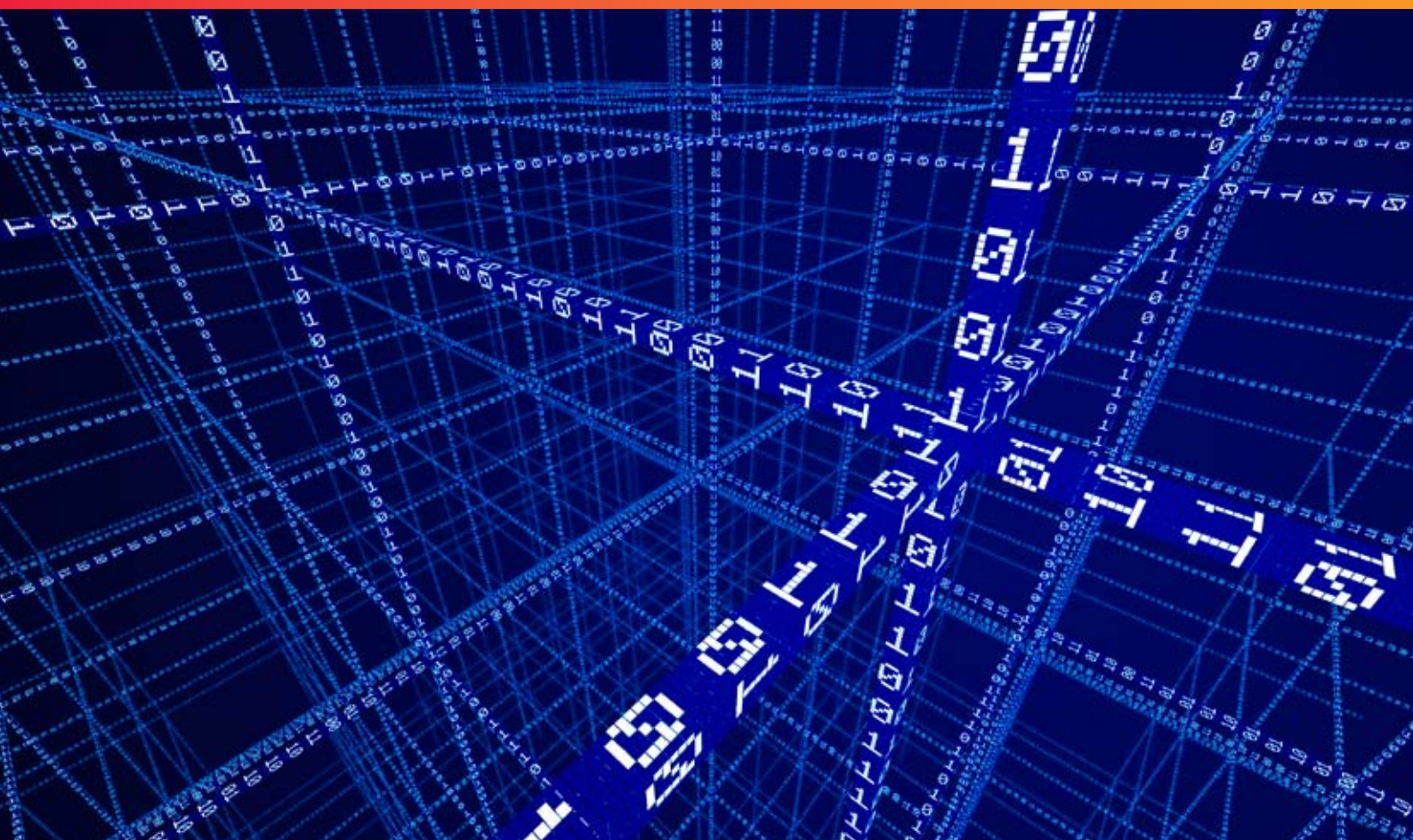


Swiss Re SONAR  
New emerging risk insights

May 2016



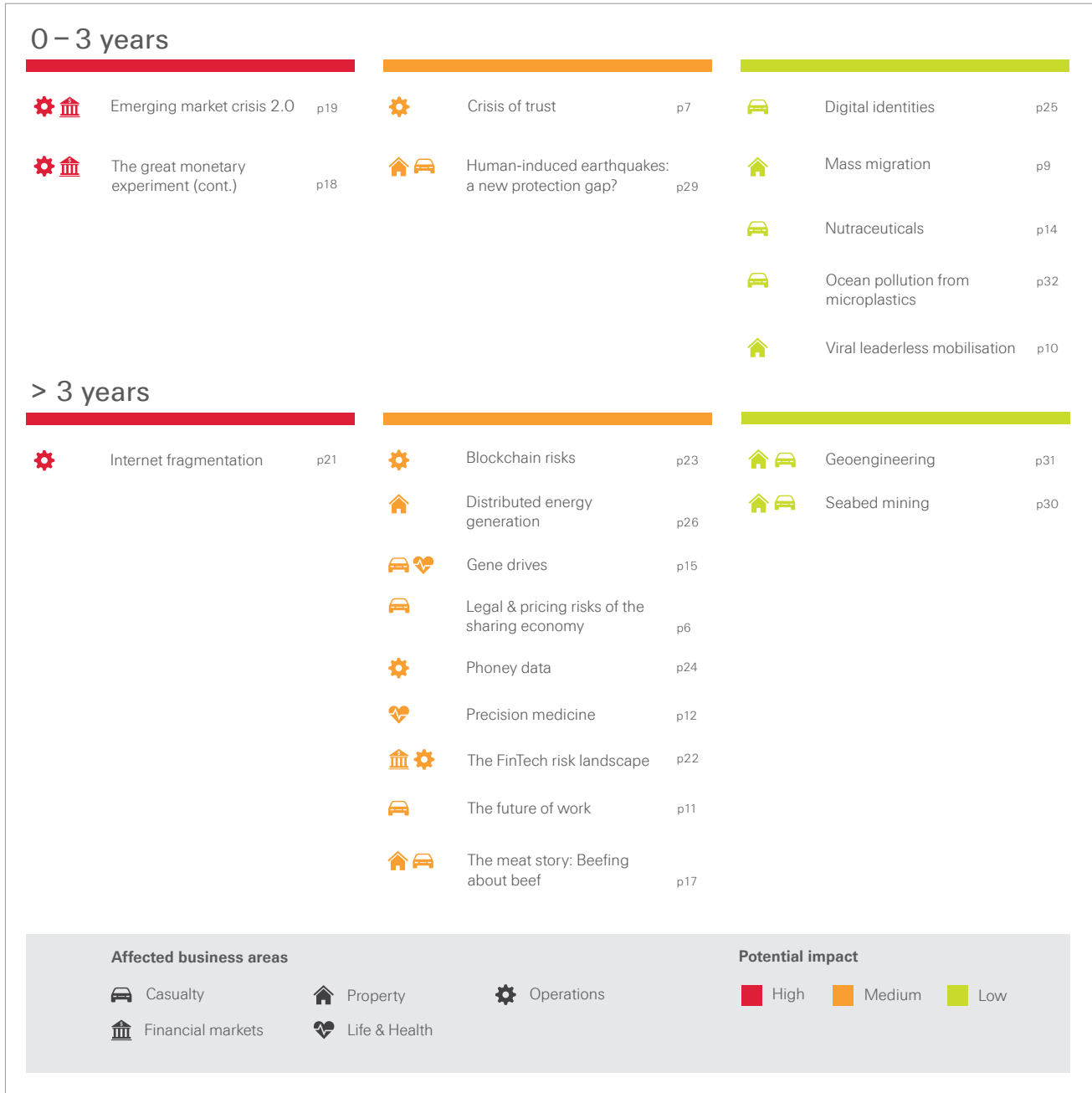
Risk management is not just about managing risks in the present. It is about anticipating future risks – and risks are emerging everywhere. Foresight information is key to enable fast, yet high-quality decision-making.

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# Overview

## Emerging risk insights by potential impact and timeframe



## Foreword

Welcome to the latest edition of Swiss Re SONAR, our annual emerging risk update.

To deal with risks is probably one of the most complex and complicated things you can do, but also one of the most fascinating ones. Risk management is not just about managing risks in the present. It is about anticipating future ones. These risks may only fully reveal themselves to our children and grandchildren. Action today may help alleviate or at least reduce some of their burden.

It would be easy to ignore many of these risks and focus on the business that we already underwrite. But that is not an option – as an industry we need to help promote a resilient society and sustainable business. Therefore we need to understand these new developments and prepare for the risks of tomorrow.

The report is a contribution to discuss the future risk landscape. It should not be understood as a forecast that tries to accurately predict what the future will bring. It rather seeks to provide an early indication of what might lie beyond the horizon. 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**

# Introduction

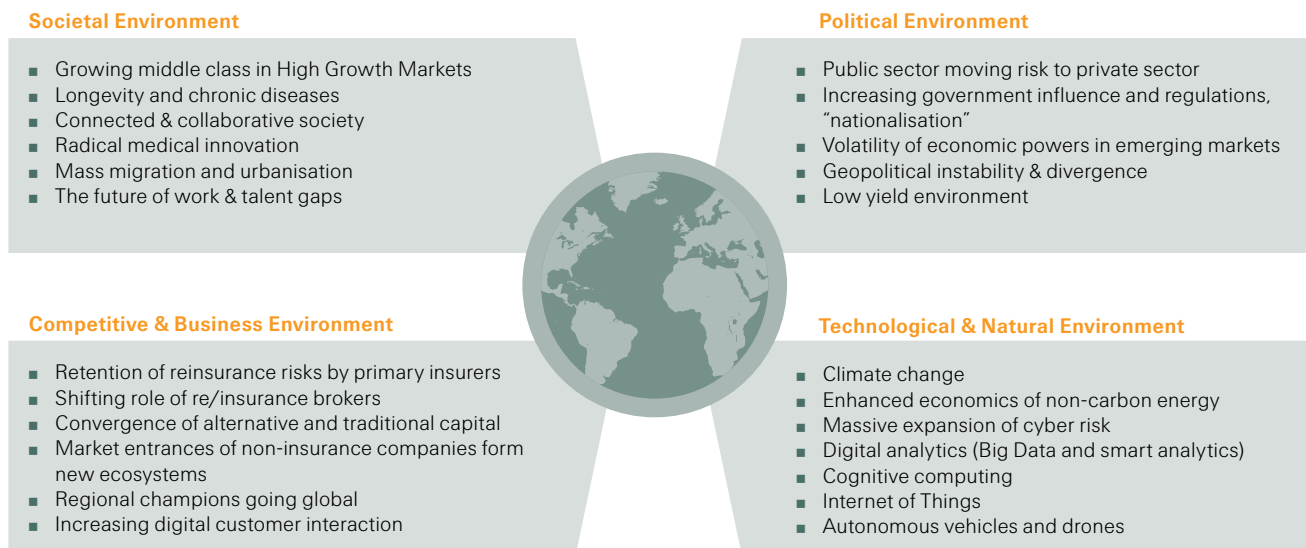
## Navigating an ever-changing risk landscape

Change is one of the few constants in the re/insurance industry, which is perennially confronted with new economic, technological, socio-political and environmental risks. Some of these risks we are familiar with, some are new. Most are increasingly interdependent.

