



Swiss Re SONAR  
New emerging risk insights

July 2014



Deflation. Cloud security. E-cigarettes. The earlier the insurance industry adapts to emerging risks, the better prepared it will be. Foresight and knowledge-sharing are essential to navigate a future in which change is the only constant.

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## Foreword

Economic, technological, socio-political and environmental changes modify the risks we face. Even when the risks stay constant, changing norms and laws can shift their burden from one party to another. Such newly emerging risks need to be monitored and managed. Swiss Re does that with SONAR, our tool for the systematic observation of notions associated with risk.

It is our pleasure to share with you some of this year's findings. The themes presented were mainly derived through Swiss Re's internal SONAR process, but also draw on some of the elements of the Risk Radar of the CRO Forum's Emerging Risk Initiative.

The report should not be understood as a forecast that accurately reflects what the future will bring, nor are all emerging risks covered. This year's edition only lists new risks; for a more comprehensive overview please see the list in the appendix or visit [www.swissre.com](http://www.swissre.com) for older editions.

Given the breadth of the risk landscape described in this publication, possibilities for solutions are vast, and the insurance industry should expand its role of mitigating emerging risks and enabling society to advance further.

By sharing our findings we hope to raise awareness for these specific risks. As the future is no longer a simple linear extrapolation of the past but rather characterised by rapid change and interdependencies, looking back and extrapolating past experiences into the future will no longer be sufficient to assess tomorrow's exposure.

This report is meant to spark your interest. If you would like to know more or discuss specific risks with us, please contact us.

Philippe Brahin  
Head of Group Qualitative Risk Management

# Executive summary

This report highlights 26 new emerging risk themes. It is meant to provide a first indication of what might lie beyond the horizon so that our readers can prepare for future challenges.

Themes 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, and many themes have cascading effects across areas and lines of business.

The list below highlights top themes for the main insurance business areas, based on the potential impact.

Top themes for **property**:

- Smart cities
- Plant pathogen threatens rubber production

Top themes for **casualty**:

- Concussion crisis in sports
- E-cigarettes

Top themes for **life & health**:

- Air pollution as mortality driver
- Financial consumer protection regulation

Top themes for **financial markets**:

- Eurozone crisis leading to deflation
- Contagious emerging market crisis

Top themes for **operations**:

- Demographic inclusion at the workplace
- From closed to open business models

Top themes with most **cascading effects**:

- Cloud computing security
- Digital slander



Potential impact

High

Medium

Low

Emerging risks are newly developing or changing risks which are difficult to quantify and whose potential business impact is not yet sufficiently taken into account.



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<b>0–3 years</b>		<b>&gt;3 years</b>	<b>Time scale</b>





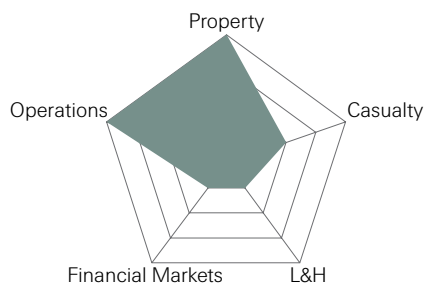


Skyline in Hong Kong: The US Fed's gradual reduction of its asset purchase programme is exposing imbalances and structural issues in some emerging markets. China's vulnerabilities are mostly domestic including, a property bubble.



# High impact emerging risk themes

Impact: **HIGH**  
 Time frame: **0–3 years**



## Cloud computing security

Multi-tenancy – sharing computer architecture by customers called tenants – is the core doctrine of cloud computing. It makes cloud computing very economical because infrastructure, software development, storage and general maintenance costs are shared. On-site requirements are also much leaner.

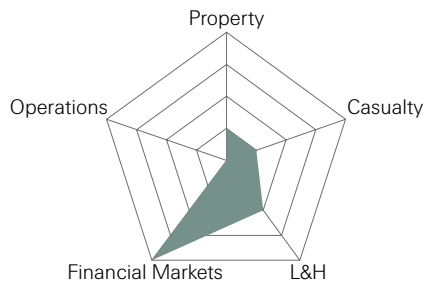
However, shared access also fuels risks such as data leakage, data loss and hijacking of computing resources. The risks of moving to the cloud are still largely unknown.

The cloud era is here and a lot of companies see their future tightly associated with it. Potential benefits are great, but the concentration of critical data and computer services heightens vulnerability.

### Potential impact:

- Internal data loss and partial business interruption
- Data corruption or data theft may lead to accumulated losses and business interruption, with one event impacting many companies
- Provider liability claims
- Reputation and financial damage if confidential client data is lost

Impact: **HIGH**  
 Time frame: **0–3 years**



## Contagious emerging market crisis

The US Fed’s gradual reduction (“tapering”) of its asset purchase programme is exposing long-simmering imbalances and structural issues in some emerging markets. If such normalisation of monetary policy happens in a disorderly way, investors may withdraw funds from emerging markets indiscriminately. In an adverse scenario, investor panic could lead to contagion across financial markets.

Countries with both high current account and fiscal deficits – Brazil, India, Indonesia, Turkey and South Africa – are especially vulnerable as a significant part of their private and public debt is held by foreign investors. In contrast, China’s vulnerabilities are mostly domestic, including a property bubble, local government indebtedness, and an intransparent shadow banking system. China also faces a challenging financial, social and economic reform agenda. Other emerging market economies are facing structural challenges, too. For example, the commodity-dependent growth models of South Africa and Brazil would be threatened if commodity prices dropped sharply.

Heightened political uncertainty also adds to investors’ risk aversion, as exemplified by recent tensions in Turkey, Thailand and Ukraine. In addition, elections are scheduled over the next months in Brazil, India, Indonesia, South Africa and Turkey.

### Potential impact:

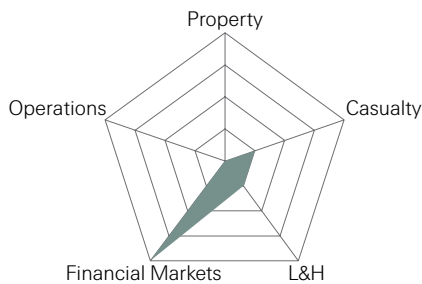
- Slower emerging market growth threatens premium and/or revenue growth targets
- If the slowdown spreads to developed markets, overall premium/revenue growth and asset performance of large corporates may not achieve targets



## High impact emerging risk themes

Impact: **HIGH**

Time frame: **0–3 years**



### Eurozone crisis leading to deflation

In the aftermath of the financial crisis, many worried about a sharp increase in inflation due to elevated sovereign debt levels and the rapid expansion of central banks' money supply. However, deflation in the eurozone seems to be the new risk to watch.

