THE GENEVA ASSOCIATION

INSURANCE FOR A BETTER WORLD

THE VALUE OF INSURANCE IN A CHANGING RISK LANDSCAPE

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The Geneva Association

The Geneva Association was created in 1973 and is the only global association of insurance companies; our members are insurance and reinsurance Chief Executive Officers (CEOs). Based on rigorous research conducted in collaboration with our members, academic institutions and multilateral organisations, our mission is to identify and investigate key trends that are likely to shape or impact the insurance industry in the future, highlighting what is at stake for the industry; develop recommendations for the industry and for policymakers; provide a platform to our members and other stakeholders to discuss these trends and recommendations; and reach out to global opinion leaders and influential organisations to highlight the positive contributions of insurance to better understanding risks and to building resilient and prosperous economies and societies, and thus a more sustainable world.

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Foreword

'Risk' is more than an ubiquitous term in insurance parlance. From car accidents to sickness, we all encounter – if not experience – the embodiment of risk every day. But risk is changing.

With the COVID-19 pandemic, we saw the manifestation of a global, systemic risk, affecting many people and businesses around the world at the same time. This brought to light a hard-but-important truth for the insurance industry and society: while insurance remains relevant for a broad range of risks, there are risks today which are too big – which cause financial losses too great – for insurers to bear alone. Unfortunately, the list of these types of risks is growing.

What does the future of insurance look like in a world with more widespread, interconnected and hard-to-predict risks? How should insurers respond to the growing prevalence of intangible risks, such as those linked to the rise of the digital economy? This year, as The Geneva Association marks its 50th anniversary, we set out to answer these questions through our research and an insurance customer survey.

This report explores specific risks that are already – or may prove – challenging to insure given their damage and loss potential and their unpredictability. Climate and cyber risks stand out. According to our survey, insurance customers do not take insurance in these areas for granted. They see an important role for governments in keeping insurance available and affordable.

More than 80% of respondents to our survey are interested in insurance offerings which go beyond traditional risk transfer, such as risk prevention services. However, only 30 – 50% of them take advantage of such services already. Insurers should proactively work to close this gap.

We also see significant opportunities for insurers to strengthen their profiles as promoters of sustainability: on the insurance side, by offering 'green products', such as coverage for electric or hydrogen vehicles, for example; on the investment side, with impact investing and by funding new climate technologies.

The takeaway for insurers is clear: their value proposition is changing because risk is changing. Insurance customers and society welcome a greater role for insurers than just paying claims, and there is promising evidence that insurers will fulfil those expectations.

Jad Ariss
Managing Director
The Geneva Association

Executive summary

The value proposition of insurance is evolving in response to the changing risk landscape and mounting challenges to insurability.

Today's economies and societies are facing a transformation of risk, which is reflected in many of the major events of the past few years. The COVID-19 pandemic was a major systemic shock, affecting most of humanity at the same time, with long-term implications for risk perception and management. A similarly unimaginable geopolitical shift was the return and long-term effects of war in Europe. Climate risks are also seemingly spiraling out of control, while public and private intangible assets and data are under increasing threat from cyberattacks.

This new global risk landscape is a significant test of insurers' capacity for financial loss absorption. Insurance companies are increasingly mindful of potential challenges to their traditional value proposition of risk transfer. This discussion has gained momentum in the context of an increasing gap between what stakeholders expect the industry to do and what it is technically able to do.

The new global risk landscape is changing dramatically, challenging insurers' capacity for financial loss absorption.

In order to explore this emerging gap, this report introduces a novel approach to representing and understanding risks that adds a dynamic perspective to the established conception of risk as a function of hazard, exposure and vulnerability. It views the risk landscape as a collection of all visible features of modern risks, such as sources, drivers, events and consequences. On that basis, we put the spotlight on a number of emerging risks which present challenges to insurability and traditional risk transfer, namely intangible and systemic risks. Examples of intangible risks include loss of reputation and general cyber risks such as data breaches. Systemic risks can arise with both tangible (e.g. climate change and cyberattacks on physical assets) and intangible characteristics (e.g. large-scale business interruption as a result of a pandemic). In the presence of systemicity, the fundamental mechanism of risk pooling and redistribution – spreading the losses of the few among the many unaffected by disaster – no longer works.

The gap between what stakeholders expect the insurance industry to do and what it is able to do is growing.

Against this backdrop, we investigate the traditional core of the insurance industry's customer and societal value – the absorption of financial risks – using a set of nine criteria of insurability, with actuarial, market and societal dimensions. For climate and cyber risks, for example, we identify major obstacles to insurability such as a lack of randomness and independence as well as highly problematic loss potentials. For intangible risks such as loss of reputation, key insurability challenges include information asymmetries and loss measurement.

In response to a changing risk landscape and mounting challenges to insurability, an increasing number of insurers are launching customer propositions that go beyond their traditional role of absorbing financial risk. Our report introduces three specific avenues for insurers to maintain or even expand their customer and societal relevance, in addition to their existing core role of absorbing financial risk:

- The provision of additional risk services, namely risk assessment, prediction, prevention, mitigation, assistance and education.
- The provision of dedicated risk and investment products which promote sustainable development.

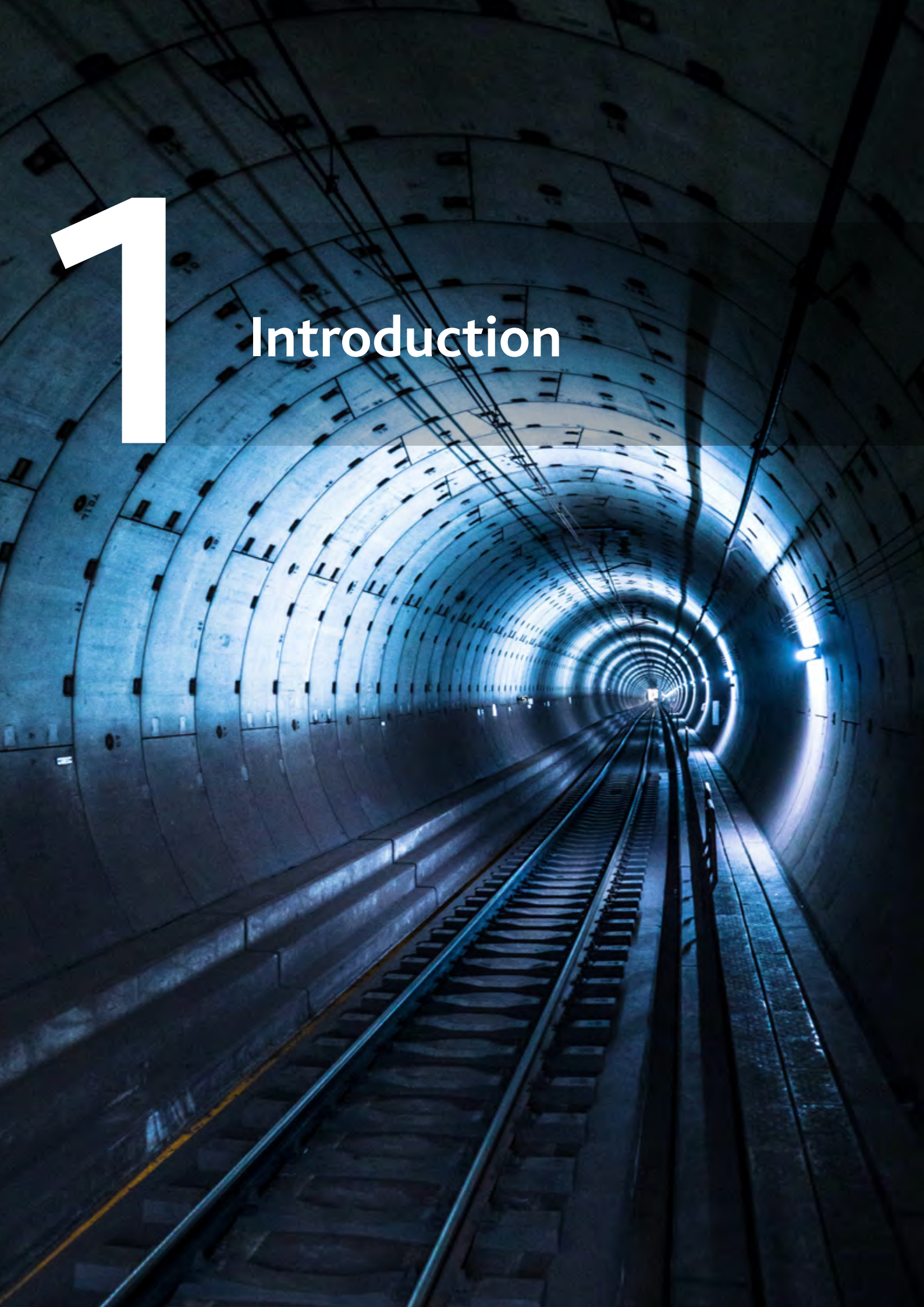
- Engagement in public-private partnerships (PPPs) which address the largest and most complex risks modern societies are facing.

Through these propositions, insurers can effectively leverage their unique capabilities such as risk expertise, strong relationships with insureds and investees as well as their long-term risk and Investment perspective. This strategic shift beyond traditional risk transfer allows insurers to contain the cost of risk and, as such, preserve insurability. It also responds to evolving customer expectations, enhances the overall customer experience and increases engagement.

To empirically substantiate the findings of this report, The Geneva Association commissioned a global customer survey, capturing the perspectives of both retail and commercial insurance buyers from the world's six largest insurance markets (the U.S., China, Japan, U.K., France and Germany).

The results confirm the relevance of the insurability debate. Both retail and commercial buyers express concerns about the future availability and affordability of certain types of cover, especially in areas such as longevity, natural catastrophe and commercial cyber and business liability risk. Most customers are in favour of PPPs aimed at promoting the availability and affordability of insurance. Regarding additional risk services, encouragingly, the difference between levels of actual usage (about 30–50%) and interest (more than 80%) suggests a certain potential for such services offered by insurers, especially in prevention and assistance.

Insurers can maintain or expand their societal relevance by providing additional risk services and products that promote sustainable development, and engaging in PPPs to address the most severe risks.



1 Introduction

Introduction

Environmental, geopolitical, economic and technological factors – and their interconnectivity – are transforming the global risk landscape.

While the second half of the 20th century was a period of relatively stable socio-economic development, the 21st century has so far involved elevated complexity, uncertainty and vulnerability due to geopolitical power shifts, rapid technological transformation, increasing interconnectivity and consequential dissemination of risk.[1] As early as 2003, the Organisation for Economic Co-operation and Development (OECD) highlighted the future importance of systemic risks[2] in the shape of interconnected global supply chains and climate change, for example.[3] Other, more recent examples include irreversible loss of biodiversity and essential ecosystem services as well as pandemics and antimicrobial resistance.[4] The expansion of intangible assets and their prevalence in today's digitalised societies is also driving up risk and uncertainty. While climate change exacerbates physical damage, the rise of intangible assets throws up new challenges and risks, such as the loss or destruction of data and reputational damage.[5]

Against this backdrop, societies are facing a transformation of risk which is reflected in many of the major events of the past few years and the overall risk sentiment emerging from recent surveys: a global pandemic that took more than two years to bring under control, an unimaginable geopolitical shock with the return of war in Europe, new macroeconomic realities (i.e. the return of inflation and the end of 'easy money') and a looming environmental crisis. In fact, climate action failure, cost-of-living crises, the erosion of social cohesion and the rapid ageing of populations have all been identified as the most relevant long-term risks with potentially systemic characteristics.[6] At the same time, public and private intangible assets and data are under increasing threat from cyberattacks.[7]

Protecting against large and global-scale tail risks is particularly challenging. It puts to the test both insurers' capacity for financial loss absorption and their risk assessment and quantification ability. Therefore, insurers have to be mindful of potential challenges to their traditional value proposition (i.e. financial risk absorption) for customers and society at large, a discussion that gained momentum in the context of pandemic risk and the increasing gap between what stakeholders expect the industry to do and what it is technically able to do.[8]

1 Rzevski 2015.
2 Defined as a risk that can result in the breakdown of entire systems as opposed to individual parts. Citi GPS and Cambridge Center for Risk Studies 2021.
3 OECD 2003.
4 Citi GPS and Cambridge Center for Risk Studies 2021.
5 The Geneva Association 2021a. Author: Darren Pain.
6 WEF 2022.
7 Lockton 2021.
8 The Economist 2020.