To use historical data to assess tomorrow's exposure is not enough – at least not in such an evolving environment. The insurance industry needs to constantly monitor the risk landscape and adapt its behaviour, market conduct and product portfolio.

## Global macro trends

Global macro trends are shaping tomorrow's risk landscape. At Swiss Re, we assess these trends through discussions with experts and surveys. We have identified 24 macro trends likely to have a high impact within the next five to ten years, covering the societal, political, technological & natural as well as the competitive & business environments.



## Not new – nevertheless ...

Not all of the 24 macro trends are new or emerging. Economic uncertainty, low interest rates or increasingly stringent regulatory requirements have already influenced the industry over the last few years. Nonetheless, they are still posing new challenges and offering new opportunities for the insurance industry.

Climate change is one of the major macro trends that will have a significant impact on our lives and will continue to challenge the re/insurance industry and society as a whole. The rise of global average temperatures disrupts a complex climatic system, resulting in more severe and frequent catastrophic events.

The accumulation of assets in highly exposed areas as a result of urbanisation and a growing middle class in emerging markets will increase the economic costs of such disasters. The world's urban population is forecast to grow from 3.9 billion in 2014 to 6.4 billion until 2050, with more than 90% of this increase occurring in emerging countries. These demographic shifts will have many consequences: mass migration will force people to abandon rural

areas, potentially putting social systems and political stability under pressure, while some emerging economies will lose skilled workers. From 2015 to 2025, for instance, South Asia is forecast to lose 10 million migrants in net.

Against this backdrop, the public sector is increasingly moving risks into the private sector. Natural catastrophes are not the only area where we see this shift. Public private partnerships also start developing in the life and health sector. People live longer. Globally, life expectancy at birth is projected to rise from 70 years in 2005–2010 to 77 years in 2045–2050 and to 83 years in 2095–2100. The costs of funding retirement income, healthcare and long-term care in old age will increase dramatically. This could have significant financial consequences for individuals, insurers, employer pension funds and society in general. At the same time, global public debt is rising, and governments have fewer resources to finance rising costs in health and pension plans. This calls for new insurance solutions and opens opportunities for partnerships between public and private initiatives.

Another macro trend that is revolutionising our lives is new technologies, such as Big Data and smart analytics. Increased connectivity of people and things, social media platforms and the sharing economy are transforming the way we innovate, collaborate and socialise. They even changed business models, with prominent examples such as Uber in transportation and Airbnb in the hotel industry.

These changes will intensify the demand and supply of new insurance products and distribution channels. Industries with a strong affinity for technology and data analytics, such as search engine companies, social media providers, telecommunication companies, but also online shops, retailers and payment providers will gain access to big pools of user data and interact with a large customer base. Insurance companies might want to secure strategic partnerships with such companies to capitalise on business opportunities, including systematic reduction of specific risks.

The insurance industry also has to deal with shifts within the industry. Attraction and retention of talent remain key in an environment of demographic shifts and changing skill requirements. This particularly applies to scarce technological and data skills that are imperative for the re/insurance industry. Additionally, structural shifts in the risk transfer value chain disturb the balance of power in established markets. Demand for reinsurance is shrinking as primary insurers increasingly retain more insurance business on their balance sheet, and supply is growing as traditional and alternative capital is merging. Correspondingly, brokers are changing strategies to defend their customer access and develop new capabilities and services.

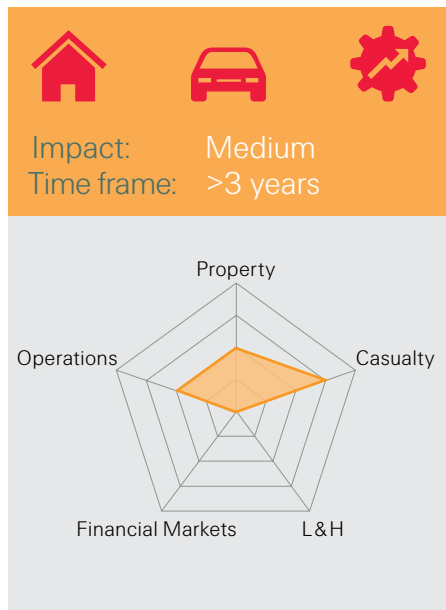
### Foresight is key

While monitoring macro trends is an important first step, it is by itself not sufficient to prepare for what the future might bring. Swiss Re has therefore embedded foresight and emerging risk detection and analysis in its risk management framework. With our SONAR tool – an internal crowdsourcing platform to collect inputs and feedback from underwriters, client managers, risk experts and others – we have established a solid process for identifying, assessing and managing emerging risks. In this publication we share some of our insights to start a dialogue on how to develop adequate solutions for the complex problems that the future may hold.

## New emerging risk insights

This chapter presents 21 new emerging risk themes and explains their potential impacts on society and the insurance industry. In addition, five 'emerging trend spotlights' highlight current developments which we deem interesting to follow, although they have not yet manifested into risks. All topics were derived through Swiss Re's SONAR process and are grouped by macro trend environment. Details on definitions and assessment scales are given in the Appendix.

### Societal environment



#### Legal and pricing risks of the sharing economy

##### Description:

The sharing economy has experienced some spectacular successes in the areas of transportation and accommodation, and service providers are increasingly moving from amateurs to more sophisticated players. While this may provide new business opportunities for the insurance industry, it also brings legal risks and challenges to adequately model and price the associated risks.

Vested interests such as commercial transportation lobbies urge regulators to subject sharing economy activities above a certain level of commercial profitability to the same stringent regulatory regimes they face. This would be detrimental to their business models. Regulators in different jurisdictions oscillate between designing specific regulatory regimes for the sharing economy and keeping with the rules already in place. This could give rise to cross-border legal and jurisdictional uncertainty.

For insurers, the rise and increasing sophistication of the sharing economy raises questions regarding the appropriate form of coverage. Traditionally, insurers absorbed some of the risks associated today with the sharing economy into their general risk pool. In some cases, the insurance industry had actually developed solutions targeted at 'sharing' scenarios (eg endorsements to regular homeowners' policies). But with the ubiquitous availability and easy access to sharing platforms and apps, the scale of the service has become much bigger and requires more research into the risk profiles and adequate pricing.

The sharing economy has also reached the very foundations of insurance. So-called peer-to-peer insurance is gaining traction – a model that is similar to traditional mutual insurance, but takes it to another level by using new technology. Early entrants are Friendsurance in Germany and Lemonade in the US. In contrast to other players in the sharing economy field, they have so far followed traditional insurance regulation without calling for new "sharing economy" rules. Peer-to-peer insurance raises questions of adverse and self-selection, pricing and reserving adequacy, and its ability to cope with catastrophic events. The incentive to follow strict commercial imperatives may be curtailed by social conventions with a 'friends'-based risk pool instead of a traditional pool of insureds.<sup>1</sup>

##### Potential impact:

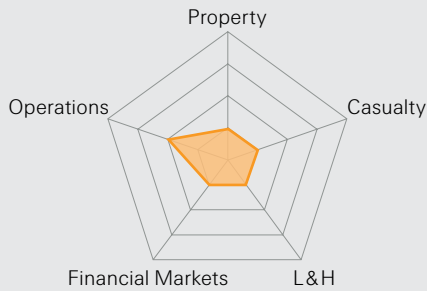
- Traditional insurers may face pressure from new players that can access new client segments through a sharing economy set-up.
- Insufficient loss experience could expose insurers to inadequate pricing models for the 'hybrid risks' posed by the sharing economy.

<sup>1</sup> Nakatsuji (2016), <http://tinyurl.com/jy5sgow>





Impact: Medium  
Time frame: 0–3 years



## Crisis of trust

### Description:

Citizens increasingly distrust public institutions, particularly governments, large corporations, especially banks and multi-nationals and the traditional media. The phenomenon is not entirely new, but has gained traction since the 2008/09 financial crisis.<sup>2</sup> The trend is clearly visible in Western democracies, as shown by the growing popularity of populist parties and candidates in countries such as Portugal, Spain, Ireland, or the US. It has caused a resurgence of populism, conspiracy theories, denigration of elites and minorities and a longing for charismatic leaders.

While there are many reasons for the decline in trust, at least part of it is due to rising inequality, a sense of disenfranchisement and rising job insecurity, resulting in a growing alienation between the elites and middle classes. In the Middle East, Africa and Latin America, there is a deep-seated frustration with the alleged inability of governments to overcome an unequal distribution of income and wealth and make people benefit from economic growth. In Western democracies, the middle class feels threatened by globalisation. People feel multi-national corporations no longer offer job security in exchange for their loyalty; manual and other clerical jobs are threatened by technology and outsourcing/offshoring. Finally, on a social level, immigration is seen as a threat to job security and local cultures and values, while at the same time people feel it became taboo to complain about immigrants [see also emerging risk theme on “Mass migration”, p. 9].

As trust in the traditional media declines, information disseminated on social media and the internet is gaining attention, despite it being fragmented and often of low journalistic standards. Bloggers, commentators and “trolls” race to outbid each other with ever more provocative statements and allegations. The messages are often undifferentiated and filled with stereotypes and prejudices. Narratives combine anti-establishment and anti-elite sentiments, anti-capitalism, and a generalised deep distrust of institutions, including insurance companies.

### Potential impact:

- A decline of trust in insurance in general may hurt business.
- A more predatory attitude may lead to an increased number of unwarranted claims.

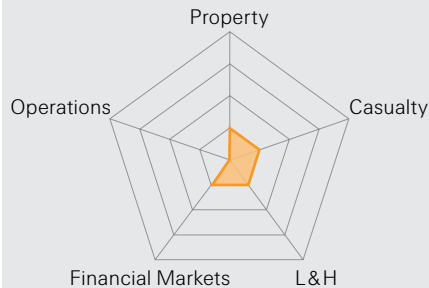
<sup>2</sup> Edelman Trust Barometer (2016), <http://tinyurl.com/jaf4373>

Europe is currently facing the biggest refugee crisis since World War II.





