.

Potential impact:
- Imbalance between premium income and losses due to changing frequency and severity of wildfires
- Significant impact on casualty covers in case wildfires are started or made worse through negligence (eg, insufficient maintenance of power lines)

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Genetic engineering

**Description:**
The ability to design genetic material in a controlled manner and reprogram a cell or a microorganism has been a major goal of biology over the last two decades. With increased computer power as well as cheaper and faster laboratory technology, biologists are now able to engineer cellular behaviour. There are now biological tools for targeted and precise genome modification. So-called TALEN or CRISPR/Cas systems, for example, have significantly improved genome editing efficiency and sparked hope that gene therapy might become a reality in the mid to long term. Such approaches could be used to treat rare and severe diseases; global pharmaceutical companies are already in court, fighting over intellectual property rights related to the TALEN and CRISPR/Cas technology.

Successful gene therapies may ultimately help to eliminate rare diseases that are associated with genetic defects and may have a positive effect on public health. However, possible side effects of genetic therapies could lead to enormous damage. If a genetic therapy fails, other genes might be damaged. In extreme cases, genetic damage might even be passed on to the next generations.

Another important aspect is data security and privacy. Since genetic therapies need extensive advance gene screening, the entire genetic predisposition of an individual will be revealed. Such personalised data must be protected from misuse.

**Potential impact:**
- Decreasing overall health care costs if genetic treatment is less costly than existing treatments
- Unforeseen and underestimated side effects of genetic therapies may increase costs in the health sector
- Liability claims if patients, and possibly even their offspring, are affected by serious side effects

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Emerging trend spotlight: Vertical cities

Vertical city projects are an answer to land scarcity and high-density urbanisation. Designed and operated by applying the latest developments in engineering, they also often embrace sustainability by efficiently using materials and renewable energy — energy potentially generated from the vertical city structure itself — in construction and maintenance.

Vertical city projects are booming, particularly in Asian and Arab cities. Ever taller skyscrapers and housing complexes aim to integrate apartments and offices with the variety of functions and services that an entire city would usually provide. Even park-like recreational green spaces with trees and water can be part of the indoor ecosystem. For example the “Bionic Tower”, a proposal made by a group of Spanish architects, is suggested to reach 1 228 metres in height, with 300 stories housing approximately 100 000 people. It would top the world’s current tallest building, Burj Khalifa, by 400 meters. The eco-friendly project would combine 12 vertical neighbourhoods with a complex of hotels, commerce, sports and leisure.

The sheer size and complexity of vertical cities makes them prone to risk accumulation. High-rise buildings are dependent on elevators, which become the bottleneck in case of power blackout or evacuation. Other challenges include the potential spread of infectious respiratory diseases via ventilation and air conditioning (eg, SARS) as well as supply chain risks. The innovative design, construction and organisation of the vertical city make its vulnerabilities an obvious focus for risk management and re/insurance.

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Today’s production of renewable energy fluctuates depending on the source. That poses quite a risk for power grids.
Challenges of the energy transition

Description:
The solar eclipse in March 2015 showed how sensitive today’s energy networks are when faced with sudden fluctuations in supply. Major preparation had to be carried out to keep the grid stable while the eclipse suddenly curtailed a large share of solar power in Europe.

Renewable energy sources all face this problem, though not to the same degree. The output of wind turbines fluctuates according to frequency, range and speed of winds, although it is less sensitive than solar energy.

Hydroelectric energy declines in the case of prolonged droughts. Replacing the power supplied by traditional sources with alternative energy sources creates challenges of supply stability.

Increasing energy storage capacity will be crucial, and this capacity needs to adapt to various forms of energy production. Many innovations are needed, ranging from high tech batteries to low tech solutions, such as heat storage in bedrock, soil and water. It will also be crucial to implement dynamically adaptive power distribution, eg through smart grids. Some of these new technologies still need to be tested and entail prototype risk, but also offer plenty of opportunities for insurance to transfer risks in development and use.

We will witness a fundamental overhaul in the set-up and operation of the energy grids worldwide in the upcoming decade. This will create new interfaces in the grid which must be addressed, since the lack of interface management is often a key loss trigger. If the challenges related to the energy transition cannot be resolved, there is a high probability that conventional energy will experience a renaissance, with unknown implications along the energy value chain.