While the traditional risk transfer function will remain crucial, not least with necessary product innovation and continued growth of insurable physical risks, [9, 10] other areas such as risk assessment, risk prevention, risk education and risk sharing with the public sector will gain in prominence.

Against that backdrop, this report explores and classifies the key sources, drivers and consequences of the changing physical and non-physical risk landscape, investigates the implications for insurability and illuminates the evolving nature of the insurance industry's economic and societal value in the face of larger and different risks that increasingly defy the criteria of traditional risk transfer. Finally, we present the results of a global survey on customers' risk perceptions and their appetite for insurance services beyond claims payments.

These shifts require insurers to expand their services beyond risk absorption to include prevention, education and risk sharing.

9 Swiss Re (2022a), for instance, expects a more than USD 30 billion increase in commercial premium volumes from 2022–2026 as a result of supply chain reshoring. Also, if countries deliver on the renewable energy investment plans they have committed to so far, those investments are projected to generate additional energy-sector-related premiums of about USD 240 billion by 2035.

10 Over the past 10 years, non-life risk transfer has proven a 'growth business'. Premiums as a share of global GDP have increased from 3.4% to 4.0%. The role of life insurance, however, has eroded (from 3.5% to 2.8%), largely as a result of decreasing savings-type business, whereas risk business (covering biometrics) was more resilient (see Swiss Re 2023).

2 The changing risk landscape

The changing risk landscape

Many emerging risks are increasingly systemic and/or intangible in nature, which challenges the mechanism of risk pooling and redistribution at the core of insurance.

The economic and societal value of insurance is a function of the relevance of insurers' business models to the main risks that individuals, households and businesses are facing. Starting from this premise, this section examines the major changes to the risk landscape that have occurred since the beginning of the 21st century. As a first step, we introduce a novel approach to representing and understanding (emerging) risks and their dynamics. On that basis, we will zoom in on two risk shifts – and some of their concrete manifestations – which we consider particularly important for the future value of insurance, namely the growing prevalence of intangible and systemic risks.

2.1 A novel representation of emerging risks[11]

Several organisations develop lists of emerging risks,[12] analyse their possible causes, adverse consequences and contexts, and publish those analyses in widely read reports.[13] Lists, however, typically do not provide a structured, let alone dynamic, understanding of the distinct characteristics of emerging risks and their relationships. Therefore, we propose a different concept, which views the risk landscape as the dynamic collection of all visible features of modern risks. It is based on the established conception of risk as a combination of hazard, exposure and vulnerability[14] but offers an original dynamic perspective on risk by introducing the terminology of the International Organization for Standardization,[15] with 'hazard' being equivalent to 'risk source' and 'consequences' of a risk event being the result of exposure and vulnerability.

2.1.1 The dynamic components of risk

A risk exists in relation to something humans value. It affects human objectives that are either tangible (e.g. human lives, livelihoods, assets, supply chains) or intangible (e.g. reputation). In this spirit, the ISO defines risk as the effect of uncertainty on human objectives or a situation where objectives are threatened and where the outcome is uncertain. More specifically, risk has three components:[16]

1. **Sources:** Elements that alone or in combination have the potential to give rise to risk. Also called *hazards*, they are either natural phenomena (such as floods, earthquakes and viruses), or human activities and behaviours.

2. **Events:** The occurrence or change of a particular set of circumstances signalling the realisation of a risk source's potential for impact. Risk events may be physical, such as an accident, or non-physical, such as a data breach.

3. **Consequences:** The outcomes of risk events. Consequences depend on exposure and vulnerability, i.e. the propensity to be adversely impacted.

Risk is typically measured by the likelihood, i.e. the frequency of risk events, and the severity of the consequences. Both can change over time, which is why we also consider risk drivers, defined as contextual elements that, without causing risks,

11 This section is based on an unpublished paper, *Emerging Risks: Clouds on the Risk Landscape*, produced by Hélène Schernberg and Aleksandar Jovanović in 2023.

12 The International Risk Governance Council (IRGC 2010) defines an 'emerging' risk as a 'new, or a familiar risk in a new or unfamiliar context or under new context conditions'. Those risks are issues that are perceived to be potentially significant but that may not be fully understood and assessed. CRO Forum (2023) offers the following definition: 'Emerging risks are risks which may newly develop or which already exist and are continuously evolving. They are characterised by a high degree of uncertainty in terms of impacts and likelihood'.

13 For example, WEF 2023a; CRO Forum 2023. The latter is more specific to insurance.

14 An example: The consequences of a hazard (e.g. an earthquake) will depend on exposure (e.g. the location of people, buildings or factories) and vulnerability (e.g. a building with multiple floors may be more vulnerable to collapse than a one-story building). Kron 2005; United Nations Office for Disaster Risk Reduction (UNDRR) 2015.

15 ISO (n.d.).

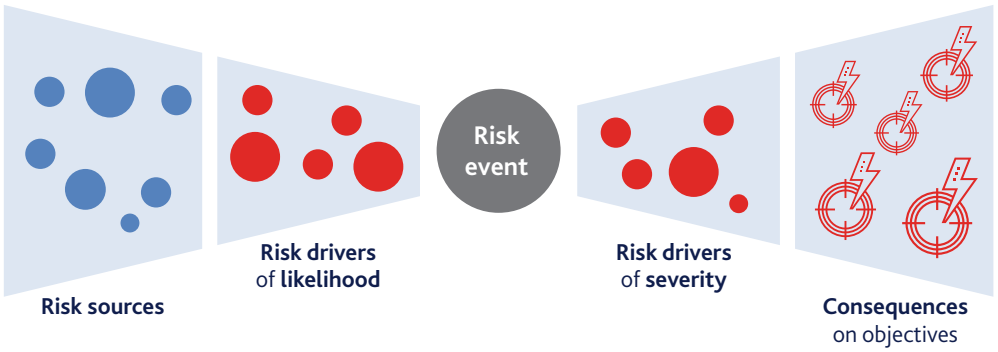
16 See ISO (n.d.).

Risks are typically measured by their likelihood of occurrence and the severity of their consequences, both of which can change over time.

affect their likelihood and/or severity. Risk drivers can include knowledge, complexity, social dynamics (e.g. technological innovation and diffusion, population dynamics or globalisation), environmental change, competing interests, values and religions, or inadequate risk governance and management.[17]

Figure 1 depicts the relationship between risk sources, events and consequences, and the influence of risk drivers relating to likelihood and severity.

FIGURE 1: THE DYNAMIC COMPONENTS OF EMERGING RISK



Source: ETH Risk Center

2.1.2 Representing the risk landscape

Based on these dynamic risk components, we provide a framework for representing risk as a set of shared features, based on four categories:

- Novelty of risks
- Changing characteristics of existing risks
- Knowledge gaps
- Governance issues

These four categories are divided into 10 subcategories. Each corresponds to a set of issues common to emerging risks, both in terms of their nature and context. These issues encompass risk sources, events, consequences and related risk drivers.

The subcategories were selected based on their potential for explaining the risk landscape in finer detail and, possibly, for predicting its evolution. While the resultant framework may contain overlaps and blurred boundaries, it offers the potential to improve existing taxonomies of emerging risks, the lack of which hinders risk communication (see Figure 2).

FIGURE 2: A NOVEL REPRESENTATION OF EMERGING RISK

Novelty of risks New risk sources New risk consequences	**Changing nature of existing risks** Frequency Severity
Knowledge gaps Complexity and connectedness Uncertainty and ambiguity Information and communication	**Governance of risks** Management of complexity Management of uncertainty Management of pace of change

Source: ETH Risk Center and The Geneva Association

17 IRGC 2010.

Category 1: Novelty of risks

The first aspect in this category is the novelty of risk sources. Most new sources of risk are man-made.[18] They often arise from innovation and progress (e.g. disruptive technologies), social and cultural dynamics (e.g. new lifestyle habits) or human impacts on the environment (e.g. the use of natural resources). For example, autonomous vehicles can trigger new liability risks.[19] In this context, the rate of emergence of new risk sources is an important consideration.

Most new sources of risk are man-made, arising from innovation and progress, social and cultural dynamics or human impacts on the environment.

The second aspect captures new risk consequences. As society evolves, so does the range of assets it values. In an increasingly virtual world, non-tangible assets such as digital data, intellectual property and online reputation have become increasingly significant – and vulnerable. An example of new risk consequences are natural disasters that can damage servers, data centres and communication networks, which can lead to loss of digital assets, data or communication services.

Category 2: Changing nature of existing risks

Existing risks can increase in frequency. For example, the number of data breaches in the U.S. reached an all-time high in 2021.[20] They can also increase in severity. This is especially true as humans transform the natural and man-made environment – including society itself, at an unprecedented scale – leading to growing exposures and vulnerabilities. For instance, urban areas are more vulnerable to heatwaves than other landscapes due to the urban heat island effect, which traps heat and exacerbates the effects of high temperatures. Even though air conditioning mitigates these risks, the consequences of heatwaves are becoming more severe due to increased urbanisation.[21]

Major drivers for such amplification include:

- Socio-economic and cultural changes (e.g. globalisation, technological innovation and diffusion, growing economic inequality, increased economic competition and search for efficiency).
- Population dynamics (e.g. population ageing, migration, urbanisation).
- Increasing environmental damage (e.g. deforestation, biodiversity loss).[22]

A powerful illustration of the effect of these risk drivers is the frequency of weather and climate-related disasters, which has multiplied by a factor of five in the past four decades.[23]

Category 3: Knowledge gaps

Knowledge-related risk drivers can also amplify emerging risks.[24] One example is complexity, which we define as the difficulty of establishing causal relationships among sources of risk, risk events and their consequences. For example, the emergence of a new disease can trigger risks such as the spread of misinformation, panic and hoarding behaviour, and the global-level breakdown of supply chains for essential goods and services. Based on current risk knowledge, these cascading effects are hard to measure and predict.

Another knowledge-related risk driver is uncertainty and ambiguity. While the former arises from the unreliability of scientific assumptions regarding the relationship between risk sources, risk events and consequences,[25] the latter is a reflection of social and political debates surrounding risks and their management. For example, there was significant uncertainty surrounding the COVID-19 virus at the onset of the pandemic, e.g. around its transmission mechanisms, fatality rate, economic losses (and their funding) and the effectiveness of different public health measures to control its spread. This uncertainty led to delays in implementing effective public health measures, such as social distancing and mask mandates, as policymakers and the public waited for more information to clarify the situation. Ambiguity is related to uncertainty and arises when stakeholders have divergent values, priorities, prior beliefs and assumptions. For instance, risks related to climate change have become a polarising issue, with some individuals prioritising immediate economic, social and political concerns over the long-term risks. Like uncertainty, ambiguity has the potential to delay risk management and precautionary measures.