Consumer price inflation in the eurozone has fallen to 0.5% in May 2014 – far below the European Central Bank's target of 2%. While inflation in the core countries remains moderately positive, inflation in Greece is already negative, while in Spain, Portugal and Ireland it is close to zero. Deflation in the peripheral eurozone economies has both positive and negative effects. On the one hand, deflation improves the periphery's competitiveness versus the core. On the other hand, it suppresses private demand and increases debt/GDP ratios. It is unclear which effect will dominate.

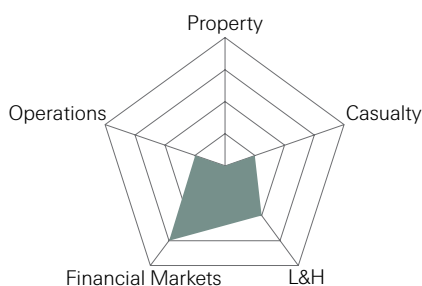
As long as growth continues to recover and inflation expectations remain firmly anchored in positive territory, the chances of deflation are small. So far, inflation expectations seem to remain positive, but the economic recovery remains fragile. If the recovery falters, a eurozone-wide deflationary spiral could develop, with a collapse in credit depressing private demand, thus dampening economic activity, income and asset prices. Declining prices and income would further increase the pressure to deleverage. If not interrupted by the central bank, a vicious spiral could develop.

#### Potential impact:

- Re/insurers might miss their European premium and/or revenue growth targets
- The asset side of the balance sheet would be negatively impacted via exposure to European equities and bonds

Impact: **HIGH**

Time frame: **0–3 years**



### Short-termism of macro-policy measures

Due to the financial crisis, long-term solutions to several fundamental problems must be worked out. But short-term fixes with potentially unknown consequences can be detrimental in the long-term. However, the incentives for policymakers to behave opportunistically in the short-term are well documented.

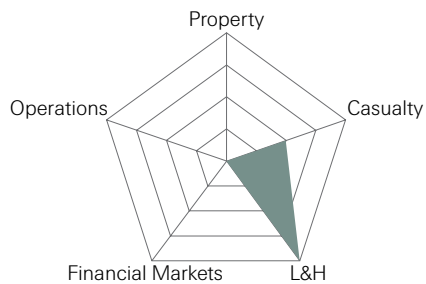
Policymakers and regulators still have much work to do with regard to tax reforms (eg in the US), global financial regulatory reforms (such as Basel III implementation), the creation of the European Banking Union, and the necessary structural reforms in many countries. Meanwhile, the European Commission has put forward a proposal for a financial transaction tax, a short-term populist proposal, which would also impact GDP negatively.

The partial inability and inertia of politicians and regulators to implement the necessary reforms has led to an increasing dependency on monetary policy. Central banks around the world are currently engaged in the greatest monetary policy experiment in history, with unknown long-term consequences.

#### Potential impact:

- Unstable macroeconomic environment and unhealthy or adverse market developments
- Increasing regulatory uncertainties

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



### Air pollution as mortality driver

Some parts of the world are experiencing a significant increase in air pollution exposure due to rapid industrialisation. In China, for instance, scientists have recently warned that air pollution in some areas is now so heavy that impacts on human health have become visible. This is a major public health issue: the overall impact of air pollution on mortality is comparable to smoking and may reduce average life expectancy by 3-5 years.

Air pollution has already been identified as a major health risk in the form of chronic obstructive pulmonary disease (COPD). It has now been found to cause cancer also. In October 2013 the World Health Organization's International Agency for Research on Cancer (IARC) officially classified outdoor air pollution as well as "particulate matter" – a major component of it – as carcinogenic to humans. The IARC evaluation found sufficient evidence that exposure to outdoor air pollution causes lung cancer and increases the risk of bladder cancer.

In addition to detrimental impacts on human health, massive air pollution may also cause economic perturbations. In China, the worsening air pollution has already exacted a significant economic toll, grounding flights, closing highways and keeping tourists at home.

#### Potential impact:

- Potential increase in litigation against polluters, car manufacturers and energy companies
- Increased occurrence of disease and rising mortality, with corresponding negative impacts on business continuity as well as Life & Health covers

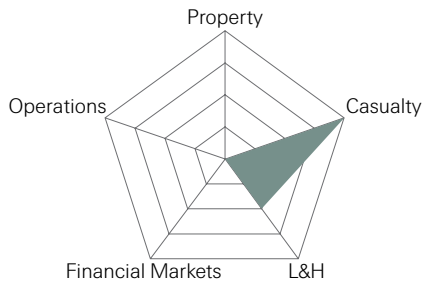


## Medium impact emerging risk themes



Impact: **MEDIUM**

Time frame: **0–3 years**



### Concussion crisis in sports

Repeated concussions have been linked to Chronic Traumatic Encephalopathy (CTE), a degenerative brain disease. In the United States, the Center for Disease Control and Prevention (CDC) estimates that there are between 1.6 million and 3.8 million sports and recreation-related traumatic brain injuries each year. These figures are increasing as the number of young people playing contact sports grows and athletes become bigger, stronger and faster.

In 2011 the first lawsuit was brought against the National Football League (NFL) and Riddell, the NFL's official helmet manufacturer. The suit alleged that the NFL and Riddell knew of the long-term risks of concussions and failed to warn the players. This was followed by additional suits. Cases are still pending. Similar suits were recently filed against the National Hockey League. In addition to the suits against the professional sports leagues, in November 2011 a class action was filed in the federal court in Illinois entitled Adrian Arrington et al. v. National Collegiate Athletic Association (NCAA), which represents more than 400 000 students who play sports at more than 1 000 colleges and universities.

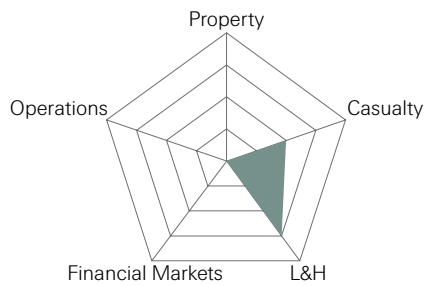
Concussion safety laws related to youth sports have been passed in 49 states. They impose requirements on schools and public entities with respect to concussion protocols and management. They include the provision of legal immunity, which could mitigate lawsuits against schools and public entities. Meanwhile, advances in medical science may lead to new liabilities as they detect new injuries caused by concussion.