Potential impact:
- Necessary innovations to support energy transition may open up business opportunities
- If uncertainties around energy transition continues, the future of the split between fossils and renewables will remain open

Emerging trend spotlight | The sharing economy

AirBnB, a company that arranges paid stays between homeowners and private guests, organised more than 13 million overnight stays in 2013. The company’s value is estimated at USD 10 billion.

Welcome to the sharing economy! With a growing awareness of the need for more sustainable lifestyles – as well as web-based platforms that make arrangements like AirBnB feasible – a new sharing movement is on the rise. With the ascent of social media, sharing has become part of a younger generation’s lifestyle. This is not limited to posting pictures, videos, opinions, thoughts and feelings, but is also opening and transforming markets for sharing physical objects. Companies like Sharoo and Mobility offer the opportunity to share private cars, and the parkU platform allows people to rent private parking spaces. All kinds of everyday items can be shared on such platforms.

Studies estimate that the sharing economy can generate a worldwide value of USD 335 billion by 2025. However, several issues need to be resolved to continue the rapid growth. AirBnB, for example, currently enjoys an advantage over traditional hotels thanks to various legal and tax issues. Regulatory authorities aim to level the playing field in the near future.

The sharing economy challenges the insurance industry in many ways. While some lines of business may see diminished overall market potential in a sharing economy, liability claims may move from individuals to collectives or companies and therefore to much larger volumes.

3 PwC, http://tinyurl.com/ophtwcf
The antibiotic boomerang

**Description:**
Antibiotic resistance is a well-known worldwide problem for both human and animal health, primarily caused by excessive use of antibiotics. Furthermore, the classes of antibiotics used in food-producing animals as well as in human medical treatment are the same, and worldwide transmission of resistance is accelerated by intercontinental travel of humans, animals and food.16

In 2013, more than 25,000 people died from infections with resistant microorganisms in Europe17 and more than 23,000 people in the US18. Since public authorities around the globe became aware of the threat, governments have begun to establish guidelines and strategies to fight antibiotic resistance. Unfortunately, however, this regulatory environment may have the opposite effect than intended.

Due to tough price negotiations between public authorities and pharmaceutical companies, margins for new antibiotic drugs are low. Additionally, new antibiotics may be declared as “drugs of last resort” without any immediate commercial benefits. As a result, there is no motivation for pharmaceutical companies to invest in research — despite the fact that the market associated with multi-resistant microorganisms is expected to increase for the next 20 years. At the moment, most research against multi-resistant bacterial strains is performed in academia, making the development of a commercial product unlikely in the near future.

In the short term, increasing drug resistance may lead to higher healthcare costs. In the long term, in a post-antibiotic world, this may lead to shifts in life expectancy, as diseases which are currently under control once again turn into deadly risks. Also, the food industry may experience losses from contamination with drug-resistant microorganisms or from contamination with non-resistant pathogens, should the use of antibiotics be restricted.

**Potential impact:**
- Progressing antimicrobial resistance and an increasing number of human infections with drug-resistant microorganisms may lead to higher costs in the health sector and to higher losses in L&H policies
- High property losses could occur if livestock farms are contaminated by drug-resistant microorganisms
- Liability claims may arise from contaminations with resistant microbes (eg, farms, food industry, hospitals, care centers)

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17 European Commission 2015, http://tinyurl.com/6r4pwqx
Emerging trend spotlight | Self-tracking

Professional athletes have been monitoring their personal health and performance data for decades. With the advent of tools such as GPS trackers and pedometers, as well as facilitated data exchange and analysis via smartphones or computers, nearly everyone can now track and quantify their daily life. Soon, personal devices will be able to monitor vital statistics that have typically only been captured in hospitals. Compared to the snapshot one gets at a doctor’s visit, self-tracking technology will continuously generate health data in much higher resolution.

The future of self-tracking devices depends on the availability of inexpensive and energy-efficient technology. If self-tracking devices succeed and become widespread, enormous amounts of health data will be generated. If these data are centralised, the information could be very valuable for scientific studies and ultimately lead to better medicine.