Impact: Low  
Time frame: 0–3 years



## Mass migration

### Description:

International migration is a global phenomenon and has become a pressing economic issue, particularly in light of the recent refugee flows from the Middle East and North Africa to Europe which have reached a level unprecedented in recent history.

While headlines in 2015 were dominated by the situation in Europe, which has seen a particularly rapid inflow of migrants (with more than 1.2 million people seeking asylum in the EU in 2015<sup>3</sup>), the challenge is global. Migration pressures across borders will likely continue to increase due to a number of unresolved, protracted crises in many regions of the world. Already now, migrants are estimated to account for over 3% of the global population.<sup>4</sup>

The sharp rise of asylum seekers has put considerable strain on transit and destination countries and has created political and social tensions. It has sparked fears of the economic burden of taking care of refugees, a potential cultural disconnection, and an alleged increase in crime.

However, there could also be positive implications. For host countries with ageing populations and a shrinking workforce, migration could alter the age distribution in a way that may strengthen fiscal sustainability.<sup>5</sup> Furthermore, the additional public spending required to meet the initial needs of newly arrived immigrants and to integrate them into the labour market may be a short-term demand stimulus (provided it is not offset by budgetary cuts elsewhere). For Europe, the OECD estimates that in 2016 and 2017 the additional spending to provide support for refugees could boost aggregate demand in the European economy by 0.1–0.2% of GDP.<sup>6</sup>

For source countries, emigration can lead to the loss of working-age labour and human capital (“brain drain”), but may also create opportunities in terms of remittances, trade and investment flows. The World Bank estimates that migrants’ remittances to developing countries have reached USD 436 billion in 2014, a 4.4% increase over the 2013 level.<sup>7</sup> The increasing prevalence of online and mobile money transfer systems in many developing countries is likely to offer opportunities for more cost-effective means of sending money. The remittance flows linked to current and future migration patterns might also be leveraged for financial development through market-based financial options.<sup>8</sup>

### Potential impact:

- While this is a major topic for society, we expect only minor impacts on the insurance industry.
- Variations in the composition of the receiving countries’ population due to a massive inflow of migrants may impact insurance schemes by shifting the characteristics of the insured (eg in terms of life expectancy, immunisation/vaccination status, prevalence of specific diseases, lifestyle choices, or product preferences).
- The risk exposure of buildings used as refugee accommodation might need to be reassessed due to higher-than-expected occupancy. The insurance industry could offer expertise to ensure that adequate loss prevention measures are established.

<sup>3</sup> Eurostat (2016), <http://tinyurl.com/hjqtfnf>

<sup>4</sup> IMF (2015), <http://tinyurl.com/zqovjzd>

<sup>5</sup> Calamur (2015), <http://tinyurl.com/h4uj3jp>

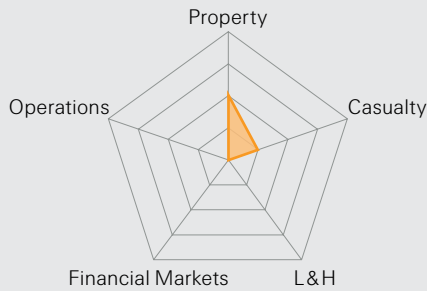
<sup>6</sup> OECD (2015), <http://tinyurl.com/zzwahtp>

<sup>7</sup> The World Bank (2015), <http://tinyurl.com/hz6bsjz>

<sup>8</sup> The World Bank (2015), <http://tinyurl.com/hz6bsjz>



Impact: Low  
Time frame: 0–3 years



## Viral leaderless mobilisation

### Description:

The technological capabilities of smartphones and the impact of social media increase the number of communication channels and the power of 'leaderless mobilisations' – the viral spreading of messages and calls for action that can result in 'flash mobs' or public shaming. Such mobilisations may be beneficial in case of political repression, for example to rally protesters and help overthrow regimes (eg Arab Spring), but can also turn against corporations and other institutions, even without physical mobilisation. This could seriously damage corporate reputations.

Rallying flash mobs is easier in a social environment where distrust towards governments, corporate institutions and organisations is widespread, and individual frustration, youth unemployment and disillusionment are high. Particularly the young and the digitally versatile are easily mobilised. Youth unemployment in Europe stood at 20% in 2015, with almost 50% in Greece and Spain, 40% in Italy, and 32% in Portugal.<sup>9</sup> But also among the broader middle class, trust in the ability of elites to govern is evaporating fast, fuelling a general sense of distrust and alienation from the elite. This may result in more and more violent riots and demonstrations that are difficult to contain, which in turn could result in more property losses.

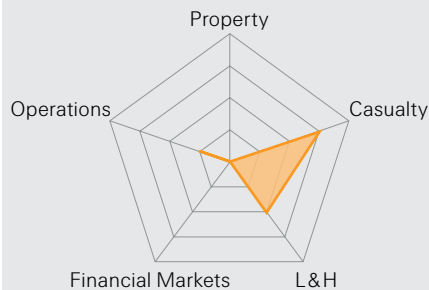
### Potential impact:

- More property and business interruption losses from riots are to be expected.
- Campaigns that hurt a company's reputation and lead to customer and stock valuation losses, with liability suits by shareholder activists as secondary effects.
- Manufacturers and distributors of smartphones and apps developers may be held liable for violent events from viral leaderless mobilisation, resulting in more liability claims.

<sup>9</sup> OECD (2016), <http://tinyurl.com/qb6xhp9>



Impact: Medium  
Time frame: >3 years



## The future of work

### Description:

With the rise of artificial intelligence and robotics, industrialised countries are on the verge of a fourth industrial revolution, also known as the industrial internet of things or industry 4.0.<sup>10</sup> This gives rise to ‘smart manufacturing’ where automation, machine-to-machine communication and other high-tech applications dominate industrial production. This will increase productivity and allow delegating strenuous and repetitive work to machines. However, it will also radically change the industrial workplace and redefine human tasks and skill requirements. As artificial intelligence is entering a stage where even complex tasks such as recognition of emotional states or business negotiations could successfully be managed by machines, white collar jobs are also coming under pressure.

While the fourth industrial revolution will create new jobs and transform work qualitatively, a high portion of paid labour jobs is also expected to vanish. This will affect the middle classes, and ultimately the insurance customer base: if people have no jobs they cannot buy insurance – at least not unless they have an income independent of employment or entrepreneurship.

A pessimistic vision for the future of industrial societies depicts a grim scenario, with mass unemployment and a frustrated workforce sharing a shrinking amount of paid labour. Such societies risk plunging into social unrest. However, if managed carefully this transition could also entail opportunities if a new informal economy of voluntary work becomes more prominent. This could, for instance, help to bridge the generation gap by enabling more people to spend part of their time engaging with and caring for elderly family members, friends or neighbours.

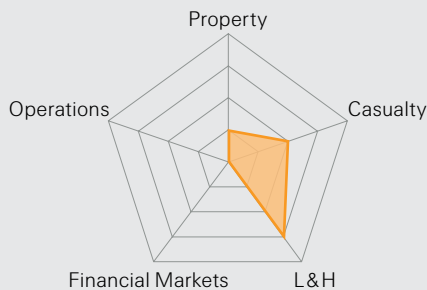
### Potential impact:

- The digital industrial revolution will increase demand for information and communication technology and corresponding insurance products.
- Mass unemployment could result in a shrinking customer base for personal insurance and a reduced portfolio for employers’ liability if newly created jobs are not outweighing the loss.
- Insurance might find new opportunities in supporting the growth of a new informal economy.

<sup>10</sup> For an overview from an insurance perspective, see the CRO Forum’s Emerging Risk Initiative position paper *The Smart Factory – Risk Management Perspectives* (2015), <http://tinyurl.com/g9gymy>



Impact: Medium  
Time frame: >3 years



## Precision medicine

### Description:

Precision medicine is an emerging approach for disease treatment and prevention that takes into account a person's genes, environment and lifestyle.<sup>11</sup> It is driven by the convergence of genomics and computer science, nanotechnology, biotechnology and cognitive science. The availability of massive amounts of data, combined with the increased capacity to extract meaning from data sets could enable improved health care on an individual basis.

While efforts initially focused on conventional therapies paired with advanced diagnostics ("targeted therapy"), there are now additional opportunities in areas such as regenerative medicine, a branch that focuses on stem cells and tissue repair. In the future, it might be possible to match a disease to the therapy that is more likely to treat it, based on the individual genetic mark-up of the patient and the advances of precision medicine. Identification and ultimately perhaps even correction of predisposing genes and risk factors might become possible.

The potential for precision medicine is regarded to be huge, particularly as ageing populations trigger demand for a new generation of medicines (see also Emerging trend spotlight on "Health 4.0"). However, there are still some drawbacks. While sequencing of individual whole genomes is already affordable, making sense of the information will still require comparative analysis of huge cohorts. Governments have recognised this challenge and are beginning to take action. In early 2015, the US government has launched the Precision Medicine Initiative (PMI), with the goal of enabling "a new era of medicine in which researchers, providers and patients work together to develop individualised care".<sup>12</sup> This entails building a national research cohort of at least one million US participants which will not just focus on disease, but also on ways to increase an individual's chances of remaining healthy throughout life.

### Potential impact:

- New data types and new data sources will create information management challenges, and data protection and transfer might become a bigger liability issue.
- For insurers, personalised diagnostics and therapies may increase costs for health insurance in the mid-term, but could reduce overall health care expenditure in the long-term by increasing treatment effectiveness and efficiency.
- With an increase of the predictive value of personalised genomic data, the insurance industry will be increasingly faced with anti-selection in life insurance and an increased lapse risk. Ultimately, it might even lead to a creeping erosion of the solidarity principle on which insurance is based.

<sup>11</sup> US Precision Medicine Initiative, <http://tinyurl.com/o4uahu6>

<sup>12</sup> National Institutes of Health (2016), <http://tinyurl.com/z8sllaj>

# Precision medicine will improve healthcare on an individual basis.



## Emerging trend spotlight | Health 4.0

Health spending is increasing rapidly around the world, driven by a growing population, aging societies and higher treatment costs. Our current health system will rapidly become unsustainable, and it is expected that the healthcare sector will undergo fundamental change.<sup>13</sup>

Technological progress and new digital infrastructure are enabling new ways of delivering healthcare. Along the lines of Industry 4.0, this development has been described as “Health 4.0”. It includes a broad range of solutions, focusing on bringing the digital and the real world together. Cybermedicine – the delivery of medical services via the internet and apps – can boost the efficiency of relationships between patients and doctors as well as between doctors and other health providers. Modern media channels enable remote diagnosis and consultations (telemedicine), and artificial intelligence computer systems like IBM’s Watson can advise doctors by analysing large amounts of data such as case histories, reported symptoms and treatments.