#### Potential impact:

- Increased workers' compensation, personal accident and liability claims
- Possible claims from other sports, potentially also from amateur associations
- Potential for spill-over effects in Europe and other regions

Impact: **MEDIUM**

Time frame: **0–3 years**



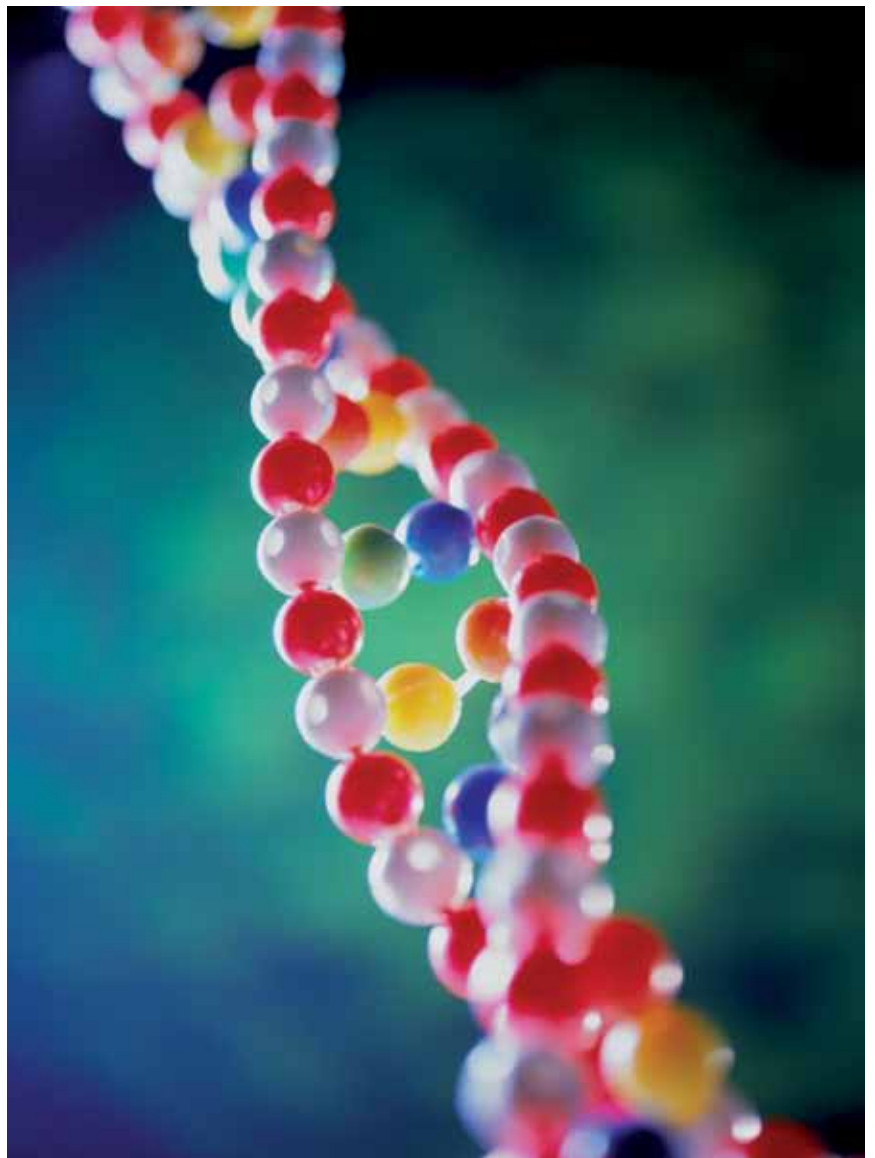
## Democratisation of genetic testing

Genetic testing can help to diagnose the genetic basis of a disease and may also uncover a predisposition to cancer or other diseases. However, results depend both on reliable laboratory procedures and accurate interpretation of results.

Over 500 genetic tests are already available, and more and more are marketed directly to consumers. From an insurance perspective, this gives rise to concerns regarding information asymmetry and antiselection, as well as concerns about data privacy. There are currently various attempts to improve protection of genetic data and to safeguard the rights of individuals to maintain privacy and access to their genetic data.

### Potential impact:

- Asymmetry of knowledge based on genetic testing may imply antiselection for L&H
- Easy and cheap access to genetic tests increases product liability and professional liability risks in case of false positive or false negative results
- Medical malpractice claims based on delayed diagnosis or wrongful interpretation of test results

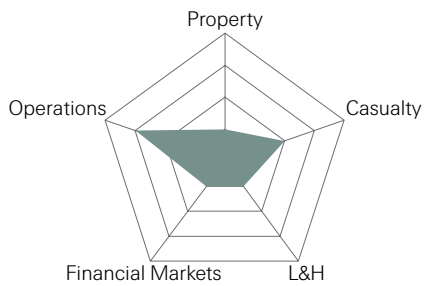




## Medium impact emerging risk themes

Impact: **MEDIUM**

Time frame: **0–3 years**



### Digital slander

The digital era has conferred more power to individuals, for example through smart phones and social media. This has given rise to new risks. False rumours, spread over the internet, can have a devastating impact on a person, a group or an organisation.

Any individual can potentially cause reputational damage to an individual or group of people by wildly attacking them on the internet. Some insurance players already offer specific insurance products to cover the costs of removing damaging content from the internet and to help restore reputation.

Large corporations face an even greater challenge in managing their online reputation. Every employee is a potential ambassador, detractor or both. Both an unauthorised post and an authorised company post could ultimately prove ill-advised. A combination of pre-emptive mitigation and comprehensive pursuit of insurance coverage post-loss is likely to provide the best protection against social-media related losses.

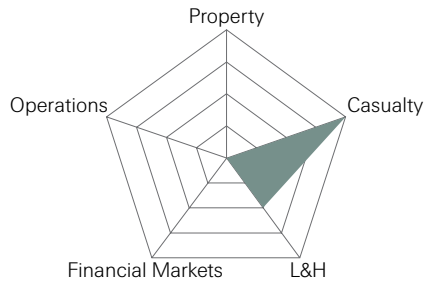
#### Potential impact:

- Increased risk of data theft and rising data restoration costs
- Liability claims against data providers (eg. due to privacy breaches)



Impact: **MEDIUM**

Time frame: **0–3 years**



## E-cigarettes

An e-cigarette is an electronic inhaler which typically uses a battery-powered heating element to vaporise a liquid solution enriched with flavour and/or nicotine. Its design often mimics traditional smoking implements. E-cigarettes are currently enjoying a boom in the United States and many European countries, with US sales exceeding USD 1 billion in 2013.