With better information, individuals will be empowered to take more control over their health — and their health insurance. They may feel confident enough to lapse and re-enter at lower premiums. Taken too far, self-tracking could also exacerbate the problem of sports addiction and, in an extreme case, lead to social issues, drug abuse and exhaustion to reach inappropriate fitness goals — particularly when combined with social media with corresponding peer pressure.

Generation of health data always raises concerns about data protection and privacy. Self-tracking could be abused if personal data is gathered and analysed by employers or insurers without the knowledge or agreement of the individual. Creating trust about such privacy concerns might be a major challenge for self-tracking devices to fully succeed.

In 2013, more than 25,000 people died from infections by drug-resistant microorganisms in Europe alone.
Sinking cities

**Description:**
Mostly due to groundwater mismanagement, and in some cases also caused by oil and gas extraction, big coastal and delta cities are sinking, with soil subsiding up to ten times faster than sea levels are rising.\(^1\) The northern part of Jakarta, the world’s fastest subsiding megacity, will have sunk by almost four meters until 2025, due to growing population and industry presence and related groundwater extraction.

While the sea level rise due to climate change has been well advertised and also calculated for the world’s coastal megacities, soil subsidence is often underestimated and probably also not adequately factored into many nat cat models and property insurance portfolios. Soil subsidence and sea level rise also often happen at the same time, leading to increased coastal flood risk. Human-induced coastal subsidence is particularly strong in urbanised river deltas with soft sediments.

**Potential impact:**
- Damage to buildings, foundations, infrastructure and subsurface structure like sewerage and gas pipes; disruption of water management; coastal floods with increased salt water intrusion
- Impact on property and casualty business lines with potential for large claims — but given that damage and erosion are a consequence of groundwater mismanagement happening over several decades, it could be challenging to assign responsibilities

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**Figure 2**
Average land subsidence in coastal cities

![Figure 2](image-url)

Source: Deltares 2014
Decaying infrastructure

Description:
Critical infrastructure in various countries is in bad condition, giving rise to potential for large losses. All forms of infrastructure can be affected, ranging from energy and utilities, transportation, ICT and food security to social services and health care (Table 1). To ensure continued safe operations, massive investments are necessary.

In the US, there have recently been reports about gas utilities operating a high concentration of aging pipes, despite warnings from federal safety regulators to replace them. A 2014 investigation found that gas explosions killed at least 135 people and injured another 600 in the US over the last decade.20

Dams are also increasingly turning into a problem. There are an estimated 800,000 substantial dams worldwide, many of which in bad shape and in urgent need of repairs. In the US, 85% of dams will have outlived their average 50-year lifespan within the next two decades, putting lives, property, the environment and climate at risk.21 The Kariba dam — which creates Africa’s largest reservoir — also needs considerable repairs to avoid degradation of key safety features. This will be covered by the USD 300 million Kariba Dam Rehabilitation Project.

In addition to the risks arising from aging, poor maintenance and investment lags, cyber-attacks are — due to unpatched vulnerabilities — also a growing concern for critical infrastructure businesses such as power utilities, telecommunications and water suppliers.

Potential impact:
- Increasing claims frequency and severity for property and casualty covers
- Environmental damage due to aging pipelines and other failing critical infrastructure
- Increasing demand for infrastructure financing, providing an opportunity for both the investment and insurance sides of the business

20 USA Today 2014, http://tinyurl.com/o78pnm9
21 Workman 2013, http://tinyurl.com/lkul7qy

Table 1
Examples of critical infrastructure

<table>
<thead>
<tr>
<th>Energy &amp; utilities</th>
<th>Transportation</th>
<th>Information and communication technologies</th>
<th>Food security</th>
<th>Social services &amp; health care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power production (oil, gas, renewables)</td>
<td>Roads, bridges, tunnels</td>
<td>Cable networks, cell towers</td>
<td>Food production (agriculture, livestock)</td>
<td>Schools, universities, hospitals, prisons</td>
</tr>
<tr>
<td>Exploration, refinery, storage, distribution, electricity generation, transmission</td>
<td>Airports, rail systems, seaports, shipping</td>
<td>Satellite, radio and other systems</td>
<td>Processing, packaging, distribution, storage</td>
<td>Sports stadiums and facilities, convention centres</td>
</tr>
<tr>
<td>Water supply, waste management</td>
<td>Cargo, logistic centres</td>
<td>Urban mass transit</td>
<td></td>
<td>Public housing, community facilities</td>
</tr>
</tbody>
</table>