People will use self-monitoring and advisory healthcare services provided through devices such as smartphones or wearables to live ever more independently. Sensors and data processors will monitor the patient’s state, offer preventive measures and issue alarms in case of emergency. Social media monitoring will be the base for early warnings at an early stage of a disease outbreak and will help to prevent pandemics.

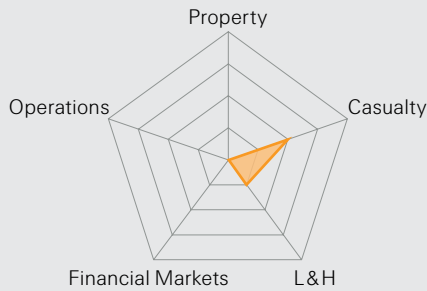
Health 4.0 is hailed as the tool to provide improved care for the masses while simultaneously moderating the increase in healthcare costs. However, there are still many economic, legal and societal challenges (eg with regard to digital data protection and security, remuneration systems, education and network expansion) which must be fully understood and managed before Health 4.0 can reach its full potential.

On a side note, the transition towards more virtualised care might also contribute to blurring the lines between the largely regulated healthcare sector and non-regulated segments such as fitness, wellness, and consumer electronics. It is likely that new competitors and new business models will seek to enter the lucrative healthcare market, shaking up the current value chain. This will also have implications for health insurers.

<sup>13</sup> Deutsche Bank Research (2015), <http://tinyurl.com/hgs5ngc>



Impact: Low  
Time frame: 0–3 years



## Nutraceuticals

### Description:

Ageing and increasingly health conscious populations make for a growing market for products which promise to help prevent lifestyle-related diseases. Nutraceuticals are products deriving from food sources that claim to contain extra medical or health benefits in addition to a basic nutritional value. They can be divided into functional foods and dietary supplements.

Functional foods are processed foods aimed at enhancing physical or mental well-being or preventing diseases. Foods high in Omega 3 fatty acids claim to be beneficial for the heart; some yogurts are promoted to prevent gastrointestinal infections; calcium-fortified foods are marketed as a tool to prevent osteoporosis. There is currently no legally binding definition of functional foods, and for most products the appropriate 'dosage' is unknown and untested.

Dietary supplements, in turn, are legally defined and regulated in most industrialised countries. The US Food and Drug Administration defines them as products intended for ingestion that contain a 'dietary ingredient' (a vitamin, a mineral, a herb) intended to add further nutritional value to the diet.<sup>14</sup>

The global market for nutraceuticals is expanding rapidly and is expected to reach USD 278 billion by 2021<sup>15</sup>, from USD 172 billion in 2014.<sup>16</sup> It holds attractive diversification potential for both food and pharmaceutical companies, which are expected to compete fiercely for market dominance.<sup>17</sup>

The regulatory landscape for nutraceuticals is currently very heterogeneous. Manufacturers, distributors and retailers need to adapt their strategies and products to comply with local regulations and market preferences.

### Potential impact:

- The 'borderline position' between food and pharmacological product raises questions on how nutraceuticals should be regulated and classified, which also has an impact on the corresponding insurance covers.
- The novelty of the products and the lack of harmonised rules make underwriting nutraceuticals challenging for re/insurers.
- Claims can be unique and complicated due to the composition of the products, labelling and advertising issues, lack of clarity on health effects (which could potentially also be negative) and difficulty demonstrating causation.

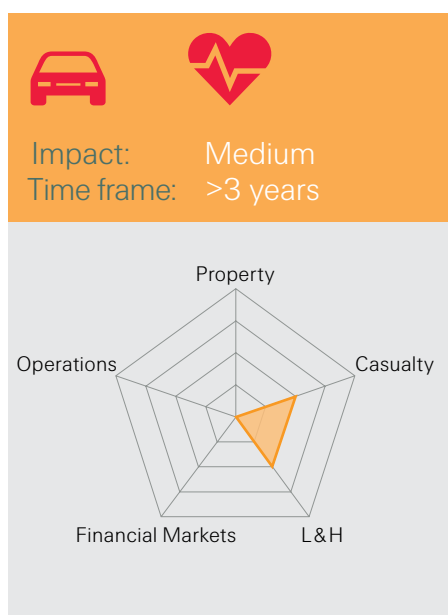
<sup>14</sup> FDA (2015), <http://tinyurl.com/otk4vjv>

<sup>15</sup> Transparency Market Research (2015), <http://tinyurl.com/j2rrpop>

<sup>16</sup> BCC Research (2014), <http://tinyurl.com/ndx4vcj>

<sup>17</sup> KPMG (2015), <http://tinyurl.com/jmxfp5v>





## Gene drives

### Description:

Gene drives are genetic systems that circumvent the rules of normal sexual reproduction and greatly increase the odds that a particular trait will be passed on to offspring, allowing it to rapidly spread across a population.<sup>18</sup> Recent scientific advances such as CRISPR-Cas9 – a gene-editing technique that has revolutionised the field of genetic engineering since 2013<sup>19</sup> – could enable a rapid application of gene drives.

Gene drives have the potential to fix difficult biological problems: they could be applied to genetically modify mosquitoes and other disease vectors so they can no longer transmit diseases such as malaria, dengue fever or the Zika virus. They could also be used to exterminate invasive species or to break the herbicide resistance of common weeds by altering their genetic make-up.

There are also a number of concerns.<sup>20</sup> If mutations happen during the process, this could allow unwanted traits to ‘ride along’ on the spreading drive, with unpredictable outcomes. Cross-breeding between modified and unmodified individuals could potentially allow a drive to move beyond its target population, again with unpredictable outcomes. And even when everything goes according to plan, releasing modified organisms into the wild may have unexpected negative side effects on the environment, as seen for many other approaches to manage invasive species.

There are also important ethical considerations. Gene drives are a very powerful tool which could get out of control. Scientists have begun to call for increased regulation<sup>21</sup>, but international governance is still lacking. While some interest groups have started voicing concerns on the potential misuse of gene drives for example in bioterrorism, it is not yet clear where the public debate is heading.

### Potential impact:

- Huge upside potential, but also uncertainties, mainly regarding the environmental impact.
- For insurers, a commercial application of gene drives could trigger GMO-related losses, eg under the EU’s Environmental Liability Directive.

<sup>18</sup> Harvard University (2014), <http://tinyurl.com/hdm2knk>

<sup>19</sup> Lander, E.S. (2016), The heroes of CRISPR. Cell 164: 18-28

<sup>20</sup> Webber et al. (2015), <http://tinyurl.com/zf2qwny>

<sup>21</sup> Oye et al. (2014), <http://tinyurl.com/gqueac9>



## Emerging trend spotlight | **Cyborgisation**

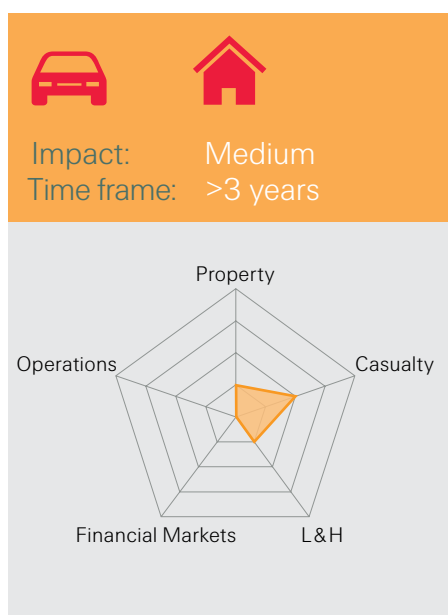
Enhanced by mechanical and electronic devices, the natural limits of the human body are disappearing. The cyborg – a (human) being with both organic and artificial components – is here with us. From the first person equipped with a prosthetic limb to bio-mechatronic organs, cyborgisation is not just about compensating handicaps, but also about powers that a human being would not have naturally. The trend towards increasing mergers between humans and machines is fuelled by new technologies, such as 3D printing, and driven by medical interest. It is about mitigating physical disability with devices such as exoskeletons to mind-controlled and motorised prostheses. But cyborgisation is also about the human aspiration to excel. If our sensory system, our brain, our skeleton and muscles can all be replaced or enhanced by add-ons or extensions, the super human is not far away.

Increasing interfaces between the analogue body and the digital cyberspace will enable direct interaction between the physical human and the digital world of data and computation. In principle, this allows for more freedom and empowerment, but also for manipulation: Our identities and self-representations may increasingly include a considerable digital part, which opens up the possibility that we could be hacked in our innermost self.

To insurance, cyborgisation is both an opportunity and a challenge. Implants and prosthetic devices can be insured and may potentially affect health costs in the long run. As cyborgisation moves to a larger scale, a shift from personal liability towards product liability can be foreseen. Cyborgisation is costly, and it will become a status symbol for the wealthy. Compulsory health insurance will be restrictive in subsidies, whereas private personal insurance may develop innovative offerings.



Meat consumption is coming under pressure.



## The meat story: beefing about beef

### Description:

While traditional diets are increasingly replaced by ones higher in refined sugars, refined fats, oils and meats in many parts of the world<sup>22</sup>, as a result of rising income and urbanisation, meat consumption is coming under pressure in many parts of the Western World.

While meat provides essential nutrients such as vitamins, trace metals and protein, it also has high levels of saturated fat and cholesterol and is associated with a modest increase in both overall and cardiovascular mortality. In October 2015, the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) published a report highlighting that regular consumption of processed meat increases cancer risk<sup>23</sup>, prompting a global uproar (“Bacon-gate”). The WHO was forced to clarify that their report “does not ask people to stop eating processed meats but indicates that reducing consumption of these products can reduce the risk of colorectal cancer”.<sup>24</sup> Nonetheless, meat consumption has become a hotly debated topic.

Meat production also heavily impacts the environment: Livestock-based food production causes almost 20% of global greenhouse gas emissions<sup>25</sup>, and is a key land user and source of water pollution by nutrient overabundance. It also competes with biodiversity and promotes species extinctions.<sup>26</sup> Studies have shown that shifting from animal-based foods to a vegan diet would significantly reduce dietary greenhouse gas emissions.<sup>27</sup>

Will eating meat soon be ostracised by society, as smoking already is in many parts of the world? While this does not seem likely in the near future, there is already pressure on meat eaters in some parts of the world to cut down their consumption – be it for health or for environmental reasons. Further changes in dietary patterns are to be expected, with some implications for the farming industry and all stakeholders in the associated value chain.