E-cigarettes are often marketed as a less harmful alternative to tobacco. Some health experts claim that e-cigarettes are useful for people trying to quit or cut down on nicotine, although no peer-reviewed study has proven such benefits. Their long-term health effects are not yet known since they have not been on the market long enough.

Concerns focus on e-liquids, the key ingredients in e-cigarettes, which are powerful neurotoxins. When e-liquids are ingested or absorbed through the skin, they can cause vomiting and seizures and can even be lethal. Toxicologists warn that e-liquids pose a significant risk to public health, particularly to children. They also represent a serious workplace hazard for those preparing and selling them if proper precautions are not taken (eg, wearing gloves while mixing e-liquids).

Laws concerning their use and sale vary and are the subject of pending legislation and ongoing debate. Under the revised EU Tobacco Products Directive, which the European Parliament approved in February 2014, the content and marketing of e-cigarettes will be tightly regulated. From mid-2016, advertising for e-cigarettes will be banned across EU member states. The products themselves will have to be childproof, the packages will require safety warnings, and the nicotine will be capped at 20 milligrams per millilitre of vaporising fluid. In the US, the Food and Drug Administration has published a proposed rule in April 2014 that would extend the agency's tobacco authority to also cover e-cigarettes. This would subject the industry to federal regulation for the first time.

### Potential impact:

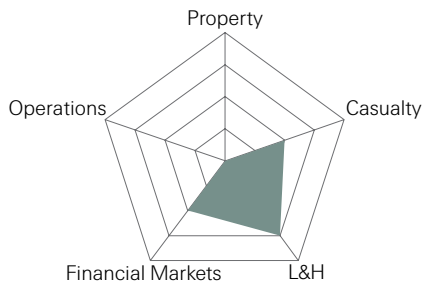
- If e-cigarettes are proven to be more harmful to health than presumed today, respiratory diseases or other health problems may increase and trigger liability claims similar to tobacco claims in the past
- Possible increased mortality among e-cigarette smokers



## Medium impact emerging risk themes

Impact: **MEDIUM**

Time frame: **0–3 years**



### Financial consumer protection regulation

So far financial regulators have focused on solvency and liquidity, but there is growing political pressure to focus on consumers and market conduct issues. High-profile misselling cases, concerns around pension fund adequacy and other conduct-related incidents have undermined public confidence in financial institutions. Financial regulators face growing pressure to better protect consumers and restore consumer confidence.

This is a global trend, and insurers will increasingly be affected by a growing consumer agenda as new regulations begin to bite. In the UK, for instance, the creation of a specific conduct authority is expected to lead to a broad review of market practices.

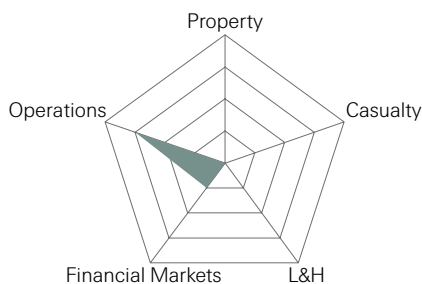
The roadmap for the future of financial consumer protection regulation covers avoidance of disclosure of conflicts in advice, product choice and ease of switching; transparency and product suitability, and recourse for dissatisfied customers.

#### Potential impact:

- Increased regulatory intervention in product innovation
- Arbitrary barriers to market entry
- Increased costs challenging efficient business models
- Penal sanctions for breaches
- Higher frequency of product liability and recall claims
- Differential ratings (eg based on gender, age, disability) may no longer be possible/legal

Impact: **MEDIUM**

Time frame: **0–3 years**



### From closed to open business models

A company that relies on an open business model counts on innovating by contributing to and adopting openly available ideas and technologies. Open model companies are more likely to realise the economic potential of unused business assets like data, technology, and processes than those relying on internal sources only.

The main driver of innovation is the cross-fertilisation of ideas and the company's ability to identify the full value of its assets through a critical, previously missing, component that is provided externally. Other benefits include cost reductions and less time required to develop new products and services.

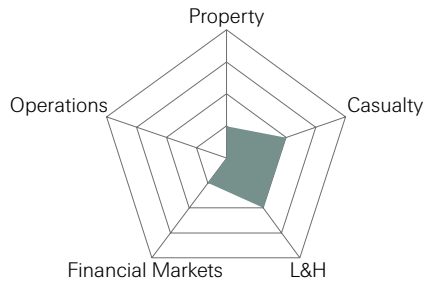
Some companies are already adopting the open business model, and can be used as a compass for future business growth. "How to do it correctly" is a big topic for research, and the applicability of open business models depends on the nature of the company's business. Embracing new technologies alone will not be sufficient to take full advantage of open business models. Companies will have to change their approach towards innovation in general and need to gear their organisational culture towards accepting external ideas and contributions.

#### Potential impact:

- Releasing information that is tied to the unique value proposition of a company might be detrimental
- Sharing general business components could hold the key for the next generation of innovation

Impact: **MEDIUM**

Time frame: **0–3 years**



### Food and water safety: trade-offs with growth

Food and water safety is increasingly compromised in many parts of the world, and anxious consumers are constantly faced with new headlines reporting the latest food scandals. Problems arise throughout the entire production process, from land cultivation and water sourcing to food processing and distribution. This is often driven by a blinkered focus on growth.

In China, for instance, more than 2% of arable land is already too polluted for cultivation due to industrial production, overuse of pesticides and fertilisers and unsustainable land use. Pollution now poses a serious threat to one of the government's highest priorities – maintaining a sufficient amount of farmland. China is investing significant funds each year to repair land with heavy metal contamination and to restore over-exploited aquifers. Food scandals continue to shake the Chinese public's confidence in the safety of local products, with repercussions beyond the country's borders as consumers shift towards foreign products.

Water safety is also increasingly under pressure. In Mexico, for instance, unsafe water has triggered a shift towards bottled sweet soda drinks. This is now considered a major driver for rising obesity rates in Mexico, which have already surpassed those in the US.

#### Potential impact:

- Increase of liability claims against soil and water polluters, farmers and food producers
- More claims under workers' compensation, recall/crisis management, malicious product tampering and product liability
- Negative impact on health business due to increased health problems and mortality





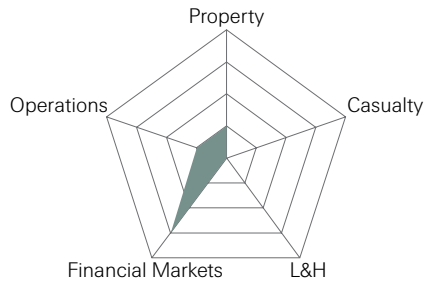


The definition of Europe is being challenged. The European Union as we know it now might not last.