Source: Fostering Infrastructure Resilience, Risk Dialogue Series, Swiss Re Centre for Global Dialogue
Hydrofracking fluids

**Description:**
Hydraulic fracturing — commonly known as hydrofracking — is a technology to extract natural gas from unconventional reservoirs. The technique is common in wells for shale gas, tight gas, tight oil, coal seam gas and hard rock wells. During the process, a fracturing fluid is blasted into deep rock strata to induce cracks and fissures. The potential impact of hydrofracking on humans and the environment remains controversial, and levels of public acceptance and regulation differ around the globe. The main focus of concern is ground water contamination, poor waste handling and induced seismicity (similar to geothermal drilling).

Lately, fracking fluids have received growing attention, resulting in an increased risk exposure for the respective industries, and ultimately the insurance industry. This mainly affects the chemical industry, which is an important element of the hydrofracking supply chain. Its involvement rests on two pillars: supplying fracking chemicals (ready-for-use mixtures), and producing industrial chemicals which are used as raw materials for fracking chemicals.

Hydrofracking fluids are tailored to the specific well conditions, and more than 750 compounds have been listed as potential additives. In a normal well operation 3–12 additives are used at a total amount of 50–300 tonnes. Despite the fact that the amount of added chemicals in fracking fluids is below 1%, the total amount of chemicals used is enormous. Shale gas production in the Marcellus shale in Pennsylvania, for instance, requires more than 200 000 tonnes of additives per year.

Due to the fact that large amounts of fracking fluids leak underground, gradual contamination of groundwater is one of the pollution scenarios, with potential long-term health effects for local populations, including cancer and birth defects.

**Potential impact:**
- Liability exposure from fracking activities is potentially severe and systemic. In a mass tort claims complex, the principle targets would likely be well operators followed by drilling contractors; suppliers of fracking chemicals (manufacturing and/or blending and mixing activities) would likely to also be exposed through product liability.
Fossil fuel mismanagement

**Description:**
A growing number of investors and regulators worry that untapped deposits of oil, gas and coal could become ‘stranded assets’ (i.e., assets which have suffered from unanticipated or premature write-downs, devaluations or conversion to liabilities\(^\text{22}\)) as governments adopt stricter climate change policies. Limits on carbon dioxide emissions will be necessary to achieve the target of limiting temperature increases to a maximum of 2°C, a benchmark set in the Cancun agreement made at the United Nations Framework Convention on Climate Change (UNFCCC) meeting in 2010.\(^\text{23}\) This implies that a majority of known oil, gas and coal deposits would have to stay underground, becoming worthless – unless there is significant progress in technologies to capture waste gases from combusting fossil fuels.\(^\text{24}\) The recent drop in global oil prices could further aggravate this situation. In an extreme scenario, much of the high-cost oil outside the Middle East could turn into stranded assets, similar to unwanted coal reserves.

A sinking oil price could also have considerable economic consequences for many developing countries which are highly dependent on revenue from oil exports. Countries that have expanded their spending in times of high oil prices might start running into higher fiscal deficits, leading to rising debt levels and increased default risks (e.g., Venezuela). Tighter economic conditions may, in turn, lead to increasing social and political instability.