### Potential impact:

- Large-scale dietary shifts would have a significant economic impact on livestock farmers and the entire associated supply chain, including insurance.
- Class actions against stakeholders in the meat value chain are possible, similar to those that already shook the tobacco industry.

<sup>22</sup> Tilman & Clark (2014), <http://tinyurl.com/zhzwp7o>

<sup>23</sup> Bouvard et al. (2015), <http://tinyurl.com/nfh4wzs>

<sup>24</sup> WHO (2015), <http://tinyurl.com/oltq5ez>

<sup>25</sup> FAO (2006), <http://tinyurl.com/nfex5vc>

<sup>26</sup> Eshel et al. (2014), <http://tinyurl.com/htln9y9>

<sup>27</sup> Scarborough et al. (2014), <http://tinyurl.com/gtkcvxy>

## Political environment



### The great monetary experiment (cont.)

#### Description:

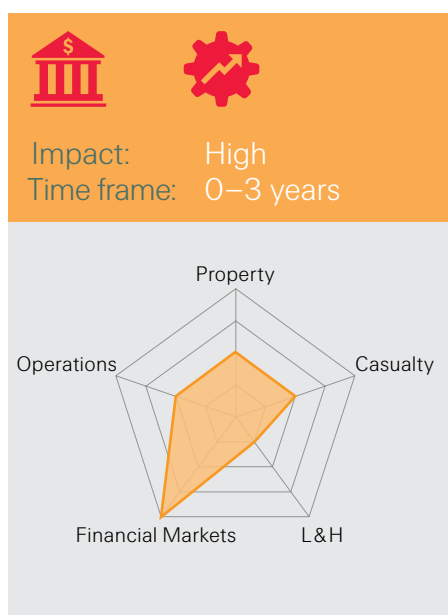
Though the US Federal Reserve (the Fed) started very cautiously to raise interest rates in December 2015, other major central banks continue to ease. The European Central Bank (ECB) further extended its asset purchase program in March and cut rates further into negative territory. The Bank of Japan (BoJ) introduced negative interest rates in January. The lower to negative interest rates environment has not conclusively led to increased lending by the banks – the intended effect – but has sometimes helped to depreciate currencies. The latest round of easing at the ECB and BoJ could be viewed as a “currency war” in which central banks try to lower the external value of their currencies to boost exports and growth in their currency area. Despite the unorthodox monetary policy measures, economic growth and inflation remains tepid in the Eurozone and Japan. As a result, discussions about additional monetary policy stimulus have intensified, including unconventional and aggressive policies such as “helicopter money”.<sup>28</sup>

The ultimate impact of such measures is highly uncertain. Ongoing negative interest rates could pressure banks enough to curb lending. Stock prices of banks in Japan fell after the BoJ adopted negative rates, and stock prices of European banks have also been hit hard this year. The Fed, the ECB and the BoJ have built up huge balance sheets, and it is unclear how these will be reduced. Helicopter money in the past has led to hyperinflation. The uncertainty from unconventional monetary policies continues to increase, as already highlighted in last year’s SONAR report. What is certain is the negative impact of low interest rates on pension funds, retirees and insurance companies.

#### Potential impact:

- The long-term costs of negative interest rates and unconventional monetary policies are still unknown, but could include a broader loss of confidence in the monetary system and lead to much higher inflation. The short-term benefits are limited, as the policies are unlikely to meaningfully stimulate demand and boost economic growth.
- Negative interest rates will further undermine the conventional business model of the insurance industry, particularly life insurers, and pension funds.
- M&A activity may become more intense as insurance companies partner in order to increase economies of scale and retain earnings power.

<sup>28</sup> WEF (2015), <http://tinyurl.com/hnot9my>



## Emerging market crises 2.0

### Description:

For years, emerging markets have attracted capital inflows due to low interest rates in advanced economies. Many emerging market commodity producers have also benefited from high commodities prices. Excess supply of commodities along with the slowdown in economic growth in China have lowered commodity prices (eg oil, metals), stressing many emerging markets. This, along with a tightening bias to US monetary policy, has led to net capital outflows from emerging markets for the second consecutive year in 2015.<sup>29</sup>

Parallels have been drawn to the emerging market crises in the late 1990s, triggering fears of an “emerging market crisis 2.0”. While many countries today have higher currency reserves and more flexible currency regimes – which makes them less vulnerable to adverse external developments – another crisis might be lurking. If US interest rates and oil prices rise faster and higher than expected, key net oil importers (eg China, Turkey and South Africa) may suffer disproportionately. Meanwhile, slower growth and capital outflows in China may add to depreciation pressures on the renminbi, dragging many emerging market currencies lower as well. This would lead to higher inflation in these countries due to currency weakness pass-through while simultaneously exacerbating the disinflationary pressures in many developed countries.

On top of that, high private and public debt remains an overhang in many emerging markets.<sup>30</sup> Rising corporate debt levels is a major issue in countries such as China and Turkey. Current account deficits also pose potential problems for some countries, eg South Africa and Turkey, given their reliance on the more volatile and short-term portfolio inflows. Finally, geopolitical risks could also exacerbate the already bleak macroeconomic outlook, and in some cases act as an impediment to much-needed structural reforms.

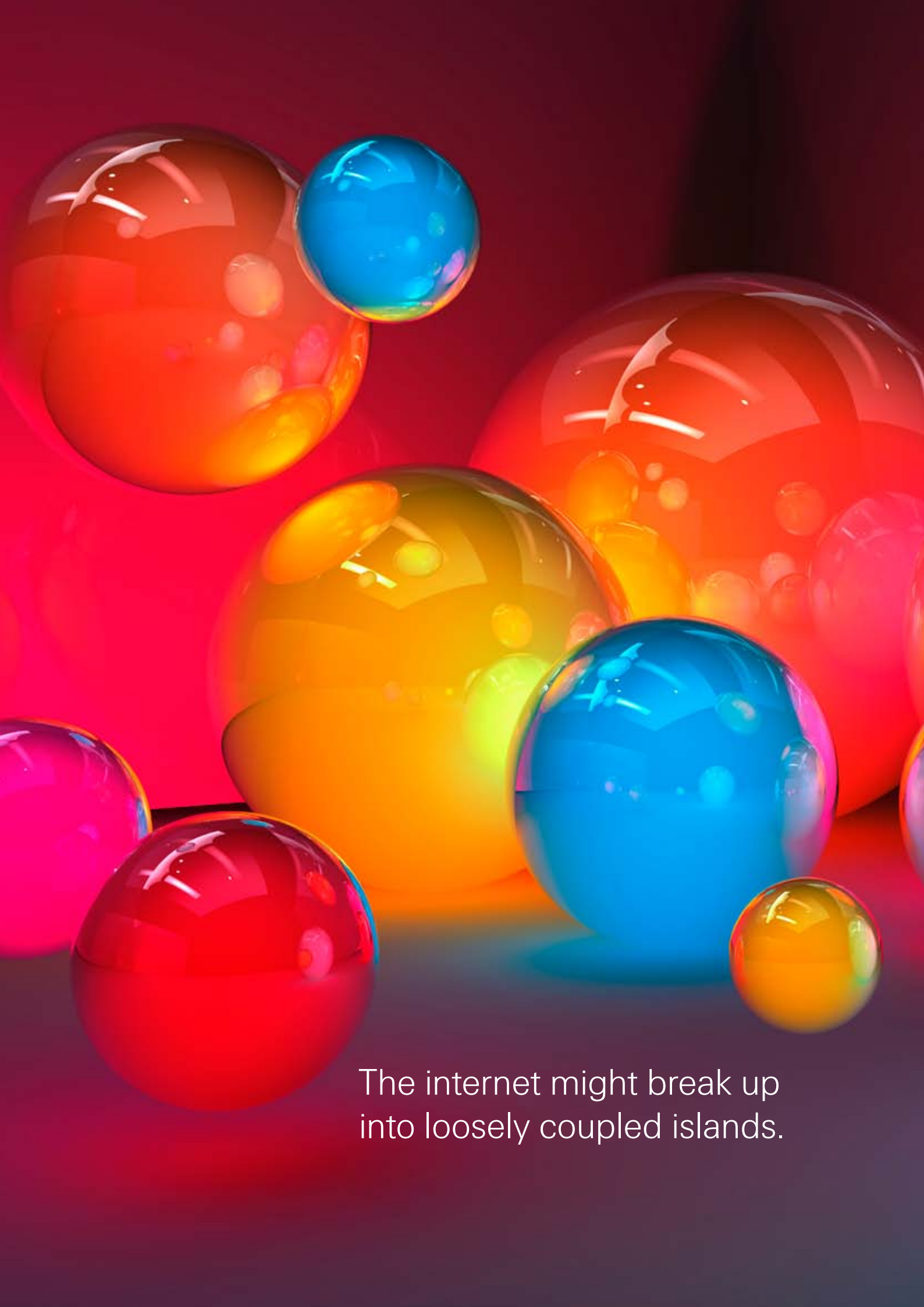
Emerging markets turmoil would hinder the market entry and penetration strategies of global insurance corporations. Economic and financial difficulties could hurt both the underwriting and the asset management side of insurers’ balance sheets, and may also trigger detrimental regulatory consequences. As exposure to emerging markets has grown over the last two decades, such effects are likely to be bigger than in the past.

### Potential impact:

- Political turmoil and riots may result in higher underwriting losses, especially in property, personal and commercial lines. Corporate defaults may produce credit losses, and interruptions to infrastructure projects would have adverse impacts on surety books.
- Corporate defaults and stock market declines would result in asset management valuation losses, especially in the case of significant spillovers to developed markets.
- Large-scale investment losses in emerging markets may trigger lawsuits from shareholders, resulting in liability and D&O claims.
- Regulatory authorities may constrain the movement of capital, limiting and/or prohibiting profit and capital market gains repatriation, or promulgate new regulations such as requiring new collateral or collateral held in hard currency. This would negatively impact the availability of capital.

<sup>29</sup> IIF (2016), <http://tinyurl.com/j9I7zc7>

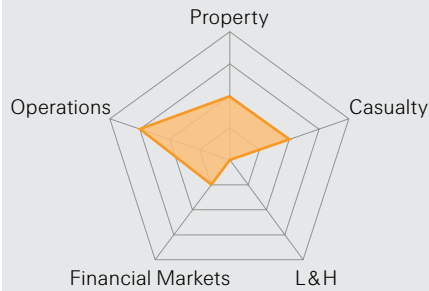
<sup>30</sup> World Economic Forum (2016), <http://tinyurl.com/zc77ofa>



The internet might break up  
into loosely coupled islands.