Impact: **MEDIUM**

Time frame: **0–3 years**



## Secession risks in Europe

The definition of Europe is being challenged. At supranational level, May 2014 elections demonstrated the rising popularity of Euro-sceptic parties not only in peripheral countries such as Greece, but also in core countries like Germany and France. In 2015 the UK will likely hold an 'in/out'-referendum on EU membership if the Conservative Party wins the general elections.

At national level, independence movements in Scotland and Catalonia threaten the territorial integrity of the UK and Spain. The Scottish will vote on forming an independent state on 18 September 2014. The UK government has promised to accept the verdict, but has also made clear that an independent Scotland cannot count on continued privileges, such as keeping the British pound. In addition, EU leaders have said that an independent Scotland would have to follow the regular EU admission procedure. If a 'yes' vote succeeds despite these challenges, it could encourage the Catalans to hold their own referendum, despite resistance from the Spanish government.

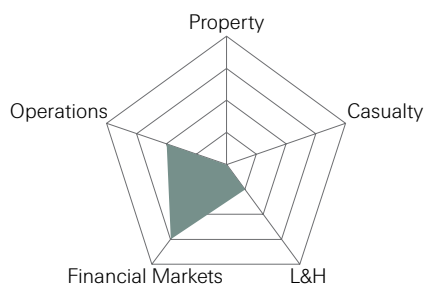
Russia's de facto annexation of the Crimean peninsula in March 2014 provided an extreme example of Europe's challenged territorial integrity. This development could encourage separatists in other countries to claim independence even without proof of a majority backing. If such demands were actively supported by major powers, they could easily lead to civil unrest, trade sanctions or even war.

### Potential impact:

- Legal and regulatory uncertainty for investors and corporations
- Negative impact on economic growth in the affected markets
- Trade sanctions could add legal uncertainty and prohibit business
- Potential for social unrest
- Tail risk of civil war or even inter-state conflict

Impact: **MEDIUM**

Time frame: **0–3 years**



## "One size fits all" regulation

The financial crisis underlined the need for more regulatory coordination at international level. The G20 pushed for regulatory convergence to create greater certainty, level playing fields and to counter the possibility of regulatory arbitrage. However, there is also a danger that a high level of convergence between financial service sectors leads to homogeneous risk management practices and aligned incentives. These can generate a systemic risk by increasing the likelihood of common behaviour in a crisis.

Insurers are concerned that the insurance business model is inadequately taken into account. The FSB policy measures being introduced have a strong banking bias. In the US, non-bank systemically important financial institutions are expected to be regulated under a banking framework. The early success of the insurance industry in promoting the characteristics of its business model is fading as policymakers focus on simplicity and comparability.

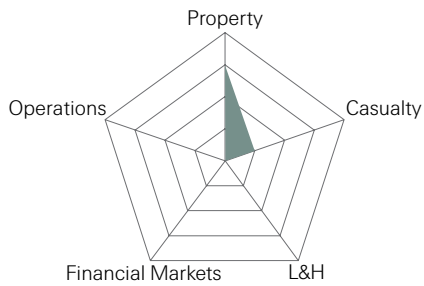
### Potential impact:

- Failure to properly recognise the insurance business model could lead to inappropriate regulation, with corresponding negative consequences for the insurance industry and its clients
- Excessive capital requirements and/or capital charges on asset classes could negatively impact the industry and particularly investment portfolios and profit margins

## Medium impact emerging risk themes

Impact: **MEDIUM**

Time frame: **0–3 years**



### Plant pathogen threatens rubber production

While plant diseases and pests are well-recognised as a threat to food production, their impact on the production of raw materials, such as cotton, hemp or natural rubber, has received less attention.

Many products we use in our everyday life, such as tyres, glues, seals, and surgical gloves at least partially consist of natural rubber. Natural rubber is indispensable for global transportation. Aircraft tyres, for instance, depend on natural rubber since they have no synthetic substitute. A shortage of natural rubber would thus hit the airline industry and all industries that depend on air transportation – and rubber production may increasingly be threatened by a plant pathogen.

Commercial rubber plantations are concentrated in Asia, where 90% of global natural rubber is produced. The rubber tree is vulnerable to a specific fungus which causes leaf blight. While this pathogen is currently limited to South America, experts are convinced that it is only a matter of time until it will spread to Asia. This could seriously impact Asian rubber production and could thus affect the global supply of natural rubber.

#### Potential impact:

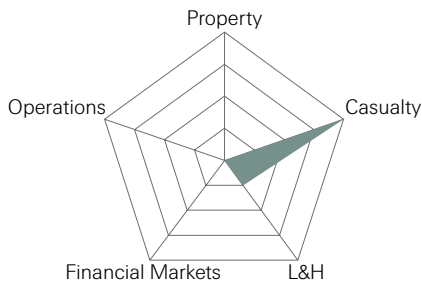
- Turnover of rubber producers and rubber industry could be heavily impacted
- Economic downturn could be triggered by a key resource supply shortage
- Accumulation of business interruption losses in agriculture covers





Impact: **MEDIUM**

Time frame: **>3 years**



### Aluminium health risks

Besides its well-known applications in aviation and household appliances, aluminium is also a neurotoxin which can alter the normal activity of the nervous system and cause damage to nervous tissue. Some studies also suggest a possible linkage of aluminium salts to Alzheimer’s disease as well as to breast cancer and bone fractures.

Aluminium salts are used in various medical products to increase the effectiveness of many vaccines and drugs to inhibit gastric acidity. They are also used in underarm antiperspirants, with currently unknown long-term effects. Clinical studies have indicated that such locally-applied cosmetic chemicals use may contribute to the development of breast cancer.

Food prepared in aluminium cooking pans is another important source of aluminium intake for humans. Studies indicate that the cumulative intake from this source might actually be considerably higher than that from medication, again with unknown long-term consequences.

Overall, widespread use of aluminium may cause an accumulation of aluminium in the human body. This could have far-reaching implications for liability insurers.

#### Potential impact:

- If aluminium salts are proven to be harmful this could lead to large serial product liability losses across industries like pharmaceuticals, cosmetics and food
- Exposure may not be considered in existing loss models, resulting in higher than anticipated losses

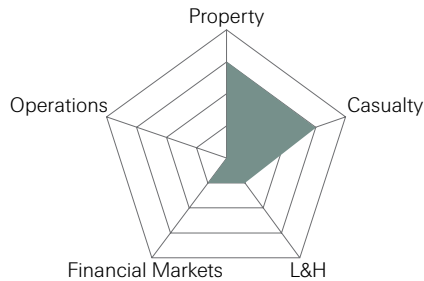


Today's cities have an increasing level of interconnectivity and a growing prevalence of digital steering and feedback systems. That brings a lot of advantages but also some new vulnerabilities.