**Potential impact:**
- Lack of income might lead to reduced inspection and cost-intensive preventive maintenance in the fossil fuel industry
- Increased theft, including unauthorised drilling into pipelines, with corresponding losses
- Reduced mining investments slowing economic growth in affected countries

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\(^{22}\) Smith School of Enterprise and the Environment, University of Oxford, http://tinyurl.com/ouekkvb

\(^{23}\) UNFCCC 2010, http://tinyurl.com/q5s8nn5

\(^{24}\) Bloomberg 2014, http://tinyurl.com/ok7duf9
The dangers of LED light

**Description:**
LEDs are light-emitting diodes frequently used in lighting fixtures for the domestic market. They have a longer life span and are more efficient than conventional incandescent light bulbs and fluorescent lamps, and their prices have declined significantly over the last years. As a result, the market share of LED lighting has increased significantly. This development is likely to continue, particularly as important markets such as the EU, the US or Japan banned some or all types of incandescent bulbs. The global LED lighting market is expected to grow from USD 42.6 billion in 2014 to USD 62.7 billion in 2016.25

The growing use of LEDs has triggered concerns regarding their impact on human health. LEDs emit blue wavelengths which are beneficial during daylight hours because they boost attention, reaction times and mood, but which seem to be most disruptive at night.26 Reading emails on a smart phone or watching movies on a hand held computer, for example, could make sleep more difficult.

Recent scientific studies have indicated that white LEDs could also be problematic, due to the potential risks for the eye.27 Although perceived as white light, white LEDs might also emit a light peak in the blue spectrum. This may result in photochemical injury of the retina, compared with other light sources that have less blue light.28

Considering the fact that LEDs are likely to become the major domestic light source in many parts of the world, there is potential for a serious risk exposure. Billions of conventional lamps will be replaced by LEDs in the near future, and even if adverse health effects are rare, the total number of bodily injury claims could be very high.

**Potential impact:**
- Potential for large serial losses in different markets as there are only a few major players in the light bulb market

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25 Hana Daetoo Securities 2014: LED
26 Harvard Medical School 2012, http://tinyurl.com/mggpafe
Office of the future

**Description:**
The office of the future is just around the corner. Topics like communication, collaboration and integration are key, and architects try to amalgamate client needs with employee needs and specific company requirements. The number of workplaces will be reduced, home offices are encouraged and flexible working schemes are introduced.

Open plan offices are now ubiquitous. Originally conceived to facilitate open communication and idea flow, open offices soon became popular due to the potential cost savings, as more people could work in a given amount of space. Lately, the trend is flexible open plan offices where employees no longer have their own designated desks, but may use any of the available workplaces. This brings even more cost savings as the number of employees working in the building, factoring in part-time work, business travel and vacation absences. For employees, ill-designed open office spaces may cause frustration, as they are perceived as disruptive, stressful and cumbersome. To be workable, open offices need to address sightlines as well as acoustics and recognize different work styles. Ideally they should provide a variety of different work spaces within close proximity of each other, allowing for individual-focused work, as well as for collaborative work.

The physical setup of the office space is not the only thing that is changing. Ubiquitous interconnectivity and digital work environments mean that many people no longer separate work life and leisure time. They are always online and accessible 24/7/365, with potentially negative implications for their health and well-being. This could ultimately lead to a decrease in productivity, an increasing number of sick days, burnouts and, last but not least, trigger workers compensation and employer’s liability claims.

**Potential impact:**
- Improved cost-benefit ratio and performance gains in case of well-managed workplace setups
- Decreasing productivity in case of ill-managed workplace setups
- Ill-designed open office solutions and digital work environments may trigger employers’ liability/workers’ compensation claims

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**Emerging trend spotlight | DIY digital homes**

Digital home equipment is booming, especially in the US. Remote control of household appliances, locks, valves and other facilities by mobile devices are rapidly becoming a reality. The advent of the Internet of Things (see p.11) will accelerate this trend. While specialised companies offer integrated systems out of one hand, such solutions can be very expensive.

Some homeowners may want the same level of security and ease in home operation but may not be able to afford integrated solutions all at once. Instead they may set up their own systems in a makeshift way, buying components as they can afford them. Command and control of such DIY digital homes can become a challenge, also in terms of software updates and security patches as well as managing the different components in a seamless and danger-free way.

A haphazard system of digital home functionalities will be vulnerable to malfunctions and could even lead to flooding or fires. Makeshift digital home equipment may also be more vulnerable to hacking than integrated systems, resulting in data theft or simple burglary. This could lead to higher than expected property losses for homeowners and their insurers.