Impact: High  
Time frame: >3 years



## Internet fragmentation

### Description:

Cybercrime and cyberspies have grown strongly over the last few years and have made the internet less safe. Studies show that at the current rate, benefits from annual information and communication technology (ICT) investments and upgrades only barely outweigh the costs of protecting systems from hacktivism, cybercrime, cyber espionage, cyber sabotage and local network instabilities. And the way forward seems to indicate more of the same.<sup>31</sup>

Governments are concerned about this development and have been building up their capabilities to prosecute criminals and hackers in the cyberspace. Governments are instituting more regulation, urging corporations to protect their online assets more effectively and requiring technology and ICT companies to store data on servers physically located within their geographical borders. Some countries are even using special software to filter out unwanted information, firewalls and isolated IT infrastructure detached from global networks. A step further in this direction is the design and development of internet protocols which make certain communications impossible. In China, for instance, the government already controls all Internet content as well as the physical infrastructure.

A fragmentation of the internet is currently being viewed as unlikely to happen suddenly. International negotiations are currently under way to agree on how the internet should be governed, but no consensus or international treaty has emerged yet. While the debate is still under way, there is a chance that disconnected national and regional nets will become more common.<sup>32</sup> Such developments would increase IT costs and regulation and would hurt insurance companies operating across borders.

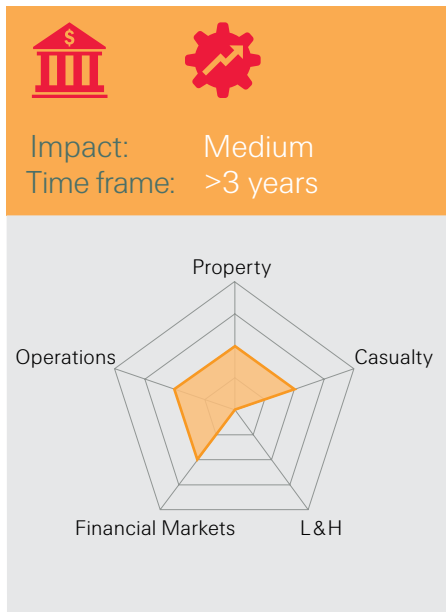
### Potential impact:

- Sunk costs in cross-border IT infrastructures that would become ineffective amid increasing fragmentation could become a legacy issue on the balance sheets of large corporates.
- Evolving regulation would increase operational risk and could trigger more liability claims (D&O, fidelity); it may also massively increase costs for setting up and maintaining separate legal structures.
- Technology companies, such as providers of cross-border cloud services, could see a disruption of their business model and might face liability suits from customers if they could no longer access data stored on cross-border servers.

<sup>31</sup> Zurich (2015), <http://tinyurl.com/z3hhnno>

<sup>32</sup> World Economic Forum (2016), <http://tinyurl.com/z5dkzul>

## Competitive and business environment



### The FinTech risk landscape

#### Description:

FinTech is an umbrella term for technology-driven financial services that promise efficiency gains and lower costs and prices thanks to disintermediation, new funding sources (peer-to-peer) and artificial intelligence-based advising. Global FinTech investments have tripled from 2013 to 2014 and doubled again from 2014 to 2015, with the bulk made in the US.<sup>33</sup> Regulators are pondering whether new and different regulation is needed or whether existing regulations would still suffice.

InsurTech has emerged as a niche within FinTech, offering innovative insurance solutions based on new technology platforms and software. Traditional financial services players have begun to embrace the trend while venture capitalists are financing numerous start-ups. FinTech thus poses possibly revolutionary risks to the business model and the internal management of established financial services players.

Increased exposure to cyber risks, especially given FinTech's usually lucrative targets, but also the potential risk of a valuation bubble and issues around liability, for example in the case of artificial intelligence-based stock trading, make FinTech a tangible challenge for the insurance industry.

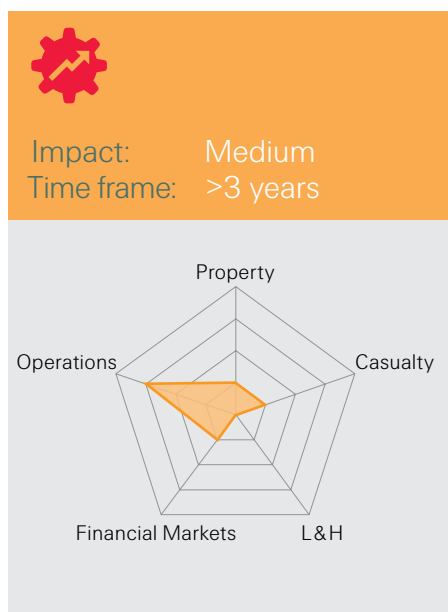
#### Potential impact:

- Immature or badly protected technology platforms are considerably exposed to cyber risks.
- Badly implemented FinTech solutions leading to failures and losses may trigger liability claims by consumers, savers and investors.

<sup>33</sup> EY (2016), <http://tinyurl.com/j7kbka6>



## Technological and natural environment



### Blockchain risks

#### Description:

The blockchain, best known as the technology that underpins the Bitcoin cryptocurrency, is a distributed ledger technology to certify ownership and verify transactions, streamline processes, facilitate verification, or share approval. It can be used to govern access rights in an interconnected environment, secure ownership titles in land registers, and trace and validate the origins of critical goods, such as precious stones.<sup>34</sup>

Also in financial services, many opportunities have been spotted for the blockchain.<sup>35</sup> The European Central Bank and NASDAQ, the second largest stock exchange in the US, are contemplating to use the blockchain technology for multiple applications.<sup>36</sup> World-wide banking infrastructure costs could be reduced by USD 15–20 billion per year by 2022.<sup>37</sup> In the insurance world, SafeShare, a London-based start-up, offers a blockchain-based insurance product aimed at the sharing economy.<sup>38</sup>

The blockchain could revolutionise industries where heavy documentation is needed, including the insurance sector where it could challenge the traditional underwriting value chain thanks to its potential for efficiency. As it could foster “an entire machine-powered ecosystem of commerce”<sup>39</sup>, it will also raise questions of liability.

The blockchain remains vulnerable to cyber risks, though it seems very difficult to hack by conventional methods. In combination with encryption, it could also be used for criminal activities, such as remunerating hackers. Other challenges relate to the enormous amounts of computing power and energy which are used for applications such as bitcoin mining<sup>40</sup>, or to regulatory uncertainty. Regulators are seeing the blockchain as uncharted territory to be penetrated which could eventually result in over- or inadequate regulation, distorting and stifling the growth and application of the technology.

#### Potential impact:

- The blockchain may undermine underwriting and the insurance value chain and could thus pose a challenge to traditional market players.
- Reliance on the blockchain in many walks of life may increase the exposure to cyber risks.
- Early and ill-advised regulation, triggered by an effort to act early as well as to prevent the technology from becoming a safe haven for criminals, may have a deleterious effect on the growth and application of the technology.

<sup>34</sup> Everledger (2016), <http://tinyurl.com/hrrexkk>

<sup>35</sup> IIF (2015), <http://tinyurl.com/zx636xs>

<sup>36</sup> Finews.ch (2016), <http://tinyurl.com/gpej42d>, KPMG (2015), <http://tinyurl.com/h2ownp2>

<sup>37</sup> Oliver Wyman, Anthemis and Santander (2015), <http://tinyurl.com/ztv74qg>

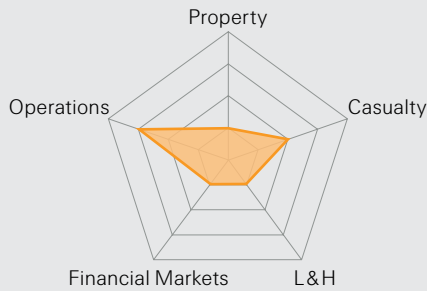
<sup>38</sup> SafeShare (2016), <http://tinyurl.com/h8hc4q9>

<sup>39</sup> Frank (2016), <http://tinyurl.com/jtuplwp>

<sup>40</sup> IIF (2015), <http://tinyurl.com/gm3z8o2>



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



## Phoney data

### Description:

The promise of Big Data and digital analytics is better risk assessment and more tailor-made products and coverages. But the resulting drive to generate ever more and ever larger data sets may lead to codification and “datification” of behaviours and natural phenomena that are methodologically elusive to such approaches, ultimately producing phoney data.<sup>41</sup>

Data integrity may become a problem for insurance companies collecting data on customers, for example via wearables, as there may be incentives to manipulate input in order to benefit from rate discounts or to escape regulation. Intrusion into sensors and apps and the manipulation of data will be amplified with the adoption of the Internet of Things (as described in the 2015 SONAR report). While the manipulation of sensors is not always easy, many of today’s data-collecting devices still have significant security gaps and enable skilled malefactors to tamper with the data.

Phoney data could undermine some of the benefits of Big Data. This is further exacerbated by expectations such as that insights from Big Data will come “automatically” to the analyst and that research designs and hypotheses are no longer necessary in this bright new data world.<sup>42</sup>

### Potential impact:

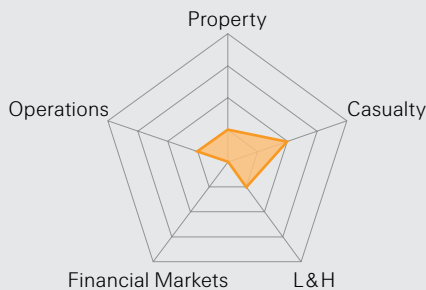
- Using manipulated or phoney data sets for insurance modelling may result in mispriced risks and unexpected claims.
- Data manipulation could exacerbate insurance fraud.

<sup>41</sup> Harford (2014), <http://tinyurl.com/ov7zedh>

<sup>42</sup> Harford (2014), <http://tinyurl.com/ov7zedh>



Impact: Low  
Time frame: 0–3 years



## Digital identities

### Description:

Thanks to social media, billions of people now have digital identities. As employers are increasingly recruiting through social networks and insurance companies may soon start vetting applications through “google checks”, the integrity and accuracy of such digital identities, which are very vulnerable to attacks and hacking, becomes paramount.

A large number of apps are already using and sharing personal data. Wearable sensors may soon add personal and health data to online profiles in real-time, resulting in a treasure chest of personal digital data. Hackers and other cybercriminals are busy exploring how they could tap into the potentially highly profitable market of stealing and selling digital identities, and the number of attempts to breach data of individuals, companies and governmental institutions has grown together with our increasing reliance on digital tools.