18 IRGC 2010.
19 IRGC 2016.
20 ITRC 2022.
21 United States Environmental Protection Agency 2023.
22 IRGC 2010.
23 World Meteorological Organization 2021.
24 Renn 2020.
25 Ibid.

Knowledge-related risk drivers such as uneven distribution of information, poor communication and uncertainty can hinder risk assessment and management.

The uneven distribution of information among stakeholders can also hinder risk assessment, management and policymaking,[26] and poor communication can amplify the consequences of risks. This was demonstrated in the delayed response to Hurricane Katrina in 2005, when the lack of communication between responders contributed significantly to failures.[27] Another increasingly relevant aspect of information- and communication-related issues is the phenomenon of 'truth decay', i.e. the diminishing role of facts and analysis in public life.[28] This is a risk driver that can undermine public policy decisions and create cynicism and apathy on an unpredictable scale.

Category 4: Governance of risks

Governance is the process of dealing with emerging risks. As such, it is a major determinant of their consequences.

Many emerging risks are global, systemic and require the adoption of international approaches.[29] Yet, it is unclear whether global entities such as the World Health Organization (WHO) or the International Monetary Fund (IMF) and World Bank can singlehandedly deliver effective governance and leadership during pandemics and financial crises, respectively.

A lack of governance for the management of risk complexity makes it difficult to coordinate the response, allocate resources and ensure efficient delivery, particularly at the international and cross-sectoral levels.

The insufficient management of uncertainty is another governance-related risk driver. Uncertainty is either reducible or irreducible. Reducible uncertainty, by definition, can be addressed through further research and data acquisition. Irreducible uncertainty, on the other hand, cannot be resolved, or not within a relevant time frame. It is sometimes synonymous with 'deep uncertainty'.[30]

Any sound governance of uncertainty should promote the capture, dissemination and use of knowledge that serves to either reduce uncertainty or improve the management of deep uncertainty.[31]

A final governance-related risk driver is slow adaptation to change. Recent crises, during which some emerging risks materialised, show that many contemporary risks emerge at a higher, often unprecedented, speed than before. New regulation or international standards may take years to be agreed, published, implemented and enforced. Practically, this means that an emerging risk that materialises in a few weeks can remain without response for months or even years.

Risks often emerge more quickly than expected, while new regulation or international standards to address them may take years to develop and implement.

In conclusion, although it is impossible to predict the future, it is possible to monitor the factors that shape the current risk landscape and its insurable parts. For this purpose, we have introduced a novel framework for representing emerging risk as a dynamic, further development of the established view of risk as a combination of hazard, exposure and vulnerability. In this new framework, risk sources (hazards) trigger events which have consequences (as a result of both exposure and vulnerability). Another novel element is the consideration of dynamic risk drivers and their role in amplifying both risk sources and consequences. These risk drivers, therefore, can change hazards, exposures and vulnerabilities. Figure 3 summarises this novel representation of (emerging) risks.

26 IRGC 2010.
27 Chua et al. 2007.
28 See RAND Corporation (n.d.)
29 OECD 2003.
30 Walker et al. 2012.
31 Walker et al. 2003.

FIGURE 3: A NOVEL REPRESENTATION OF (EMERGING) RISKS

New risk sources	New risk consequences	Higher frequency of risk events	Worsening risk consequences	Higher risk complexity and connectedness	Higher risk uncertainty and ambiguity	Deficits in risk information and communication	Insufficient management of risk complexity	Insufficient management of risk uncertainty	Insufficient management of the pace of change
Novelty of risks		**Changing character of existing risks**		**Knowledge gaps**			**Governance of risks**		
Mostly man-made resulting from innovation and progress, social and cultural dynamics and human impacts on the environment	Associated with evolving range of valued assets and new exposures and vulnerabilities	As a result of socio-economic, environmental, demographic and technological changes	As a result of changing exposures and vulnerabilities	As a result of socio-economic, environmental, demographic and technological changes	Uncertainty about the relationship between risk sources, events and consequences challenges risk assessment (frequency and severity)	Uneven or biased distribution of information 'Truth decay' (diminishing role of facts and analysis)	Doubts about global governance and leadership (e.g. WHO) Lack of inter-disciplinary approaches	Lack of management of tractable unknowns	Under-estimation of speed at which risks emerge Disconnect between speed of emergence and speed of response
Examples Autonomous vehicles Social media International travel and trade	**Examples** Loss of digital assets due to natural disasters Cyberattacks compromising human lives	**Examples** Climate-related disasters Data breaches Infectious and chronic diseases	**Examples** Urbanisation: More severe consequences of heatwaves Floods causing more harm in densely populated areas	**Examples** A new disease can trigger misinforma-tion, panic and hoarding Mental health risks from social media	**Examples** Uncertainty about the coronavirus at the onset of the pandemic Divergent stakeholder beliefs (e.g. AI)	**Examples** Delayed response to Hurricane Katrina (2005) Politicisation of risks such as climate change	**Examples** Siloed thinking in climate change (atmospheric science, ecology, economics, sociology)	**Examples** Cure for cancer Food security Climate risk mitigation	**Examples** Computer-based spread of financial market volatility Disease spread enhanced by global travel

Source: ETH Risk Center and The Geneva Association

2.2 Digging deeper: Tangible, intangible and systemic risks[32]

Based on a connected and dynamic perspective on emerging risks, we can now explore specific tangible, intangible and systemic risks which have featured prominently in the academic, commercial and policy discourse on insurability over the past few years.[33]

For tangible risks, we chose, as examples, climate change, food and water shortages (existing risks with exacerbating features) and cyberattacks on physical assets such as infrastructure (a novel risk). For intangible risks, we consider well-known risks such as loss of reputation, socio-political instability and common cyber risks such as data breaches. In Table 1, these risks are characterised not only by their sources, consequences, frequency and severity but also their systemic character and interconnectivity.[34]

32 This section draws on bespoke research conducted for this report by Professor Alex Braun and Professor Martin Eling from the Institute of Insurance Economics, University of St. Gallen.

33 See section 3.

34 However, as shown in Figure 5, the distinction between tangible and intangible is not binary but a continuum. It is also important to note that emerging risks are often assessed based on expert judgment.

TABLE 1: CHARACTERISTICS OF EMERGING RISKS[35]

	Tangible risks			Intangible risks		
	Climate change	Food & water shortages	Cyberattacks on critical infrastructure	Loss of reputation	Socio-political instability	Common cyber risks
Examples of consequences	Rising sea levels, extreme weather events, warming-induced loss of biodiversity	Economic volatility, socio-political instability	Attacks on energy grids, e.g. power plants	Reputational damage amplified by real-time digital news diffusion	Boycotts, sanctions	Data breaches, ransomware attacks, distributed denial of service attacks
Frequency	Low but increasing	Low but increasing	Rather low	Rather low	Low but increasing	High
Severity	Potentially extreme; economic losses estimated at up to 23% of worldwide GDP until the end of the century	Potentially high; funding gap estimated at around USD 265 billion per year to preserve food security	Potentially high; difficult to estimate, only scenario analyses exist; potentially in the billions	Potentially high; difficult to estimate; firm-level estimates range between a loss of 1–3% in firm value per incident	Potentially high; difficult to estimate as consequences are largely indirect	Low; average cost of a data beach and ransomware attack estimated at around USD 4.5 million
Systemic character	Yes. Implications on entire eco- and economic systems	Yes. Particularly for developing countries	Yes. Attack on critical infrastructure can have implications for society and economic systems	Rather not	At the national level, implications for economic systems	Generally not. Particular cases have systemic consequences, e.g. if widespread software solutions are targeted or national intelligence information is breached
Interconnectedness	Yes, e.g. extreme weather can result in damage to critical infrastructure and decreased economic competitiveness	Yes, e.g. crop failure can result in socio-political instability	Yes, e.g. power outages or cloud outages can result in loss of firm reputation and damage economic competitiveness	Rather not, but spillover effects to related firms are possible, e.g. in same industry	At the national level, e.g. reduced economic competitiveness and loss of reputation	Yes, e.g. loss of reputation and competi-tiveness at the firm level. For systemic events, far-reaching complications include political instability

Source: Institute of Insurance Economics (University of St. Gallen) and The Geneva Association

2.2.1 Tangible risks

Climate change is arguably the biggest source and driver of risk of our time, with surging economic losses expected in the coming decades, including damages to property, infrastructure and crops as well as consequences for the life and health of millions of people around the globe.[36] Inherent to climate change is its continuous exacerbation, beyond impacts which are already irreversible at this point, with increasing levels of greenhouse gases in the atmosphere that will lead to more frequent and severe extreme weather events.[37] For 2022, Swiss Re estimated the global economic losses from natural catastrophes at around USD 270 billion, compared to insured losses of around USD 111 billion.[38] The report highlights

35 Pandemic risk is deliberately excluded (see The Geneva Association 2020a for an in-depth exploration). All figures in the table are referenced further in the section. Also, all assessments are made at the global level, i.e. they do not take into account geographical differences.
36 The Geneva Association 2016. Authors: Maryam Golnaraghi, Swenja Surminski and Kai-Uwe Schanz.
37 Mills and Lecomte 2005.
38 Swiss Re 2022b.

climate change as a particular driver of losses.[39] In the long-term, the global economy could face a reduction of up to 23% in GDP by the end of the century due to temperature impacts alone.[40] Climate change can also have second-order effects such as increased income inequality due to disproportionate impacts on low-income populations, e.g. in the U.S.[41] Climate change thus poses a systemic risk to entire ecosystems and economic systems.

Climate change is arguably the biggest source and driver of risk of our time. Its exacerbation is expected to result in more extreme weather events, food and water shortages, and increased income inequality.