Impact: **MEDIUM**

Time frame: **>3 years**



## Smart cities

Information and communication technology can support city functionality (ie create “smart cities”) through self-steering systems, for example with regard to resource and waste management or traffic and transport. Digital infrastructure can also increase energy efficiency as new forms of energy production (eg, from city-generated solar, biogas or wind power) are connected to intelligent buildings via smart grid networks.

Real-time feedback loops through sensors, webcams, GPS, mobile phone and internet use data could increase the efficiency of traffic control, transportation and disaster management. Furthermore, they may have positive impacts on healthcare and the provision of public services.

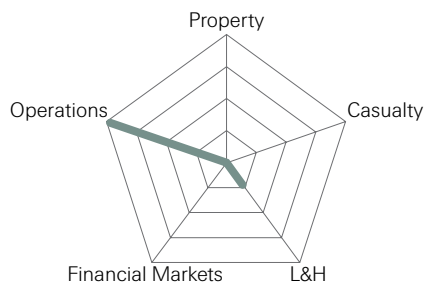
Besides these multiple benefits, an increasing level of interconnectivity and the growing prevalence of digital steering and feedback systems also give rise to new vulnerabilities. These could involve cascading effects with multiple damages as well as long-lasting interruptions if the problems turned out to be complex and/or difficult to repair. Interconnectivity and permanent data generation give rise to concerns about data privacy, and exposure to electromagnetic fields may also increase.

### Potential impact:

- Cascading effects triggered by external shocks or through malfunction of control systems may lead to large loss accumulation
- Data privacy issues and data theft trigger 3rd party claims against data holder and service providers

Impact: **MEDIUM**

Time frame: **>3 years**



## Demographic inclusion at the workplace

To adapt to longer lives and accelerated demographic dynamics, corporations not only need to reassess pension funds and workforce planning, but also corporate cultures, mindsets, HR policies, job profiles and career planning. In times when the word “retirement” might become obsolete, funding longer lives means fostering work environments that enable people to work longer if they so need or desire. At the same time, work places need to absorb and attract “millennials” – the generation born between the early 1980s and the early 2000s. In many markets this generation finds it difficult to get regular jobs and to build careers, and is sometimes even considered at risk of becoming “a lost generation”.

Workplace inclusion across generations will allow new career paths and working models to evolve. This could reduce the strain of funding longer lives. Failure to adapt to workforce demographic dynamics, on the other hand, may ultimately lead to competitive disadvantages for unsuccessful corporations.

### Potential impact:

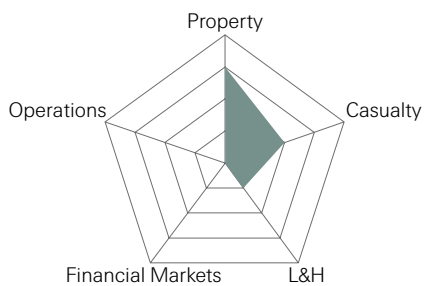
- Companies which fail to provide for demographic inclusion at the workplace may ultimately face a talent gap





Impact: **MEDIUM**

Time frame: **>3 years**



### Urban farming

Urban farming is the practice of cultivating, processing and distributing food in or around a village, town, or city. In many developing countries it has grown significantly as an artefact of rapid urbanisation when people have brought their rural ways of life (incl. animal husbandry) with them when moving from the countryside to the city. In developed nations, in contrast, urban farming has boomed recently in the wake of endeavours towards a more sustainable way of life.

Singapore, for instance, is placing high hopes in vertical farming – high-rise greenhouses with layers of platforms that are slowly rotated to make most efficient use of space and sunlight. Such efficient production may lower transportation costs and external dependencies. Other innovative solutions combine hydraulic greenhouse cultures with fish farming, which can boost productivity and improve the profitability of urban farming.

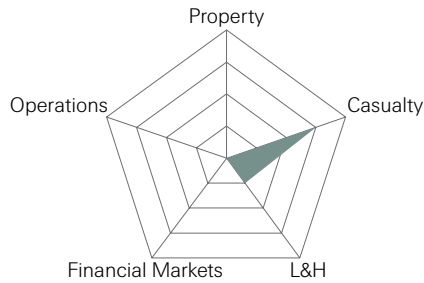
Besides multiple benefits from organic waste composting, rainwater harvesting, biological soil decontamination and water cleaning systems, as well as aesthetic and social benefits, urban farming may also pose new risks. These include risks arising from brittle greenhouse structures (potentially built on flat roofs), food poisoning through contaminated soil and water and air pollution. Furthermore, the close proximity of humans and livestock in the case of urban animal husbandry may increase pandemic risk.

#### Potential impact:

- Changed risk landscape for agricultural insurance (eg greenhouse covers)
- Liability claims against urban farm owners and operators in case of disease outbreak
- Uncertain increase in pandemic risk, possibly impacting L&H covers

# Low impact emerging risk themes

Impact: **LOW**  
Time frame: **0–3 years**



## Action cam liability

Action cameras are high-definition personal cameras, which are wearable or mountable in unusual places such as planes, cars, cycles, helmets, boats or even surfboards. They are specifically designed and marketed to be employed in extreme action video photography – and are therefore small, light, shock-resistant, often waterproof, and relatively cheap in comparison with other digital cameras.

Many promotional videos for these action cameras show people doing “extreme sports” – jumping from cliffs, surfing high waves, flying through the air and diving in the sea. For many, recording and subsequently posting risky actions seems to be an integral part of the pleasure derived from owning an action camera. This is likely to incite riskier behaviour among users.

Action camera manufacturers could be held liable for incidental or consequential damages relating to or resulting from use of their products. The increasing trend of documenting actions and experiences also has potential impacts in legal proceedings, with recordings serving as evidence of accident or wrongdoing.