### Potential impact:

- Insurance lines that rely on personal data (eg health, life) are strongly exposed to manipulations of digital identities. Due diligence in data collection and investments in strong data protection will drive up costs for insurance companies.
- Restoring digital identities after a loss could involve costly legal battles which could have an impact on legal fees paid by insurance companies.



## Emerging trend spotlight | Gamification

Gamification is the application of game-based techniques, thinking and mechanics to non-game environments. Enabled by digitalisation, gamification is already used by many companies to strengthen customer relations, and foster cooperation and innovation.

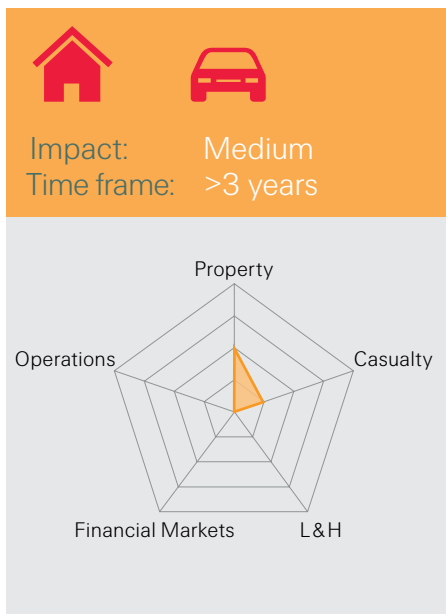
Gamification ranges from playful entertainment to more serious contents and purposes, and it is spreading fast also in business contexts. Enriched by the use of compelling stories and/or attractive design, gamification is based on mankind’s natural desire for competition, success and reward. Brand messages are delivered through incentives such as the chance to get a special price, a high score, or reach the next level in a game.

Gamification creates communities, offers ways to collect useful data, and can foster a healthy spirit of competition. The insurance industry is adopting it to strengthen customer relationships and encourage healthy behaviours.<sup>43</sup> Complex topics such as contingency planning or product choice in life insurance can be better explained through game-like apps. A recent survey has shown that there is significant consumer interest in games that help people to better understand their risks and insurance needs.<sup>44</sup> Games can also improve safety management by providing real-time simulations of risky situations and allowing people to ‘experience’ the consequences of certain decisions.

However, gamification may also produce unwanted negative effects, such as super-competitiveness and incentives to tamper and manipulate data – be it to “win” at any cost or to conceal poor performance or irregularities, for instance with health apps. The insurance industry could also face a reputation risk if the effects of super-competitiveness become detrimental to people’s health, for example by leading to exhaustion or extreme weight loss among participants who used wearables and other sensors as part of an insurance gamified program.

<sup>43</sup> See *The Perils of Man* for an example of a game sponsored by Swiss Re as part of its 150-year anniversary to playfully provide insights into the world of risk, particularly for a younger audience: <http://tinyurl.com/j78mraw>

<sup>44</sup> Swiss Re (2015), sigma 6/2015 – Life insurance in the digital age, <http://tinyurl.com/j6nmalo>



## Distributed energy generation

### Description:

Distributed energy consists of a range of smaller-scale and modular devices designed to provide electricity in locations close to consumers.<sup>45</sup> This includes fossil and renewable energy technologies such as photovoltaic arrays, wind, combustion and steam turbines, as well as energy storage devices such as batteries and flywheels or combined heat and power systems.

In a distributed energy set-up, millions of households will develop from consumers-only into energy producers. This will have far-reaching implications for our whole energy system, especially for power grids.<sup>46</sup> Traditional radial distribution systems have to transform into multi-source systems, which poses challenges for their maintenance and coordination.<sup>47</sup>

For many countries, small-scale autonomous energy production could help to reduce dependencies on foreign energy supply. Many African countries, for instance, are expected to leapfrog the industrialised countries and move straight from a no energy to a distributed energy set-up.<sup>48</sup> This is supported by initiatives such as the Africa-EU Renewable Energy Cooperation Programme which supports the development of markets for renewable energy in Africa.<sup>49</sup>

Reshaping the energy system from centralised to distributed production will not be without problems, with grid stability and power availability at peak hours being the main challenges. Smart solutions for energy storage, transmission and distribution will be key success factors, requiring significant investments and smart financing concepts.

### Potential impact:

- For re/insurers, the move towards distributed energy production could be an opportunity to contribute to de-risking the new technologies.
- Smart grids entail significant cyber risks which should be taken into account while underwriting them.
- Economic pressure on traditional utility companies might result in reduced maintenance of legacy large-scale operations which could increase property risk exposure.

<sup>45</sup> U.S. Department of Energy, <http://tinyurl.com/hbjze24>

<sup>46</sup> Swiss Re Centre for Global Dialogue (2012), *Fostering Infrastructure Resilience*, <http://tinyurl.com/gpmkbrk>

<sup>47</sup> Manditereza & Bansal (2016), *Renewable and Sustainable Energy Reviews* 58: 1457-1465

<sup>48</sup> World Resources Institute (2015), <http://tinyurl.com/ztfzmye>

<sup>49</sup> RECP, <http://tinyurl.com/hnkskmj>



## Emerging trend spotlight | Smart cities

Imagine a city where people can live and work and love and play without having to face the downsides of today's dense urban settlements. A city where traffic jam and air pollution are things of the past, where urban farms flourish and solar panels glitter in the morning sun. A city which caters to the needs of its citizens while reducing its environmental footprint. Imagine a smart city.

The concept is now very much in vogue, although it means different things to different people. Most smart city projects have a strong focus on developing and integrating new information and communication technology (ICT) solutions. These can be used to better manage the city's physical infrastructure, optimise resource use and improve safety. They can also enable cities to engage more effectively with their citizens and empower these to actively participate in shaping their living environment, ultimately making the city a more attractive place to live in.

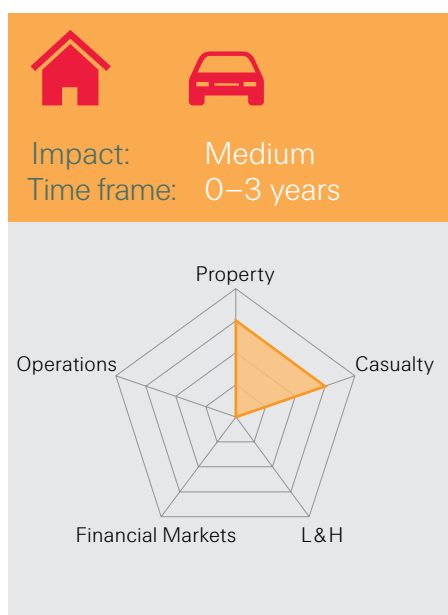
Smart cities represent a potentially massive new market for the private sector, and many companies are gearing up for the changes. However, there are some concerns about funding proprietary systems that would collect (and, depending on the set-up, perhaps even own) vast amounts of data on all facets of city life with public money. As a result, interest groups have started lobbying for using open-source collaborative technologies instead.

All the things that make a city smart also potentially enable the future city to be a vast arena of perfect and permanent surveillance by whomever has access to the data feeds. And what about the risks attached to power or internet blackout? What happens if something goes wrong with the operating system of the fully interconnected smart city of the future? Do we have a fall-back layer in place?

The insurance industry can play an important role in enabling smarter cities and reducing the associated risks. The complexity of ever more interconnected services, buildings and infrastructures increases vulnerabilities and exacerbates the size of potential losses. If disaster strikes, it is crucial that affected critical infrastructure is fixed immediately, which can only be done if sufficient liquidity is available. Insurance can provide the necessary financial back-up to help cities become more resilient – making them not only smart, but also strong.

Wastewater injection  
from hydrofracking may  
trigger earthquakes.





## Human-induced earthquakes: a new protection gap?

### Description:

Many regions around the world face a moderate level of seismic hazard without having experienced a recent earthquake (eg the mid-continental US and many parts of Latin America, Europe and Asia). This results in little awareness of earthquake risk, and earthquake insurance is deemed unnecessary by many – leading to a potential protection gap. This may be exacerbated by a rising number of earthquakes linked to human activities such as hydrofracking, enhanced geothermal systems and CO<sub>2</sub> sequestration.<sup>50</sup>

Oklahoma is a prominent case in point. The state has experienced an enormous increase in earthquake events since 2010, as documented by the United States Geological Survey.<sup>51</sup> There is strong evidence that these are caused by the hydrofracking industry.<sup>52</sup> The Oklahoma Geological Survey has determined that the majority of recent earthquakes in central and north-central Oklahoma are very likely triggered by the injection of wastewater into disposal wells. Other states such as Kansas, Texas and Ohio have also seen increased earthquake activity that has been linked to wastewater disposal.

As the increase in earthquake activity associated with man-made actions is a relatively new situation, most risk models used by the insurance industry do not incorporate the associated increase in seismic hazard. Losses arising from the rapidly rising number of human-induced seismic events are largely uninsured or fall into the deductible of traditional earthquake insurance products, which have been designed to protect against a total loss rather than damage arising from frequent small earthquakes.

### Potential impact:

- There is an increasing likelihood for litigation/class actions against hydrofracking operators, with significant accumulation risks for re/insurers when events trigger claims on the property and on the casualty side.

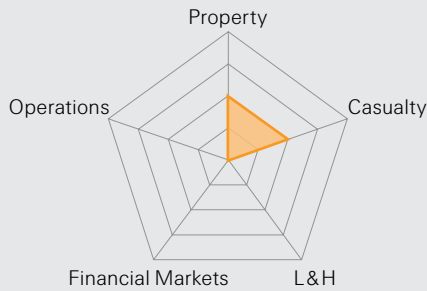
<sup>50</sup> U.S. Department of Energy, <http://tinyurl.com/zkqhczu>

<sup>51</sup> United States Geological Survey (2016), <http://tinyurl.com/p85cx48>

<sup>52</sup> Oklahoma Office Of The Secretary Of Energy & Environment (2016), <http://tinyurl.com/h7ahwz8>



Impact: Low  
Time frame: >3 years



## Seabed mining

### Description:

Seabed Mining (SBM) is an experimental industrial field focusing on extracting submerged minerals and deposits from the sea floor – be it by submerged robotic excavation machinery, large-scale vacuuming of the sea floor or other techniques. SBM has been hailed as a solution to ensure security of supply and fill a gap in the market where recycling is not possible or adequate, or where the burden on terrestrial mines is too great.<sup>53</sup> While interest in mining the seabed is not new, recent technological advances and increasing global demand for metals and rare earth elements may make it more economically viable in the near future.<sup>54</sup> There is also growing interest to explore Deep Sea Mining (DSM), which aims to retrieve deposits from seabeds deeper than 500 metres.