Climate change also strongly affects food and water security. Increasing temperatures and dryness can lead to droughts and plagues of insects, which threaten crop harvesting. At the same time, intense agricultural methods can lead to reduced water tables and soil destruction.[42] This is particularly severe for developing countries where the population relies on local production.[43] The cost of preserving global food security at its current level is estimated at an enormous USD 265 billion per year, decomposed into USD 198 billion for investments in agriculture such as land development, machinery as well as plantation crops, and USD 67 billion for complementary social protection programmes, mainly in rural areas.[44]

Cyber risks to physical assets, in contrast to those such as data breaches and distributed denial-of-service (DDoS) attacks, are novel and tangible risks. The increasing interconnectedness of IT systems, including critical infrastructure such as electricity and cloud services, exposes physical installations to cyberattacks, with potentially significant consequences such as business interruption, cloud outages and, in an extreme event, blackouts. The latter can be considered systemic as they result in widespread harm to public safety, national security and economic systems. The increasing dependence of infrastructure systems on technology makes them ever more vulnerable to cyberattacks, with far-reaching impacts.[45]

2.2.2 Intangible risks

Loss of reputation is particularly difficult to estimate since it reflects events such as a breakdown of operations. Reputational risk is on the rise as ubiquitous digital connectivity leads to spread of word about negative corporate incidents in real time on a global scale, amplifying potential reputational losses.[46] Such losses after operational risk events have been estimated at around 1–3% of firm value.[47]

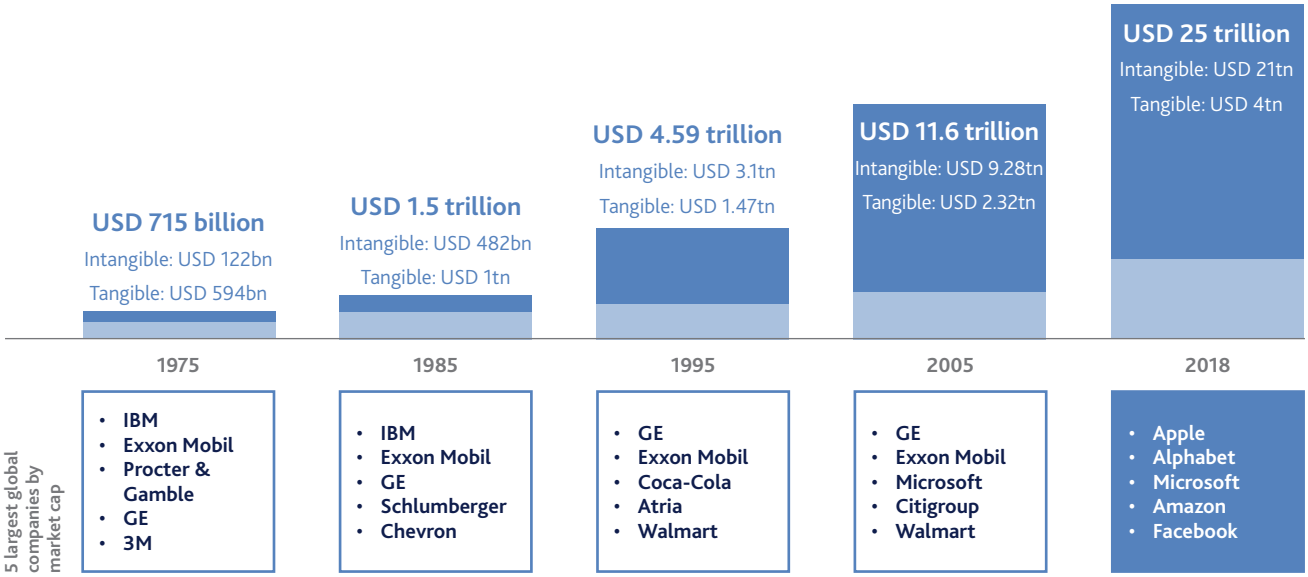
Socio-political instability is also increasing, as reported by the Institute for Economics and Peace (IEP).[48] The economic consequences are multi-faceted, ranging from boycotts and sanctions against specific companies, industries and countries to increased unemployment and severe recessions.

Common intangible cyber risks vary in type. They include data breaches, DDoS attacks and ransomware attacks. Differentiating between perils, IBM estimates the average cost of a data breach and ransomware attack at USD 4.3 million and USD 4.5 million, respectively.[49] At the aggregate level, McAfee and the Center for Strategic and International Studies estimate the global cost of cybercrime at USD 1 trillion annually.[50] This compares to estimated insured losses of as little as USD 7 billion.[51] Despite their enormous loss potential, these high-frequency, low-severity types of cyber risks are, in most cases, not systemic. Their severity can range from minor to catastrophic, depending on the nature of the cyber event and the type of information that is lost. However, the interconnectedness of technology, increasing reliance on data and information systems and global dependence on very few IT service providers (e.g. AWS, Azure, SAP) create the potential for systemic risk, e.g. if software vulnerabilities across industries and countries are exploited.[52]

39 Otto et al. 2023.
40 IPCC 2022.
41 Carleton and Greenstone 2021.
42 Pimentel 2006.
43 Thornton et al. 2011.
44 FAO, IFAD and WFP 2015.
45 Fell et al. 2022; The Geneva Association 2023a. Author: Darren Pain.
46 The Geneva Association 2021a.
47 Eckert and Gatzert 2017; Kamiya et al. 2021; Sturm 2013.
48 IEP 2023.
49 IBM 2022.
50 McAfee 2020.
51 Swiss Re 2021a.
52 The Geneva Association 2023a; Allianz 2020.

As an illustration of the rapidly changing intangible risk landscape, Figure 4 specifies the growing relevance of intangible assets, such as patents, brand value and customer data, using the S&P 500 as an example. Since the mid-1970s, the share of intangible assets in total S&P assets has increased from less than 20% to more than 80%.[53]

FIGURE 4: TANGIBLE VERSUS INTANGIBLE ASSETS FOR S&P 500 COMPANIES 1975–2018



Source: Aon[54]

2.2.3 The notion of systemic risk

Another major shift in risk characteristics that affects insurance and insurability is the increasing prevalence of systemic risk, both tangible and intangible.[55] We define systemic risks as those that have the potential to cause economic and societal losses that are sufficiently significant to result in the breakdown of an entire (economic) system. As opposed to diversifiable catastrophic risks (e.g. earthquakes and windstorms), systemic risks simultaneously impact such a large proportion of society, across multiple geographies and industries, that traditional risk transfer mechanisms through insurance typically break down.[56]

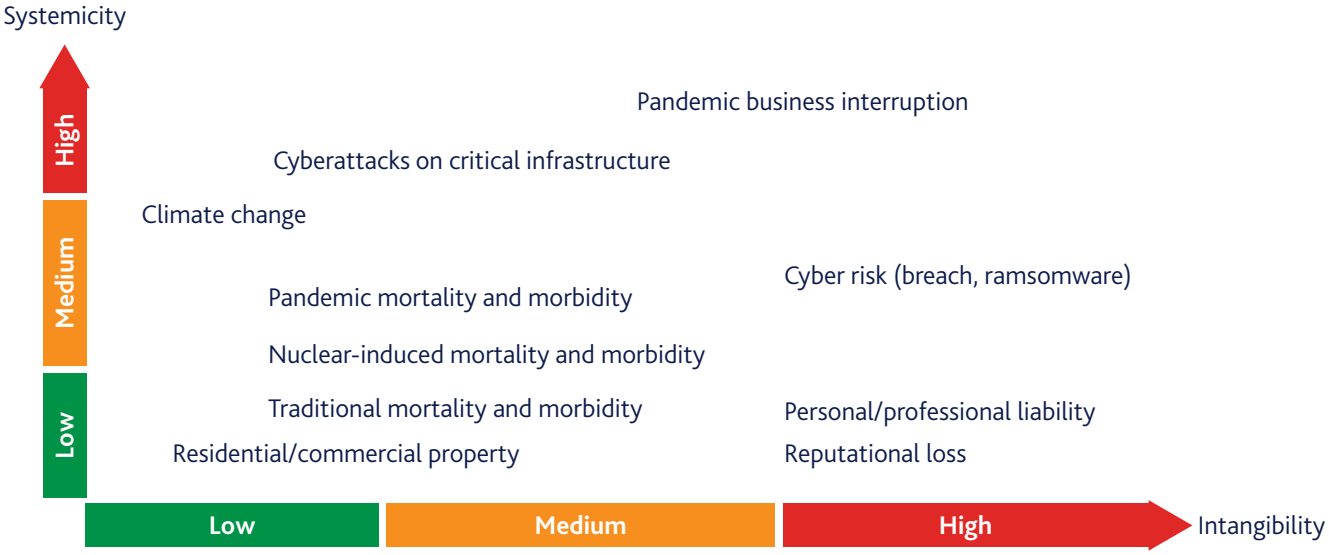
The world experienced systemic risk in 2020 when the COVID-19 pandemic impacted virtually all households and businesses simultaneously, over an extended period of time. The fundamental mechanism of risk pooling and redistribution – spreading the losses of the few among the many unaffected by disaster – no longer worked. This was true for business interruption insurance in particular, when the destabilising effects of the pandemic rippled through the entire economy. The simultaneous 'losses of the many' could no longer be diversified and mutualised across risk pools.[57]

Systemic risk is increasing in prevalence. As this simultaneously impacts large proportions of society, across multiple geographies and industries, traditional risk transfer mechanisms typically break down.

53 Aon 2019. It is important to note, however, the major differences between countries, for example between the U.S., with a share of intangible assets in total assets of listed companies of around 80%, and China, with a share of just 15%. See Brand Finance 2020.
54 Aon 2019.
55 It is worth emphasising that while the perception of systemic risk has increased over the past few years, most of these risks (e.g. pandemics, war, nuclear accidents) are not new. A genuinely new variation of systemic risk is cyber. Also, climate change is seen as increasingly systemic as its consequences are better understood.
56 Chartered Insurance Institute (CII) 2021.
57 The Geneva Association 2020a; Van Hulle 2020; Hartwig and Gordon 2020; Richter and Wilson 2020.

Figure 5 groups a number of insurable risks along the two dimensions of systemicity and intangibility. The lower left-hand area exhibits 'traditional' risks, which are tangible and well diversifiable. The other areas give examples of risks which are more challenging to insure, especially for property and casualty insurers.

FIGURE 5: THE INCREASING PREVALENCE OF SYSTEMIC AND INTANGIBLE RISKS



Source: The Geneva Association

3 Implications for insurability and risk transfer

Implications for insurability and risk transfer

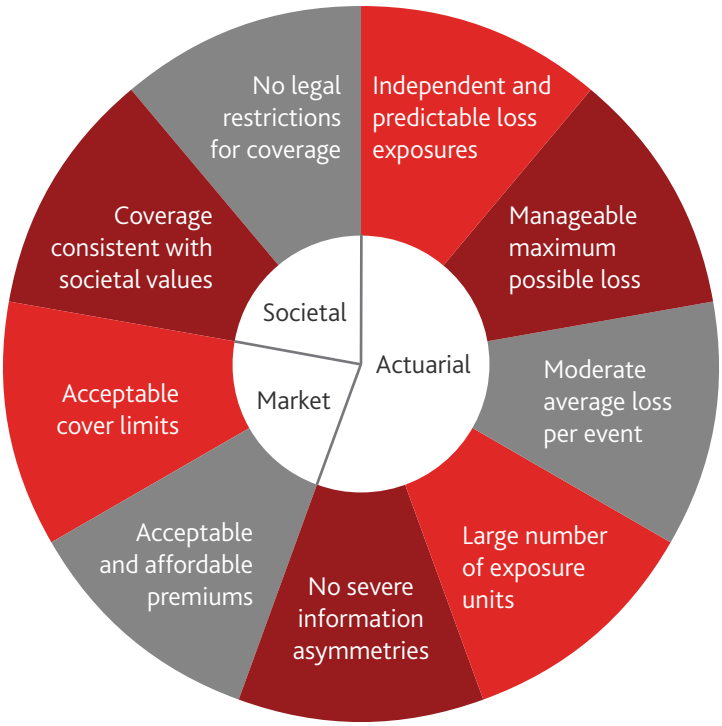
Climate and cyber risks present particular obstacles to insurability due to their lack of randomness and independence.

3.1 Applying the most common criteria of insurability

On the basis of the novel, overarching representation of emerging risk introduced in section 2.1 of this report and an analysis of evolving risk characteristics discussed in section 2.2, we can now investigate the traditional core of the insurance industry's customer and societal value – the insurability of risks.

The academic literature offers different sets of criteria for the insurability of risks. A widely used framework is that of Berliner,[58] who provides a compact set of nine criteria with actuarial, market and societal dimensions (see Figure 6 and Table 2). These criteria have already been applied to a wide range of insurance domains such as climate risk, cyber risk and pandemic risk.[59] Risks that fulfil all nine criteria are considered perfectly insurable in the commercial market.