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Traffic jam in the skies

Description:
The sky gets more and more crowded with drones, weather balloons and microsatellites. Appropriate regulation is essential to ensure safe air traffic, but is currently still lagging behind technological developments. In regions without proper regulations, an increased risk for collisions and accidents may occur, resulting in higher claims frequency for re/insurers. Regulation is also key for industry development. The recently adopted Riga Declaration on Remotely Piloted Aircraft, for instance, stresses the necessity for European regulators to ensure “that all the conditions are met for the safe and sustainable emergence of innovative drone services”.30

The number of drones used for commercial purposes is soaring in many parts of the world. Primary applications are in agriculture, energy, utilities, mining, construction, real estate, news media, and film production.31 According to the UK Civil Aviation Authority, almost 500 businesses in the UK now have licenses for remotely controlled aerial vehicles weighing less than 20 kilograms. Applications for commercial licences are being approved at the rate of about 40 per month as firms rush to develop new uses, anticipating changes in regulation. The US Federal Aviation Administration predicts that 7 500 unmanned craft weighing 25 kilograms or less will be operating in the US by 2018.32

The rapidly increasing number of drones is prompting fears about a heightened collision risk for commercial airplanes, as reports about drones getting close to airplanes make headlines. In June 2014, for instance, an unidentified drone came close to hitting a landing plane at London Heathrow airport, triggering an “A” rated incident report (serious risk of collision). There is also increasing worry about drones being used as weapons by terrorists. In autumn 2014, reports about reoccurring drone flights over several French nuclear power plants prompted fears of terrorist attacks.

The number of microsatellites has also increased rapidly since the early 2000s.33 These miniature satellites in the range of 1–50 kilograms are primarily used for research purposes, but more commercial players are appearing on the scene. It is estimated that the nano- and microsatellite market will reach a volume of more than USD 1.8 billion in 2019.34 Currently, the market is largely unregulated, giving rise to a growing risk of collisions as the number of microsatellites keeps soaring.

Potential impact:
- Increasing use of drones may add an “aircraft” fleet exposure to companies that had no airborne operations before
- A higher number of flying objects is likely to increase collision risks
- Privacy concerns due to more remotely controlled or autonomous small flying objects equipped with cameras

30 Riga Declaration 2015, http://tinyurl.com/keef8fw
32 Doward 2015, http://tinyurl.com/m9v4wxk
Drones, weather balloons and microsatellites are crowding the sky. But appropriate regulation is lagging behind technological developments.

Source: Satellite Industry Association
Chemicals in the environment

**Description:**
Due to our longer life expectancy we are also exposed to certain chemicals for longer, which may lead to negative consequences for our health. Better diagnostic tests might also result in more people successfully suing large corporations. However, this is likely to be a long-term matter as it will take time to establish a legally sufficient causal relationship between a specific insured wrongdoer and harm.

In particular, epigenetic, endocrine disrupting and accumulation mechanisms are not yet well understood, especially for new substances. This includes disruption of hormone activities, diseases triggered by storage of chemicals in the body (as illustrated by cases of lead poisoning from old water pipes), interference with neurological transmission (such as the welding rod disease) or allergies caused by indoor pollution.

With ongoing research in the field of environmental chemistry, scientific insights might fuel new liability claims. Some studies, for instance, have already shown that interactions between our genes and the environment can influence our health. Yet, there are many open questions: how can environmental factors influence the function of cells and lead to disease? What role do epigenetics play in the onset of diabetes and other conditions? What if chemicals such as arsenic, Bisphenol A, persistent organic pollutants, phthalates, heavy metals, trichloroethylene, or air pollutants could be better linked to specific diseases and epigenetic mechanisms? All of this may influence the re/insurance risk landscape, particularly with regard to product liability claims.

**Potential impact:**
- Chemical companies could be sued for putting damaging products on the market
- Epigenetic changes might be used as a marker or as a forecast tool for diseases that have not yet manifested, improving diagnostics and treatment options – but epigenetic alterations may also cause ‘cross-generational damage’ and significantly increase the lag time between exposure to a substance and damage manifestation
- Increased number of workers’ compensation/employers’ liability claims from people exposed to chemicals at the workplace

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Scarcity of raw materials

Description:
Various raw materials are running out, including sand for concrete production and helium for various technical applications. The shortages create an incentive for alternative procedures, such as waste mining/recycling, with currently unknown implications across the value chain (see also the spotlight on urban mining, below).