So far, the International Seabed Authority (ISA) – an autonomous international organisation which has been established following UN Conventions to organise and control human activities on the seabed outside of national jurisdictions – has granted 26 contracts to dig for minerals on the deep seabed since 2001. This encompasses approx. 1 million km<sup>2</sup> in the Pacific, Atlantic, and Indian Oceans in areas beyond national jurisdiction.<sup>55</sup>

Scientists and environmental groups are raising concerns about the potential impact of SBM and DSM on ecosystems that are very vulnerable to physical disturbance due to fragile habitats and extremely slow recovery rates. They are lobbying for an improved regulatory framework and the introduction of a network of marine protected areas which would be off-limits to mining.<sup>56</sup> This could have implications for the growth ambitions of the seabed mining industry.

### Potential impact:

- Property and liability exposures of seabed mining activities could be significant, but are hard to estimate due to lack of experience and a potentially shifting regulatory environment.

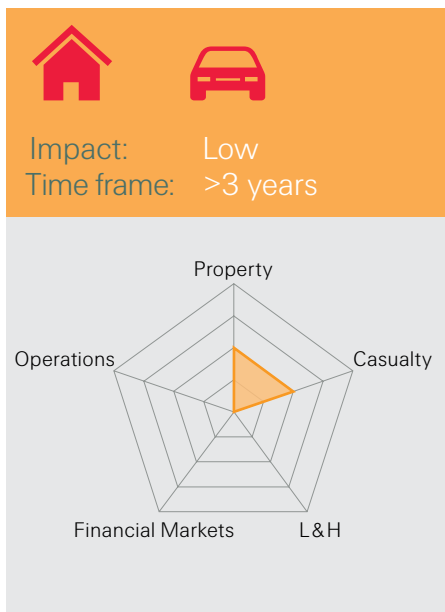
<sup>53</sup> European Commission (2016), <http://tinyurl.com/jlcpsdv>

<sup>54</sup> Wedding et al. (2015), Science 349: 144-145, <http://tinyurl.com/hr8cuf8>

<sup>55</sup> Wedding et al. (2015), Science 349: 144-145, <http://tinyurl.com/hr8cuf8>

<sup>56</sup> Greenpeace (2013), <http://tinyurl.com/jm8vlnh>





## Geoengineering

### Description:

Geoengineering is the deliberate large-scale intervention in the Earth's natural systems to counteract climate change.<sup>57</sup> It has been touted as a way to reduce global warming.

There is a wide range of possible techniques. Some focus on managing the amount and impact of solar radiation, while other focus on removing carbon dioxide from the atmosphere. Solar radiation management techniques include albedo enhancement to reflect more heat back into space, space reflectors to intercept sunlight before it reaches the earth, or stratospheric aerosols such as sulfates. Carbon dioxide removal techniques include afforestation, bioenergy with carbon capture and sequestration, or fertilising the oceans with iron particles to increase the uptake of CO<sub>2</sub> across the sea surface.<sup>58</sup>

Smaller-scale geoengineering such as flood protection is already common, and some large-scale geoengineering techniques are so inexpensive that an individual state, a company or even a person could potentially use them. However, public acceptance for large-scale geoengineering is currently very low, with various interest groups lobbying against its application.<sup>59</sup> This might change with a growing number of climate-change related extreme events. It could thus only be a question of time before someone starts to experiment with large-scale geoengineering – with intended as well as unintended consequences.

### Potential impact:

- Large-scale geoengineering has potentially huge liability exposures due to unintended side effects. However, it will be very difficult to establish whether a natural catastrophe stems from a man-made action or not, and it may even be impossible to establish liability in a legal sense.

<sup>57</sup> Oxford Geoengineering Programme (2016), <http://tinyurl.com/au6tf5u>

<sup>58</sup> Oxford Geoengineering Programme (2016), <http://tinyurl.com/au6tf5u>

<sup>59</sup> For instance <http://www.geoengineeringwatch.org> or <http://www.geoengineeringmonitor.org/>



## Emerging trend spotlight | Space race reloaded

The race for space has been refuelled. After a long downswing in national space programs following the end of the Cold War, aspirations of private innovators and investors are feeding a new space euphoria with concrete plans.

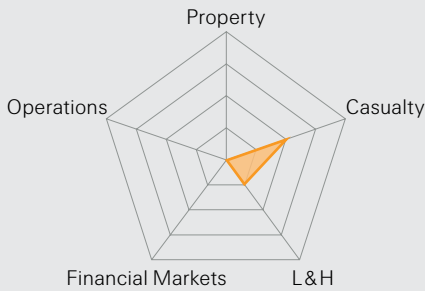
A number of famous entrepreneurs and private companies like Virgin Galactic or XCOR Aerospace are experimenting with spaceship services to provide recreational passenger spaceflight commercially. Players like those named above have expressed their intent to create a sub-orbital space tourism industry. While the new race for space among wealthy adventurers like Richard Branson is obvious, private companies are also beginning to express a strong interest, and national players are starting to take on an important and reinvigorated role. China, European conglomerates and others have enriched and diversified the field of international competition and collaboration in space endeavours.

While space tourism will most likely remain a niche market with limited potential, the related technical ability and entrepreneurial ambition opens a whole new era of space transport and logistics. Reusable rockets, as recently successfully tested by Elon Musk's SpaceX, might change satellite delivery. While the production of launch vehicles is and will remain very expensive, the safe landing and quick refuelling of the same vehicle can bring down the cost of one travel immensely.

The new space euphoria offers plenty of insurance opportunities – of which space tourism is probably only a minor one, as it has limited potential to scale. It seems likely that satellites will prove much more interesting for insurance than space tourists. But the new race for space is not so much about a particular destination (like Mars) or a particular form (like moon colonies, space stations or a mass market for satellites). It is about generally opening possibilities through technical innovation on the one hand, and about increasing cost-efficiency on the other. The recent success stories attest to both sides – and they indicate the advent of an ambitious new industry which is here to stay.



Impact: Low  
Time frame: 0–3 years



## Ocean pollution from microplastics

### Description:

Plastic pollution is ubiquitous throughout the marine environment. An estimated 4 to 12 million tons of plastic enter the ocean from land each year, and that number is predicted to increase exponentially by 2025 if we don't improve our waste management infrastructure.<sup>60</sup> Already now, it is estimated that more than 5 trillion plastic pieces weighing over 250,000 tons are afloat at sea.<sup>61</sup> It has even been claimed that there might soon be more plastic in the ocean than fish<sup>62</sup> – although the calculations underlying this statement have been contested.<sup>63</sup>

Marine pollution by larger plastic items was recognised as a key environmental issue several decades ago, and we have all seen the pictures of turtles entangled in plastic bags or birds that died from eating plastic debris. The challenges posed by microplastics, however, have only recently come to the awareness of a broader audience.

Microplastics are tiny pieces of plastic which find their way to the ocean when cosmetics products such as facial scrubs or toothpaste, which contain them as scrubbers and abrasive beads, wash down the drain or when larger plastic objects break down in the seawater. Due to their small size, microplastics are ingestible for a large number of small marine organisms. As these are then eaten by larger organisms, the microplastic particles start accumulating in the food chain and might ultimately reach our dinner plates. What's more, microplastics can bind a variety of undesirable chemicals on their surface through adsorption which will also be passed up the food chain.

As plastics do not break down for many decades, the amount of microplastic in the oceans will continue to increase. Given their ubiquity, it is not feasible to remove microplastics completely or even substantially. Instead, current efforts focus on reducing their intake. Environmental groups have started advocating for a ban on microplastics, and regulation is beginning to catch up. The United States, for instance, passed a bill in December 2015 which bans the use of microplastics in cosmetics from July 2017 onwards.<sup>64</sup> However, a truly global solution for this universal issue is not yet on the horizon.

### Potential impact:

- Increasing plastic pollution will likely have detrimental impacts on biodiversity and may ultimately result in a reduced amount of fish and seafood, further exacerbating food scarcity in many parts of the world.
- For the insurance industry, there could be implications for liability covers arising from (a) product liability for the manufacturers of microplastics and various products containing them, and (b) recall for polluted fish/seafood products.

<sup>60</sup> Jenna et al. (2015), Science 347, <http://tinyurl.com/z2w93e7>

<sup>61</sup> Eriksen et al. (2014), PLoS ONE 9(12), <http://tinyurl.com/oswhvb7>

<sup>62</sup> WEF (2016), [http://www3.weforum.org/docs/WEF\\_The\\_New\\_Plastics\\_Economy.pdf](http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf)

<sup>63</sup> Hornak (2016), <http://tinyurl.com/zuuhuvp>

<sup>64</sup> Schwartz (2015), <http://tinyurl.com/z9u9892>

Large plastic debris breaks into small pieces which put a strain on the marine environment.



## Conclusion

Risks by definition cannot be certain – they are just probable. Emerging risks carry even less certainty. Nevertheless, as an industry we are forced to look into the future and deal with tomorrow's challenges.

This publication is intended to raise awareness for what might lie ahead. Some of the emerging risk topics presented here may never materialise, but others definitely will. The earlier the re/insurance industry starts adapting to new risks, the better prepared it will be. It is within the responsibility of the readers to assess the potential impacts and decide upon necessary actions.

The topics highlighted in this report could also give rise to new opportunities. Given the breadth of the risk landscape, possibilities for solutions are vast, and the insurance industry could and should expand its role of mitigating risks. By providing re/insurance for new 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.

Working together and sharing knowledge across stakeholders can help the insurance industry to better prepare for and deal with emerging risks. We have launched this publication in this spirit and look forward to discussing further with you. Please reach out to your local Swiss Re contact if you wish to continue this dialogue. We are smarter together.

Continue the dialogue:

<https://openminds.swissre.com/stories/>

## 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 a dedicated 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 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 and have been assessed and edited by Swiss Re's emerging risk management experts. This report only features new emerging risk insights, and topics covered in previous editions are not listed again. You can retrieve prior reports from our webpage: <http://tinyurl.com/ny9zje2>

### 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:

<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

Spider graphs illustrate the potential impact on major business areas (Property, Casualty, Life & Health, Financial Markets, Operations) on a scale from 0 (= no impact) to 4 (= significant impact).

### What is meant by time frame?

We divide themes into those likely to occur in less than 3 years and those likely to occur 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.

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