FIGURE 6: THE FUNDAMENTAL CRITERIA OF INSURABILITY



Source: The Geneva Association, based on Berliner[60]

58 Berliner 1982.
59 Charpentier 2008; Biener et al. 2015; Eling and Lehmann 2018.
60 The Geneva Association 2020a; Berliner 1982.

1. **Randomness and independence of loss occurrence:** Losses should be uncorrelated and the insured should not be able to influence them through their actions. This criterion presents major challenges for all emerging risks discussed in this study. Even reputational losses associated with a particular firm can have spillover effects on related firms (as typically seen in banking crises, for example), implying stochastic dependence.

2. **Maximum possible loss:** The maximum loss should be manageable for the insurer. For example, cyber risks such as data breaches are limited in their overall loss potential, although some extreme events (such as WannaCry) have occurred. Cyberattacks on critical infrastructure such as nuclear plants or other energy systems, in contrast, are problematic in this respect.[61]

3. **Average loss per event:** The average loss per occurrence should be predictable and manageable. This allows the insurer to accurately estimate the expected cost of insuring the risk. For example, climate change can lead to extreme and less predictable and manageable losses per natural catastrophe if severity continues to increase under the current global warming trend.

4. **Number of exposure units:** The risk should be spread over a sufficiently large number of independent exposure units (i.e. policyholders), which can form an insurance pool. This reduces the variability of the loss experience. Cyberattacks on critical infrastructure, for example, are a risk with a limited number of units (e.g. nuclear power plants) and are therefore difficult to pool.

5. **Information asymmetries:** The insurer and the insured should have access to the same information about the risk. Information asymmetries lead to inaccurate risk assessment and adverse selection. For example, political instability in a country is a risk that both the insured and the insurer should be able to assess equally well. Other risks, such as loss of reputation, in contrast, might be prone to adverse selection as insureds tend to have superior knowledge of risk-relevant factors.

6. **Insurance premiums:** Insurance premiums should be both economically viable and reflect the expected cost of the risk. For example, insuring against the consequences of climate change is still viable in less exposed regions, but could become prohibitively expensive in high-risk areas, both in poor and rich countries.

7. **Cover limits:** The limits of the insurance coverage should be clearly defined at reasonable complexity. For example, reputational losses are ambiguous, imposing complexity on trigger design and cover limits. Smaller cyber losses from data breaches might be covered by existing policies, but large-scale attacks on critical infrastructure must be excluded.

8. **Public policy:** Coverage must be in accordance with public policy and societal values (e.g. does not promote criminal behaviour).

9. **Legal restrictions:** Coverage should be in accordance with current and future legal restrictions. For example, governments might change the legal framework and make insurance compulsory if the consequences of climate change become too extreme.[62]

Table 2 summarises the assessed insurability of select emerging risks, based on actuarial, market and societal considerations. We subsequently highlight the main limitations to insurability for each of the categories (described in Table 1).

61 The Geneva Association 2023a.

62 The first four criteria reflect the previously introduced concept of 'risk sources'. Randomness and independence, maximum possible loss, average loss per event and the number of exposure units all depend on the hazard (e.g. hurricane risk). 'Risk events' and 'risk consequences' describe the realisation of the risk (e.g. the occurrence of a hurricane) and its associated losses.

TABLE 2: INSURABILITY OF EMERGING RISKS

		Emerging risk					
		Climate change	Food and water shortages	Cyberattacks on critical infrastructure	Loss of reputation	Socio-political instability	Common cyber risks (data breaches, ransomware)
Criteria	Randomness and independence of loss occurrence	▲	▲	▲	■	▲	▲
	Maximum possible loss	▲	▲	▲	■	▲	●
	Average loss per event	▲	▲	■	●	■	●
	Number of independent exposure units	■	■	■	●	■	●
	Information asymmetries	●	■	■	▲	●	■
	Insurance premiums	■	■	■	■	■	■
	Cover limits	▲	▲	▲	■	■	■
	Public policy	●	●	●	●	■	●
	Legal restrictions	■	■	●	●	■	●

▲ Highly problematic ■ Potentially problematic ● Unproblematic

Source: Institute of Insurance Economics (University of St. Gallen) and The Geneva Association

The literature on climate change acknowledges insurability challenges, particularly due to huge and increasing losses (both single and accumulated), limits to diversification due to geographical correlation, the need for policy limits and deductibles, and potentially prohibitive insurance pricing.[63] These challenges can also extend to crop insurance, with implications for food and water security.[64] Insurability requires that loss potentials can be quantified, which is possible for risks such as crop failure and damage to physical assets, but very difficult for others (e.g. loss of biodiversity). In addition, increasing loss frequency and severity can lead to premiums which are no longer affordable.[65] This might prompt government intervention, potentially leaving insurers with the choice of offering coverage at predefined conditions or exiting the market for property catastrophe insurance altogether, as recently witnessed in the state of California.[66] Alternatively, governments can engage in partnerships with insurers, aimed at preserving insurability and promoting risk prevention and mitigation.[67]

Some insurability challenges associated with climate change extend to food and water security. Partnerships with governments may be required in this area to preserve insurability and promote risk mitigation.

The biggest obstacle to the insurability of cyber risk is the stochastic dependence of the losses, which challenges diversification through risk pooling.[68] Catastrophic cyberattacks on critical infrastructure could be associated with maximum possible losses that go far beyond the risk-bearing capacity of the global insurance industry.[69]

63 Charpentier 2008; McKinsey 2020.
64 Mills et al. 2005. Lloyd's (2023b) offers a systemic risk scenario that models the global economic impact of extreme weather events leading to food and water shocks, with an estimated economic loss of USD 5 trillion over a five-year period.
65 Schäfer et al. 2019.
66 Evans 2023.
67 See section 4.3 of this report.
68 Biener et al. 2015.
69 Lloyd's (2023a) offers a systemic risk scenario that models the global economic impact of a hypothetical yet plausible cyberattack on a major financial services payments system, resulting in economic losses of USD 3.5 trillion over a five-year period.

In addition, cyber risk typically suffers from a lack of data for reliable risk quantification. It is also a dynamic, man-made risk that changes with the behaviour of cyber criminals and the cyber risk competencies of attacked firms. Other obstacles to insurability include moral hazard and adverse selection, i.e. reduced incentives for cyber risk prevention once coverage is in place, and a stronger demand for insurance among firms with a high exposure to cyber risk. These issues can be partially mitigated through deductibles and risk assessments but are exacerbated by the fast-evolving nature of cyber risk. Difficulties also arise when defining exclusions which require a clear differentiation between state-sponsored attacks and terrorist attacks.[70] In combination, these factors impose high uncertainty on potential cyber risk policies, hindering insurability, driving up premiums and slowing cyber insurance market growth.[71]

For reputational risk, testing the insurability criteria is particularly difficult. This type of risk is a direct consequence of a variety of primary events, raising questions about the independence of the loss occurrences. For example, a major data breach in a company may not only result in a financial loss but also damage its reputation. Another concern is spillover effects on the reputation of firms in the same industry or on those with similar business models. The biggest obstacles to the insurability of reputational risks, however, are:

- Asymmetric distribution of information, typically in favour of the insured,[72] which can give rise to adverse selection and moral hazard and would need to be mitigated through deductibles or the exclusion of liability for misconduct.[73]

- Fundamental difficulties in loss prediction and loss measurement, particularly due to a lack of data and the generally ambiguous determination of the reputation loss.[74]

Similar issues arise for socio-political instability, a phenomenon which is typically neither random nor independent and can be associated with huge maximum possible losses due to its correlation characteristics. It can be partially addressed through political risk insurance, which can be broadly grouped into instruments for the protection of foreign direct investments and for international trade.[75]

3.2 The scope for innovative approaches to risk transfer

The previous section highlighted growing obstacles to insurability and suggests a strong need for insurers to think beyond financial risk absorption.[76] This section outlines a number of innovative approaches that could be used to enhance traditional risk transfer mechanisms.

3.2.1 Technological advancements

Technological advancements, such as richer datasets and sophisticated modelling, may improve the insurability of risks.[77] Internet of Things (IoT) sensors, for example, can provide real-time data on the health and performance of industrial and homeowners equipment, allowing for more accurate pricing of insurance.[78] Machine learning algorithms can analyse vast amounts of data to identify potential cyber threats, and help underwriters price cyber insurance policies.[79] Furthermore, new technology-enhanced risk transfer instruments, such as parametric insurance, can provide additional insurance capacity for natural catastrophes; in these cases, the payout is determined based on physical parameter values, such as wind speed, rainfall levels or number of days above a certain temperature, rather than an insured loss.[80]

Technological advancements may improve the insurability of risks. Machine learning algorithms can analyse vast amounts of data to identify potential cyber threats and help underwriters price cyber insurance policies.

70 The Geneva Association 2021b. Authors: Rachel Anne Carter and Julian Enoizi.
71 OECD 2020; The Geneva Association 2023a.
72 Desai 2011.
73 Gatzert et al. 2016.
74 Ibid.
75 Braun and Fischer 2018.
76 See section 4 of this report.
77 Swiss Re 2017.
78 The Geneva Association 2021c. Authors: Isabelle Flückiger and Matteo Carbone; Aggarwal et al. 2021.
79 The Geneva Association 2023a; Subroto and Apriyana 2019.
80 Braun 2016.

3.2.2 Alternative capital

The capital markets are often described as the natural bearer of large-scale risks. For the past 25 years or so they have provided insurance capacity, primarily in the form of insurance-linked securities (ILS). If traditional re/insurance capital is at the capacity limit, such alternative capital can increase insurability. ILS provide an additional risk transfer channel for the insurance industry, allowing insurers to take on more risk and provide more insurance coverage to households and businesses. This is particularly important for complex and large-scale risks, such as those posed by climate change, which can be difficult to insure through traditional means.[81] At the end of 2022, alternative investments contributed to global re/insurance capacity in the amount of USD 96 billion, mainly for property catastrophe risks.[82] This compares with uninsured natural catastrophe losses in the same year of about USD 150 billion.[83] More recently, the market has been expanding to cyber risk, albeit at a small scale.[84]

Despite the potential of alternative capital to narrow protection gaps, there are challenges. A lack of reliable risk models is a persistent issue, especially for risks that depend on dynamic human behaviour, such as cyber or liability. In addition, investors prefer risks that are uncorrelated to other asset classes. Hence, alternative capital will likely not be able to address the largest and most systemic events such as large-scale cyberattacks.[85]

81 Braun et al. 2019.
82 Gallagher Re 2023.
83 Munich Re 2023.
84 Fitch 2023.
85 Braun et al. 2019.

4 The need to think beyond risk transfer

The need to think beyond risk transfer

In response to the changing nature of risks and challenges to insurability, many insurers are expanding their propositions to go beyond risk transfer.

An increasing number of insurers have been launching customer propositions that go beyond their traditional role of absorbing financial risk. A changing risk landscape and mounting challenges to insurability, as discussed in the previous sections, are among the main reasons. This strategic shift reflects the need to contain the cost of risk and, as such, contribute to maintaining insurability.[86] In addition, new propositions are needed to meet changing customer expectations and enhance the overall customer experience and engagement.[87]

The following section discusses three specific avenues for insurers to maintain or even expand their customer and societal relevance in a changing risk environment.