### Potential impact:

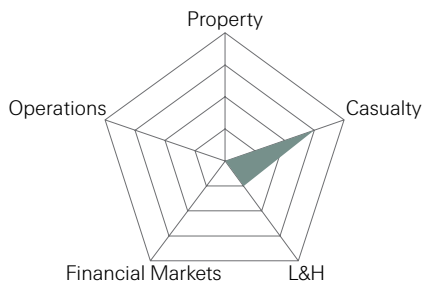
- Increased product liability claims
- Data integrity issue under personal liability (eg, movies published without permission)
- Increased Life & Health risk due to changed human behaviour, increased mortality and healthcare costs





## Low impact emerging risk themes

Impact: **LOW**  
 Time frame: **0–3 years**



### Epigenetics: genome modification as a liability loss driver

The term epigenetics refers to changes in gene activity that cannot be explained by changes in the DNA sequence. Genes hold the information to build and maintain an organism's cells and thus provide the instructions for constructing and operating living organisms. Not all genes are active at all times, and epigenetic mechanisms, such as DNA methylation, control gene expression. Chemicals that reduce or increase methylation may thus affect the development of cells and consequently organisms.

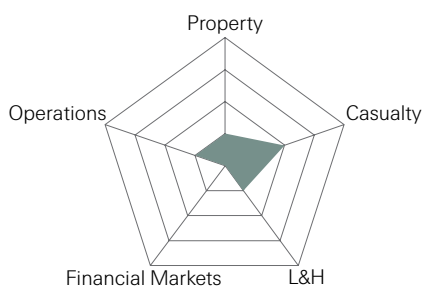
While epigenetics is not an emerging risk per se, scientific progress with regard to the underlying mechanisms and drivers may change the liability risk landscape. Scientists have already identified a number of chemicals that may affect gene expression, and some recent studies are showing correlations and effects which could have implications for insurers.

Chemical substances identified as being able to activate genes and generate hereditary effects (and thus cause multi-generational harm) could lead to large, unexpected claims. Even though analytical data about epigenetic alteration will most probably not be able to establish a clear cause-effect relationship between the exposure to a specific chemical and the onset of disease, it might provide evidence of exposure and indicate toxicity mechanisms. Epigenetic effects have already been suggested as being relevant for diseases such as asthma, autism, cancer, various degenerative and inflammatory diseases and obesity.

#### Potential impact:

- New product liability losses arising from chemicals that can switch on/off genes
- More claims under occupational disease coverage in workers' compensation
- Increased dispute resolution cost

Impact: **LOW**  
 Time frame: **0–3 years**



### From 3D to 4D printing

As we highlighted in the previous edition of the Swiss Re SONAR report, 3D printing is likely to impact various industries. The concept could be taken further with the introduction of 4D printing.

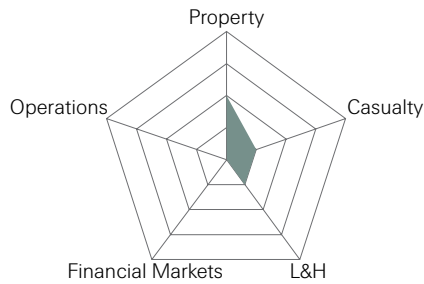
The fourth dimension of 4D is the functionality of materials that are used in the printing process. Some materials can change over time when exposed to water, temperature changes or air, and can even self-assemble into pre-determined shapes. By combining 3D printing technology with these highly advanced materials one can achieve various novel applications. In the medical industry, for instance, 4D printing might be used for implantable biomaterials/organ printing or for nanobots injected to fight cancer. It might also find application in construction, furniture, sportswear, and the automotive, aerospace and marine industries.

The rapid pace of development and the convergence of scientific developments from different fields have the potential to dramatically change the risk landscape for affected industries. This extra dimension brings additional complexity and vulnerability in relation to printed materials. Possible defects of 4D-printed products may thus be even more critical than those of 3D-printed products.

#### Potential impact:

- Product liability losses due to long-term effects/health impairments of advanced 4D-printed products

Impact: **LOW**  
Time frame: **0–3 years**



### Missing aircraft triggers technological change

Malaysia Airlines flight MH370 went missing on 8 March 2014 and had still not been found at time of print. Similar to the Air France flight AF447, which crashed into the Atlantic Ocean on 1 June 2009, this triggered extensive search activity involving several countries and international agencies.

To determine what actually happened on board of MH370, investigators have to locate the flight data recorder (black box). This takes time: In the case of AF447, investigators took nearly two years to retrieve the main wreckage and the black box even though debris had been found within 24 hours of the aircraft going missing (as opposed to MH370).

The events around MH370 and AF447 vividly illustrate that there is a real risk of not being able to locate an aircraft after a loss. This is likely to trigger changes in technology, allowing rescue teams to locate an aircraft in the future. Experts have long since called for complementing flight data recorders by expanding the data transfer capabilities of the aircrafts themselves to allow for real-time data streaming. As such a new technology is very costly, it will most likely only be implemented for modern long-haul aircrafts. Nonetheless, the amount of data will be significant and may even challenge current satellite communication infrastructure.

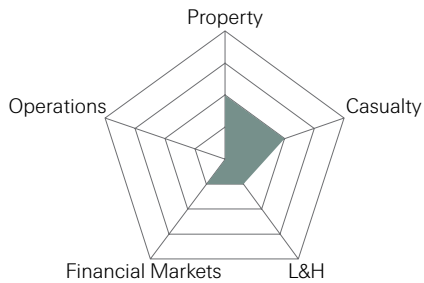
#### Potential impact:

- Difficulty tracing aircrafts after a crash delays establishing liability awards and makes it difficult to estimate the final liability reserves
- Complementing the black box with new technology may increase costs and create new exposures regarding data policy



## Low impact emerging risk themes

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



### Collapse of oceanic ecosystems

As oceans become ever more polluted, the marine ecosystem is harmed and biodiversity threatened until self-recovery may no longer be possible. This is likely to have far-reaching implications for social and economic well-being and, ultimately, the planetary ecosystem.

Decreasing oxygen levels in the ocean caused by climate change and nitrogen run-off, combined with other chemical pollution and rampant overfishing are undermining the ocean's ability to withstand atmospheric "carbon perturbations". This may ultimately compromise the ocean's contribution to buffering climate change.

Global warming in turn is triggering ocean acidification. This impacts the well-being and reproduction of organisms such as oysters, clams, sea urchins, shallow water coral, deep sea corals and calcareous plankton, which will ultimately strain the entire oceanic food web.

Overfishing and pollution also give rise to growing jellyfish populations. This can pose serious threats for various human activities. In south east Sweden, for instance, a huge cluster of jellyfish has already forced one of the world's largest nuclear reactors to shut down, and marine biologists predict that such incidents will become more common going forward. Furthermore, micro plastic particles may accumulate in the food chain, with still unknown long-term consequences.