Sand is one of the main ingredients in concrete, and the construction industry’s demand for concrete is growing. Due to overharvesting of sand deposits, serious environmental damage has occurred and beaches are being exploited. This results in more erosion and destabilisation of coastlines, with exposed coastal areas less protected against extreme weather events. It can also severely affect the environment, ecosystems and ecosystem services; for example, pumping sand from the seabed may hurt coral reefs or fish breeding. As suitable deposits are shrinking, there is a growing incentive to use sand that is unsuitable for construction purposes (e.g., desert sand), leading to less resilient constructions and, ultimately, collapses.

Helium is used for various purposes, ranging from manufacturing semiconductors to cooling superconducting magnets for MRI medical imaging. It is generally obtained as a by-product from natural gas processing. Available helium has become scarcer in recent years. This is partly due to the fact that the US — the world’s largest supplier — is increasingly focusing on shale gas, which contains relatively little helium. Simultaneously, demand has grown considerably in emerging economies, leading to a global helium shortage.

Potential impact:
- Natural catastrophes hitting coastal areas harder, due to reduced natural protection
- Rising construction costs due to increasing prices for concrete and/or deteriorating building quality due to use of substandard concrete
- The shortage of helium will increase the price and make alternative production attractive, but no long-term insurance impact expected

Impact: Low
Time frame: >3 years

Emerging trend spotlight | Urban mining

Will a waste site be the gold mine of the future? Can we still afford to deposit, bury, or burn our waste without trying to recycle some of the valuable materials it contains?

Electronic goods ranging from mobile phones to LCD TVs require raw materials that are in short supply. The materials can be found and mined in ever more remote areas — or on our waste sites. Profitable recycling just depends on demand and price.

Urban mining — the process of recovering compounds and materials from products no longer used — is a promising branch of waste recycling. It is not restricted to extraction from electronic waste. Potential sources of materials range from building and road constructions to decommissioned wind farms. Designing efficient recovery systems for so-called secondary materials requires innovation and creates new market and job opportunities in turn. Despite the tempting upside potential, adequate control over material quality and the environmental and social impacts caused by urban recycling and refining are critical. Synergy potentials from integrated use of primary mining and urban waste mining need to be addressed, and environmental and social sustainability frameworks and standards must be extended to urban mining.

Just as a shortage of raw materials drives the search for alternative procedures and substitutes, so will emerging risks provide an incentive to innovation in risk management.
Conclusion

This publication is intended to raise awareness for what might lurk behind the horizon and to trigger action where necessary. Although some of the emerging risk topics presented here may never materialise, others definitely will. The earlier the industry starts adapting to them, the better prepared it will be for tomorrow’s challenges. It is within the responsibility of the readers to assess the potential impacts on their assets and draw the appropriate conclusions.

The topics highlighted in this report may not only bring additional downside risk exposure, but could also give rise to new opportunities. Given the breadth of the risk landscape illustrated here, possibilities for solutions are vast, and the insurance industry could expand its role of mitigating others’ risks and enabling society to advance. By providing re/insurance for new and innovative products, our industry plays a vital role as innovation enabler while bringing its risk management expertise to the table to avoid losses from occurring in the first place.

There is no easy solution that will work for all emerging risks as new threats come in various shapes and forms from a multitude of sources. However, working together and sharing knowledge across stakeholders can help the insurance industry to better prepare for and deal with emerging risks.
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 topical experts from Swiss Re’s various business areas. The findings are regularly shared internally and summarized 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 insights?
Emerging risk insights illustrate potential new threats for the insurance industry. They are mainly derived from SONAR but also draw on other sources. All insights have been assessed and edited by Swiss Re’s emerging risk management experts. This report only features new emerging risk insights, i.e. topics covered in previous editions are not listed again. You can retrieve prior reports from our webpage: http://tinyurl.com/ny9je2

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

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

What is meant by time frame?
We divide themes into those likely to occur in less than 3 years and those likely to occur only later. 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.