4.1 Providing a broader spectrum of risk services

4.1.1 Risk assessment

Risk assessment is at the core of insurers' ability to absorb financial risk. It is employed to appraise and analyse the hazards, exposures and vulnerabilities linked with insurance policies. As discussed in the previous section, risk assessment is particularly important and challenging in the context of intangible and systemic risks.

In the contemporary risk landscape, the role of data is set to be pivotal. A prominent example is climate change, an issue that will require a concerted effort between insurers, insureds, non-industry experts and policymakers to be effectively addressed.[88] Insurers will be expected to complement their traditional value proposition of risk transfer with risk assessment services that support disaster resilience,[89] such as informing corporate customers' decision-making with scenario analysis tools that capture both physical and transition risk and build on a combination of qualitative and quantitative risk assessment approaches.[90]

Similarly, when it comes to cyber risk, the significance of risk assessment services cannot be overstated. For insurers, these services are a key driver of product value, allowing for the evaluation of customers' cybersecurity preparedness and posture and the development of customised risk management strategies to protect digital assets and privacy.[91]

Business interruption risk is a further example. Through improved risk assessment, insurers can help companies quantify exposures and set up sensible safety margins, build continuity plans and create a culture of risk awareness.[92] Risk assessment tools are also finding increasing application in the area of innovative dynamic products, which are designed to continually adapt to the ever-evolving circumstances and needs of customers.[93] In this context, proactive risk assessment procedures take centre stage to provide customers with adaptive products, for example in health insurance, which reflect changes in lifestyle and behaviour.[94] This data-driven and dynamic

86 Insurers can act as 'governance' entities by demanding the adoption of precautionary measures, such as staff trainings on cybersecurity, implementation of cybersecurity standards and safety protocols. Eling and Schnell 2016.
87 See section 5 and the results of the Geneva Association global customer survey, which confirm concerns about the future availability and affordability of cover.
88 Lyubchich et al. 2019.
89 Courbage and Golnaraghi 2022.
90 The Geneva Association 2021d. Author: Maryam Golnaraghi.
91 Bartolini et al. 2019.
92 Marsh 2018.
93 McKinsey 2021.
94 Pnevmatikakis et al. 2021.

risk assessment approach will not only be the prerequisite for offering innovative risk transfer products but may also provide the basis for standalone services provided to insurance customers.[95]

4.1.2 Risk prediction

Based on ever more sophisticated risk assessment procedures, risk prediction services, frequently outsourced to specialised vendors, play an increasingly important role in the insurance industry. These services encompass a range of modelling and computational procedures that aim to estimate the likelihood of a risk materialising and its potential impact in a specific location. Once again, data forms the backbone of this process, with historical data, patterns and trends scrutinised to construct robust models and predictive analytics.

Risk prediction services use a range of data to estimate the likelihood of a risk materialising and its impact. This helps insurers make more precise decisions on pricing, underwriting and risk management strategies.

Based on informed predictions, insurers can make more precise decisions concerning pricing, underwriting and risk management strategies than with traditional lengthy processes that rely on complex actuarial formulae.[96] More important in the context of this report, customers can benefit directly from risk prediction services, for example through improved personal safety[97] or healthcare usage as well as predictive services which help foresee worsening health conditions.[98]

4.1.3 Risk prevention

Risk prevention is a service that derives from both risk assessment and prediction. While risk prediction is almost purely theoretical and based on modelling, prevention entails all activities (in collaboration with the customer) that effectively reduce the likelihood of a risk materialising. Insurers can play a meaningful role for their customers in this respect, e.g. by promoting healthier lifestyles and safer behaviours through wellness initiatives that have been found to be effective in preventing chronic diseases.[99] This role, however, is dependent on a conducive legal framework, for example for 'pay-as-you-live' pricing in health insurance.

One of the standout innovations in risk prevention is telematics-based insurance. For instance, 'pay-how-you-drive' policies have resulted in a 50% reduction in fatal accident risk.[100] Health outreach programmes targeting at-risk clients, which have led to a 20% decrease in doctor and emergency room visits, provide another example.[101]

With access to real-time data and a direct connection to policyholders, the insurance industry can assume a prominent role in developing risk prevention tools and strategies, foster safer practices, minimise damages and ultimately enhance their value proposition both at the customer and societal levels. Additionally, insurers have a vested interest in helping their customers avoid risks through prevention services, which lower the cost of claims.[102] By actively engaging with customers and providers (e.g. car manufacturers and hospitals) and promoting measures that prevent risks, insurers contribute to a safer and more secure environment for society at large, generating a positive externality.[103, 104]

4.1.4 Risk mitigation

Risk mitigation encompasses various approaches designed to reduce or minimise the potential negative impacts of a risk on individuals, households and organisations.

Risk prevention tools allow insurers to foster safer practices, minimise damages and enhance their value proposition at the customer and societal levels.

95 Swiss Re 2020.
96 Moreover, the integration of learning algorithms and advancements in the field of artificial intelligence have further enhanced the quality of results obtained from risk prediction efforts. See Boodhun and Jayabalan 2018.
97 Frees 2014.
98 Deloitte 2019. Insurers also need to manage potential conflicts of interest and liability risks associated with predictive services.
99 Angeles et al. 2021.
100 Reimers and Shiller 2019.
101 David et al. 2019.
102 Sølvsten 2022.
103 The Geneva Association 2022a. Author: Kai-Uwe Schanz.
104 See section 5 and the results of the Geneva Association global customer survey, which finds significant interest in reward programmes and health risk prevention services among retail customers. Small and medium-sized enterprise (SME) commercial customers prioritise property loss prevention, employee health prevention and post-event assistance services.

While insurance coverage remains the most relevant form of risk mitigation, insurers, based on their risk expertise, can offer a wide spectrum of additional mitigation services, for example supporting customers in designing and implementing emergency response and disaster recovery plans involving build-back-better policies to increase resilience,[105] or business continuity plans adapted to the specific needs of a company, including regular data backups and auditing sessions.[106]

Although the underlying risks remain, thanks to these services policyholders are in a better position to minimise losses and bounce back more quickly.[107] Combined with risk assessment and prevention services, insurers can offer interested customers a comprehensive risk management proposition.[108]

4.1.5 Risk assistance

Insurers have long offered a variety of risk assistance services to support policyholders following a covered loss event. The spectrum ranges from round-the-clock claims reporting and support services, emergency response coordination (e.g. arranging for immediate repairs), incident-related travel assistance to support in recovering from identity theft incidents, supply chain assistance through support in finding alternative suppliers or continuous support during natural disasters.[109, 110]

The benefits for customers are obvious and include timely support and access to experts and resources, resulting in less stress and enhanced peace of mind during challenging times.[111]

For insurers as well, offering post-event assistance services makes much sense. Such services can foster customer loyalty and satisfaction, help establish a unique selling proposition in competitive markets based on tangible and practical support beyond claims payments as well as reduce claims costs by pointing customers to trusted providers (e.g. repair shops).[112]

4.1.6 Risk education

Financial literacy has been identified as a crucial driving factor of risk awareness[113] and insurance penetration.[114] However, while financial literacy is essential, it may not inherently imply an understanding or clear explanations of insurance concepts. To address this, insurers can offer educational services that increase people's awareness of general and specific risks and provide guidance on policy interpretation. Through those initiatives, insurers can enable customers to apply risk knowledge to insurance decision-making.[115]

In addition, by promoting and facilitating the dissemination of knowledge, insurers contribute to reducing costs and risks for both themselves and their customers.[116, 117]

Figure 7 summarises the spectrum of risk services discussed in this section and offers specific examples.

Educational services that increase people's risk awareness and provide guidance on policy interpretation can reduce risks and costs for both insurers and their customers.

105 Hofmann 2022.
106 Gardener 2008.
107 Kousky 2019.
108 Surminski and Hudson 2017.
109 NAIC 2017.
110 MarkLogic and Marketforce 2019.
111 Alex Research 2017.
112 Bain & Co. 2023.
113 Stoian et al. 2021.
114 The Geneva Association 2022b. Authors: Dennis Noordhoek, Bill Marcoux and Kai-Uwe Schanz.
115 Lin et al. 2019. In order to minimise externalities (i.e. free-riding competitors), collaborative endeavors with other insurers and stakeholders might also be worth considering.
116 Carter 2012.
117 The Geneva Association global customer survey found that customers' awareness of and interest in risk education services is still comparatively low compared to other services offered by insurers (see section 5 for details).

FIGURE 7: RISK SERVICES BEYOND RISK TRANSFER

Risk assessment	Risk prediction	Risk prevention	Risk mitigation	Risk assistance
• Climate and cyber risk assessment for customers' scenario analyses	• Frequency and severity prediction models for accurate pricing	• Promotion of healthier lifestyles and safer behaviours through wellness initiatives	• Supporting customers in designing and implementing emergency responses, also for uninsurable/ difficult-to-insure risks (e.g. pandemic business interruption)	• Less post-event stress and enhanced peace of mind for customers
• Business interruption risk assessment for customers' exposure and safety management	• Health prediction services for foreseeing worsening health conditions	• Reduction of hospitalisation risk through telematics-based insurance	• Supporting customers in developing business continuity plans	• Promotion of improved customer risk management through post-event risk consultancy

Risk education

- Improved risk mitigation as a result of financial and insurance literacy initiatives
- More effective utilisation of healthcare and preventive services and overall claims reduction on the back of improved risk literacy

Source: The Geneva Association

In conclusion, while the foundational service provided by the insurance industry is, and is likely to remain, that of risk absorption, the fast-changing risk landscape requires strategic and operational agility and flexibility from insurers. These capabilities are needed to contain the rising cost of risk, push the limits of insurability and meet evolving customer needs.[118]

4.2 Promoting sustainable development

Another important source of additional or new customer and societal value for insurers is to specifically promote sustainable development through dedicated risk and investment solutions. Given their risk management expertise, strong relationships with insureds and investees as well as long-term risk and investment perspectives, insurers are in a unique position to promote sustainability and build socio-economic resilience for individuals, households, businesses and even governments.

Insurers are in a unique position to promote sustainability and build resilience through their risk management expertise, customer relationships and long-term risk and investment perspectives.

Sustainable insurance can therefore be understood as 'improving resilience through sustaining and enhancing access, affordability and insurability, reducing risks and exposures through risk management, innovation, prevention, as well as investing in green and robust assets'.[119]

Adopting a value chain perspective, this section will explore this additional source of customer and societal value with a clear focus on insurers' distinct capabilities as risk takers, risk experts and long-term investors.

The discussion on insurers' sustainable investment products and activities is relatively advanced, not least as a result of a robust regulatory environment. The EU's Sustainable Finance Disclosure Regulation (SFDR), for example, offers a framework for such products and aims to improve transparency about their sustainability features. More specifically, the SFDR distinguishes between 'Article 8/ light green' investment products, which promote generic sustainability characteristics, and 'Article 9/dark green' products, which pursue specific and measurable sustainable investment objectives.[120]

118 However, a few downside considerations should not be ignored: additional risk services may be difficult to monetise (see section 5 of this report), associated with externalities (e.g. customer education which eventually benefits free-riding competitors) and subject to competition from other potential providers such as governments, car manufacturers or construction firms.
119 Gatzert et al. 2020.
120 Pugnetti et al. 2022.