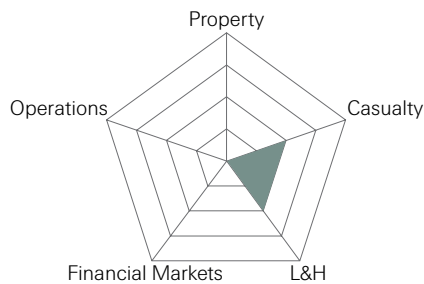
An international panel of marine scientists is now demanding urgent remedies to halt ocean degradation based on findings that the rate, speed and impacts of change in the world's oceans are greater than previously thought.

#### Potential impact:

- Increasing litigation concerning impairment of oceans
- More frequent maintenance intervals for on- and offshore infrastructure, with corresponding cost increases
- Reputational risks for corporations ignoring the issue



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



### Enhanced humans

The transhumanism movement seeks to transform humanity by developing technologies to enhance human intellectual, physical, and psychological capacities. Futurist Ray Kurzweil’s project “human body 2.0”, for instance, envisages a radical upgrading of our body’s physical and mental systems that will use nanorobots to augment and ultimately replace our organs or blood cells. Wearable computers such as Google glasses and powered exoskeletons, which are used in dangerous environments as well as to support those with disabilities, are already available today.

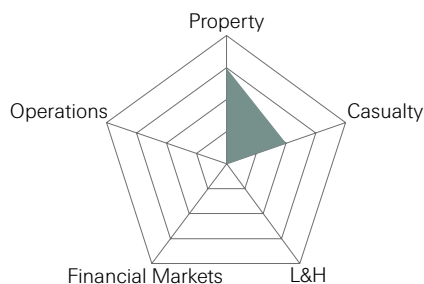
Augmentative medicine aims to improve body functions beyond human standards through, for instance, gene therapy or genetic designing of offspring. The question of personhood will be central once designing offspring becomes simple and gene therapies are developed to enable adults’ genetic makeup to be enhanced.

Human enhancement projects give rise to numerous ethical, but also legal problems. Ethical issues focus on whether it is acceptable to manipulate the very fundamentals of human biology, but also touch upon very specific issues such as concerns that only the rich will be able to access and benefit from such enhancements. Legal issues focus on questions around liability, eg who will be liable if an implanted device fails and third parties get injured or if a person with a chip-enhanced brain injures or kills another person.

#### Potential impact:

- Liability exposures around malfunction and faulty design
- Potential reputational risk by supporting ethically sensitive topic/technology
- Impacts on L&H covers (eg increased treatment costs due to augmentative medicine)

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



### Methane hydrate – an upcoming energy source?

Methane is a major component of natural gas. Part of the world’s methane exists in the form of methane hydrate, a methane gas trapped inside a crystal lattice structure of water, forming a solid structure similar to ice.

Significant deposits of methane hydrate are found under sediments on the ocean floors of the earth. By some estimates, it is twice as abundant as all other fossil fuels combined. This has led to a discussion as to whether methane hydrate might trigger a new energy revolution and could ultimately even lead to a geopolitical power shift away from ‘petro states’ towards ‘methane states’.

Methane hydrate extraction is currently limited to small pilot projects and research activities. Commercial extraction will require technological advances and will pose new environmental and economic risks. As it requires submarine drilling, it could lead to a critical change in the ratio of undersea pressure and temperature. This may cause the methane hydrate to become fluid and spill into the ocean, contributing both to ocean warming and to greenhouse emissions into the atmosphere. Potentially negative impacts of increased methane emissions are already debated in the context of hydraulic fracturing (‘fracking’).

#### Potential impact:

- Negative reputational impacts for companies involved in extracting and processing methane hydrate and their re/insurance counterparts
- Increased greenhouse gas emissions may contribute to global warming and ultimately increase nat cat loss exposure



Some of the 26 emerging risk topics presented here may never materialise, others definitely will. Nevertheless, the earlier the industry starts adapting to them, the better prepared it will be for future exposures, but also for future opportunities.

There is no silver bullet that will work in all cases – but sharing knowledge is a good first step to prepare for what might lie ahead.

We have launched this publication in this spirit and look forward to discussing these topics further with you. Please reach out to your local Swiss Re contact to continue this dialogue. We are smarter together.

## Terms and definitions

### **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 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 summarised for external audiences here.

### **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, ie, topics covered in the previous edition are not listed again.

All insights consist of a description of the topic and the potential implications for re/insurers and other large corporations. They feature an assessment of the potential overall impact, the expected time frame and a chart indicating which business areas might be impacted.

### **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 three years and those likely to occur later. This 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.

# Last year's emerging risk themes

For more information please visit: [www.swissre.com/library](http://www.swissre.com/library)



## Potential impact

Potential impact	1-3 years	4-10 years	>10 years	Time frame
<b>HIGH</b>	<ul style="list-style-type: none"> <li>■ Prolonged power blackout</li> <li>■ Run-away inflation and surging bond yields</li> <li>■ Big data</li> </ul>	<ul style="list-style-type: none"> <li>■ Endocrine disrupting chemicals</li> </ul>	<ul style="list-style-type: none"> <li>■ Unforeseen consequences of electromagnetic fields</li> <li>■ Unforeseen consequences of nanotechnology</li> </ul>	
	<ul style="list-style-type: none"> <li>■ Cyber attacks</li> <li>■ Supply chain vulnerability</li> <li>■ Underestimated nat cat exposure</li> <li>■ Changing communication patterns</li> <li>■ Toxic substances and workplace safety</li> <li>■ Changing lifestyle</li> <li>■ Emerging infectious diseases</li> <li>■ Unresolved sovereign debt crisis</li> <li>■ Underinvestment in critical infrastructure</li> <li>■ Legal actions drive changing claims patterns</li> <li>■ Personal damage compensation in Europe</li> <li>■ Regulatory fragmentation and extra-territoriality concerns</li> <li>■ Contingent reputational risks</li> </ul>	<ul style="list-style-type: none"> <li>■ Drug resistance</li> <li>■ The future of medicine</li> <li>■ Imminent global talent crunch</li> </ul>	<ul style="list-style-type: none"> <li>■ New forms of mobility</li> </ul>	
<b>LOW</b>	<ul style="list-style-type: none"> <li>■ Social unrest</li> <li>■ Do-it-yourself galore</li> </ul>	<ul style="list-style-type: none"> <li>■ A risky harvest</li> </ul>	<ul style="list-style-type: none"> <li>■ The robots among us</li> </ul>	

**Business areas**

- Property
- Casualty
- Life & Health
- Financial Markets
- Claims
- Operations

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