While offering such products exposes insurers to the risk of greenwashing and associated reputational damage, not being able to provide them to customers could make insurers' investment propositions unattractive.[121, 122]

The most common approaches used by insurers to embed sustainability in their proprietary and third-party asset management operations include (see also Figure 8):

- ESG integration. An approach whereby 'asset managers complement traditional, quantitative techniques of analysing financial risk and return with qualitative and quantitative analyses of ESG [Environmental, Social, Governance] policies, performance, practices and impacts.'[123] This includes negative and positive/best-in-class screening.
- Active ownership. Engaging with investees with the objective of promoting more sustainable business practices and accompanying their green and just transition.[124]
- Impact investing, through which insurers intentionally pursue a specific and measurable sustainability impact at a financial return commensurate with the project's risk.[125]
- Sustainable savings products for life insurance customers which promote ESG characteristics or even pursue specific measurable sustainable investment objectives.[126]
- Funding of green or climate technologies.[127]
- Investments in sustainable infrastructure or promotion decarbonisation, climate resilience and age positivity for example.[128]

For risk products, specific regulations and reporting taxonomies are still in preparation. In the meantime, the United Nations Environment Programme Finance Initiative (UNEP FI) Principles for Sustainable Insurance (PSI) can serve as a global framework for sustainable product strategies in insurance. The PSI stipulate that sustainable insurance products should go beyond financial risk absorption and also incentivise policyholders to take risk-mitigating measures, thus helping to reduce risk and preserve long-term insurability.[129]

Figure 8 outlines the most common current sustainability-driven propositions along the insurance value chain. Approaches in product design and development include:

- New products that cater to a changing risk landscape, e.g. for cyber risk and post-retirement work.[130]
- Green products, e.g. coverage for electric and hydrogen vehicles, discounts for low- and zero-emission vehicles and for policyholders who repair rather than replace, and coverage for shared mobility.[131]
- Inclusive, 'essential value-based', 'no-frills' products that mitigate affordability issues.[132]
- Products which offer incentives for risk prevention and mitigation (e.g. pay as you live, pay as you drive, 'building back better')[133] and employ IoT (e.g. in homes, factories and cars).[134]

The most common sustainability-driven practices in underwriting[135] can be summarised as follows:

- Forward-looking, risk-based pricing, accounting for the increasing unsuitability of historical data for risk model calibration (e.g. climate change).[136]
- Risk-based pooling of major individual (e.g. accident) and social risks (e.g. longevity).[137]
- Risk transfer linked to (minimum) standards of resilience, e.g. in cyber insurance.[138]

121 Actuarial Association of Europe (AAE) 2023.
122 However, the Geneva Association global customer survey reveals that the relevance of dedicated sustainability propositions for customers' buying decisions is still limited (see section 5 of this report).
123 US Sustainable Investment Forum Foundation 2018.
124 PRI Association 2018.
125 The Geneva Association 2022a.
126 Pugnetti et al. 2022.
127 Eling 2022; The Geneva Association (forthcoming).
128 Carter 2020.
129 EIOPA 2022; Gatzert et al. 2020.
130 Eling 2022; The Geneva Association 2022c. Authors: Adrita Bhattacharya-Craven, Richard Jackson, Kai-Uwe Schanz.
131 Stricker et al. 2022.
132 The Geneva Association 2023a.
133 Gatzert et al. 2020; AAE 2023.
134 The Geneva Association 2021c.
135 Many of these activities can be regarded as 'business of usual' for insurers.
136 Herweijer et al. 2009.
137 Eling 2022.
138 Ibid.

- Impact underwriting. Consistent with actuarial, risk-based principles, insurers, as risk managers and underwriters, can make specific and measurable contributions to sustainable development by applying their data and risk expertise as well as their risk bearing capacity, e.g. in microinsurance.[139]

- Inclusive underwriting, with the objective of promoting insurability by assessing individual risk as accurately as possible and through the deployment of technological innovation to enhance the access or affordability of insurance for disadvantaged customer groups such as cancer survivors.[140]

How insurers handle claims is key to customers' perception of the value of insurance.[141] Embedding sustainable practices in this part of the value chain is, therefore, particularly important. Examples include:

- Services that assist customers in preventing the insured event from occurring, e.g. health prevention, chronic disease management, theft prevention systems (alarms, geolocation devices), combined with discounted rates.[142]

- Non-financial compensation or support that aims to restore the well-being of the customer, prior to the occurrence of the insured event, e.g. rehabilitation services.[143]

- Advisory and assistance services, aimed at reducing risk after the occurrence of the insured event (e.g. 'building back better').[144]

- Fraud detection measures to counteract illegitimate claims and prevent unnecessary rate increases to the detriment of honest policyholders.[145]

- Efficiency measures which enable faster, automated payouts based on remote sensing and parametric triggers, for example.[146]

FIGURE 8: SUSTAINABILITY-DRIVEN PROPOSITIONS ALONG THE INSURANCE VALUE CHAIN

Product design	Underwriting	Claims	Asset management
• New products (e.g. cyber, mobility, retirement) • Green products (e.g. electric vehicles) • Inclusive, 'essential value-based' products • Products which incentivise risk prevention and mitigation (e.g. pay as you live, pay as you drive, 'building back better')	• Forward-looking risk-based pricing (e.g. climate risk) • Risk-based pooling of major individual (e.g. accident) and social risks (e.g. longevity) • Risk transfer linked to (minimum) standards of resilience (e.g. cyber insurance) • Impact underwriting (e.g. microinsurance for small farmers) • Inclusive underwriting (e.g. insurance for cancer survivors)	• Services that assist customers in preventing the insured event from occurring (e.g. theft) • Non-financial compensation or support to restore the well-being of the customer pre-occurrence (e.g. rehabilitation) • Services to reduce risk post-occurrence (e.g. 'building back better') • Fraud detection measures to counteract illegitimate claims • Efficiency measures which enable faster, automated payouts	• ESG integration • Negative and positive/ best-in-class screening • Active ownership • Impact investing • Sustainable life insurance savings products • Funding of green or climate technologies • Investments in sustainable infrastructure (e.g. decarbonised, climate resilient, age appropriate)

Source: The Geneva Association

139 The Geneva Association 2022a.
140 SCOR 2020; AAE 2023.
141 The Geneva Association global customer survey highlights the importance of customer service (see section 5 for details).
142 AAE 2023; see also section 4.1.3 of this report.
143 Ibid.
144 Hofmann 2022.
145 Eling 2022.
146 WEF 2023.

In summary, by consciously integrating sustainability into their value chain, insurers can promote resilience and reduce risks beyond 'business as usual', for themselves, their customers and society at large.

4.3 Engaging in public-private partnerships

A third avenue for insurers to preserve their value in a changing risk landscape is to engage in public-private partnerships (PPPs) which address the largest and most complex risks modern societies are facing and go beyond existing structures that address natural catastrophe and terrorism risks.

Most existing PPPs involving insurance leverage government intervention to improve the insurability of catastrophe risks. 'Risks that can be insured need not be legislated; uninsurable risks, however, have to be dealt with by nation states'.[147] If a risk is not insurable on the insurance or extended financial market, typical PPPs cover different layers of the potential loss. The first layer is 'owned' by primary insurers, which receive premiums from the risk pool of insureds. This exposure is reinsured in the second layer up to a certain coverage limit. The third layer comprises government absorption of the excess losses.[148] Worldwide, there are more than 450 government-funded pool solutions in place.[149] They combine insurance sector capacity with sovereign funds. Most PPPs in insurance pursue a similar conceptual objective, which is 'to transform uninsured risk into insurance-based products'[150], based on a combination of insurance, reinsurance and finite government backstopping through premiums, levies or taxes.[151]

Public-private partnerships involving insurance and leveraging government intervention can improve the insurability of catastrophic risks.

This section, however, adopts a different perspective. Instead of viewing PPPs primarily as a means to facilitate financial risk absorption by insurers, we focus on structures that address large-scale and systemic risks which preclude or defy insurability, such as economic losses from pandemics, climate change or large-scale attacks on critical infrastructure.[152]

FIGURE 9: RISK TRANSFER UNDER PUBLIC-PRIVATE PARTNERSHIPS – APPROACHES AND EXAMPLES

Source: The Geneva Association

PPPs that cover systemic risks require an uncapped (or very high) government backstop.

In order to address systemic risks in a meaningful way, PPPs need to involve significant government funds. For some risks such as terrorism and natural disasters, a limited government backstop may be sufficient. For systemic risks, however, an uncapped (or very high) government backstop is critical if the PPP's objective is to harness the specific capabilities of the insurance industry. Governments need

147 Stahel 2003.
148 CII 2021.
149 AXA XL 2018.
150 Jarzabkowski et al. 2018.
151 CII 2021.
152 The Geneva Association 2021b; Nzuki 2021. See Chubb (2020) for a concrete proposal on a PPP to address pandemic business interruption.

to get involved as 'insurers of last resort' and could draw on insurers' potential and limited risk-bearing capacity but, and more important in the context of this report, also mobilise insurers' vital, non-risk-bearing contributions to risk preparedness and resilience building (e.g. through risk assessment, risk mitigation and claims management as discussed in sections 4.1 and 4.2).[153]

PPPs operate across the continuum illustrated in Figure 9, which ranges from enabling commercial risk transfer through redistributing risk among policyholders to replacing commercial risk transfer by removing extreme and volatile risk from the insurance market.

Enabling risk transfer refers to taking the risk of loss of a relatively small group of highly exposed policyholders and sharing it across the wider pool of variably exposed policyholders through a levy.[154] Low-risk policyholders pay a slightly higher premium than their actual risk in order to subsidise an affordable premium for those who are highly exposed to risk. Thus, the premiums of the many, widely distributed across possible exposures, can continue to cover the extreme losses of the few. However, they can only do so with some government legislation that enables a levy on lower-risk policyholders to subsidise higher-risk ones, as with Flood Re in the U.K., or through a non-profit government monopoly in which insurance is mandatory and offered at a fixed price, as with Cantonal Building Insurance in Switzerland.[155]

Complementing risk transfer constitutes some middle ground between enablement and replacement, for example by removing some elements of risk from the market while redistributing others, as with the Australian Reinsurance Pool Corporation.

Replacing risk transfer implies the removal of risk from the commercial insurance market onto the 'balance sheet' of the public sector. This approach is particularly suitable for risk that is seen as too volatile or extreme for the market to assume. In this scenario, insurance companies may accept premiums from insureds and issue and service their policies. However, they do not absorb any financial risk but pass the entire premium associated with the risk to a special vehicle which can then provide the cover because it has access to some limited or unlimited government guarantee to pay for losses, as with Pool Re in the U.K.[156]

In summary, PPPs play a valuable societal role besides financial risk absorption. Insurers can act as professional distributors and claims managers as well as experts in risk assessment and pricing (sending out important signals to society). By doing so, insurers contribute to societal risk mitigation and preparedness even in the face of (uninsurable) systemic risk.[157]

153 The Geneva Association 2021e.
154 Jarzabkowski et al. 2018.
155 Ibid.
156 Ibid.
157 The Geneva Association global customer survey demonstrates strong support for PPPs designed to promote the availability and affordability of cover, but not for the deployment of taxpayers' money (see section 5 for details).

5 The reality check – A global customer survey

The reality check – A global customer survey

Customers across the world's six largest insurance markets are concerned about the future availability and affordability of insurance and show appetite for products that will help to maintain insurability, such as preventive services.

In light of the momentous changes affecting the global risk landscape, understanding the perceptions and expectations of customers becomes pivotal for insurers to maintain and further extend their relevance.

The insurance industry has long been exclusively associated with the absorption of financial risk. However, as risks escalate in complexity, ranging from cyber threats to climate change, customers are increasingly looking for more than just a safety net. The global insurance industry has started to respond to what might become a paradigm shift, with customers seeking comprehensive coverage that not only transfers and mitigates risks but also encompasses services that lower risk in the first place.

Against this backdrop, The Geneva Association commissioned an online customer survey, capturing perspectives from the world's six largest insurance markets: the U.S., China, the U.K., Japan, France and Germany.[158] In each market, a sample of about 1,000 economically, regionally and demographically representative insurance policyholders were polled, approximately 900 retail customers and 100 commercial customers in total, representing companies with up to 250 employees. The survey was conducted in the second quarter of 2023.

By examining customers' current attitudes towards risk and insurance, their appetite for services beyond financial risk absorption and their future expectations towards the insurance industry, we hope to assist insurers in aligning their corporate strategies and business models with emerging risk trends and evolving customer preferences.

This section offers a comprehensive overview of the most relevant survey results. In a nutshell:

- The survey confirms the relevance of the insurability debate. Both retail and small commercial buyers of insurance express concerns about the future availability and affordability of certain types of cover, particularly in areas such as longevity, natural catastrophe and commercial cyber and business liability risk.
- Encouragingly, the difference between levels of actual usage (about 30–50%) and interest (more than 80%) suggests a sizeable potential for additional risk services, especially in prevention and assistance, warranting continued investments from insurers.
- The survey also reveals that among retail customers there is (still) a lack of awareness of dedicated sustainability and financial education services.
- For retail customers, price is the key determinant of buying decisions. SME customers prioritise insurers' ethical credentials rather than specifically designed or labelled sustainability initiatives. Going forward, price will play an even larger role for both segments. The survey also finds that the current and future role of additional risk services in influencing purchasing decisions appears to be limited.
- Retail and SME customers prefer personal, rather than virtual, interaction with their insurers. For insurers to continue to deliver value to their customers, this channel therefore needs to be sustained.
- Most customers are in favour of PPPs aimed at promoting the availability and affordability of insurance, as emphasised in this report. There is, however, no majority support for spending taxpayers' money, which, if representative of the electorate, would limit the scale and scope of such PPPs.

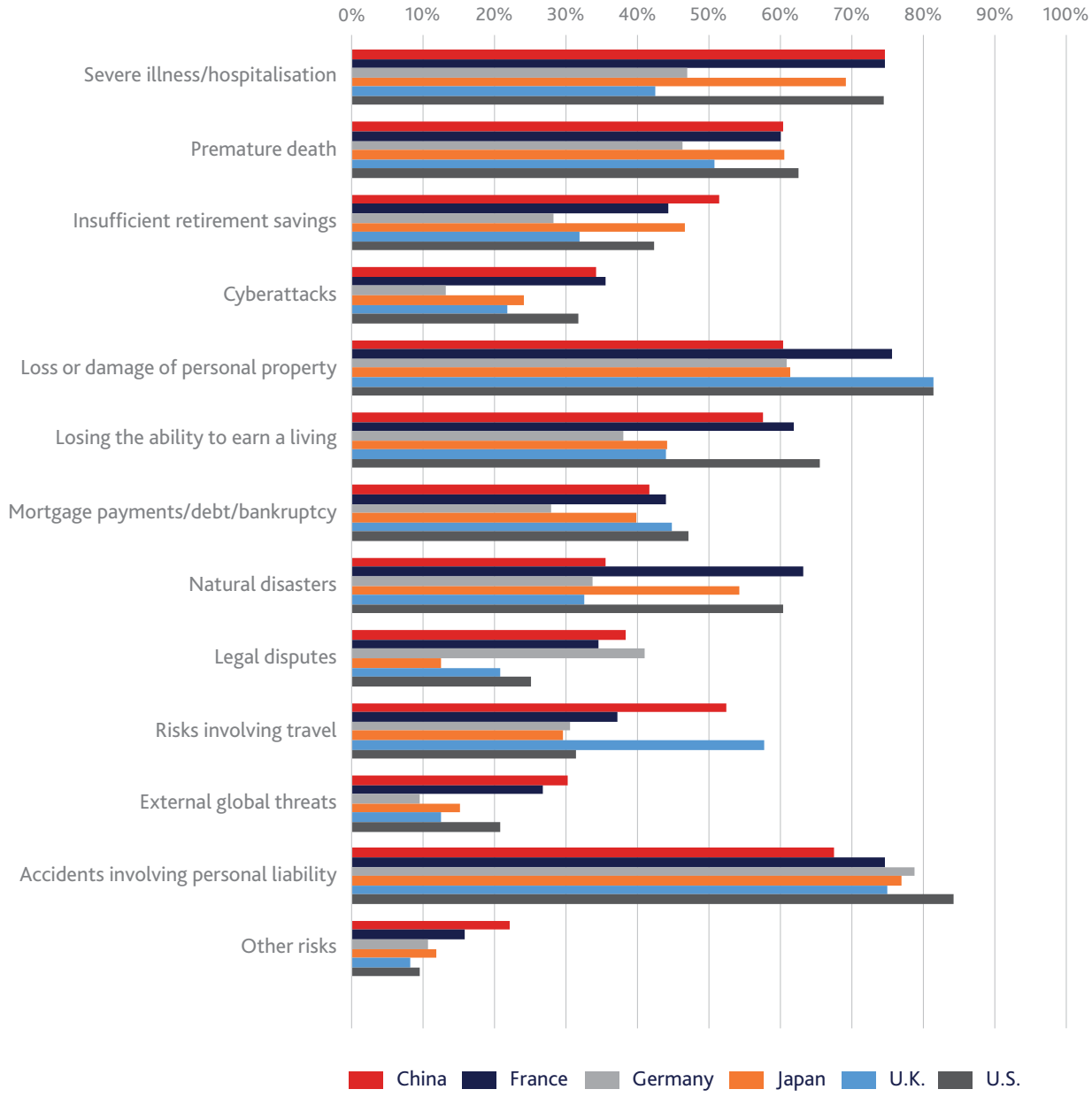
158 Swiss Re 2023.

5.1 The retail customer perspective

Figure 10 shows how approximately 5,400 global retail customers view the relevance of insurance in the context of specific risks (irrespective of their current insurance policies in place). Accidents involving personal liability (e.g. car accidents) are generally considered a risk for which insurance is deemed most useful by respondents (around 70–80%). In France, the U.K. and the U.S., property damage risk is also viewed as an area where insurance has an important role to play (more than 75% of respondents). The third most frequently mentioned risk is severe illness and hospitalisation, except for Germany and the U.K., where public healthcare is dominant. Insurance is deemed least relevant for external global threats.

FIGURE 10: THE RELEVANCE OF INSURANCE FOR SPECIFIC RISKS (RETAIL CUSTOMER PERSPECTIVE)

For which of the below risks, if any, would you consider insurance most necessary and useful for you personally or members of your household?

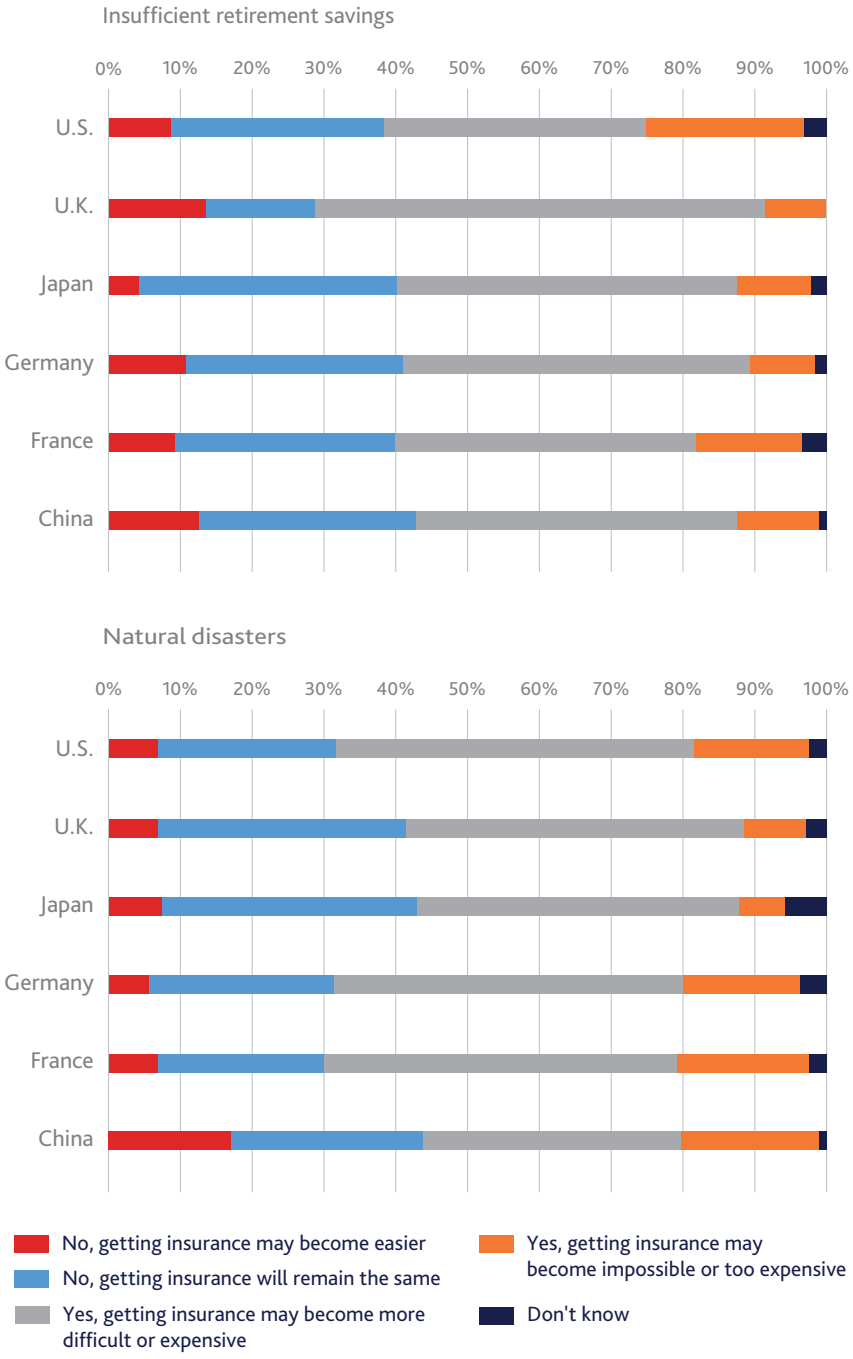


Source: The Geneva Association Global Customer Survey, powered by Dynata

The insurability of risks is a growing concern among retail respondents. Insufficient retirement savings and natural disasters rank highest, with more than 50% of respondents expressing concerns in all surveyed countries. In the U.K., about 70% of survey participants worry that longevity pension insurance may become more difficult (or even impossible) and expensive to obtain. In Germany, France and the U.S., a similar share of survey participants voices concerns about coverage for natural disasters (Figure 11).

FIGURE 11: CONCERNS ABOUT THE FUTURE INSURABILITY OF RISKS (RETAIL CUSTOMERS)

Are you concerned going forward that it may become more difficult or even impossible to get insurance for some of these risks?

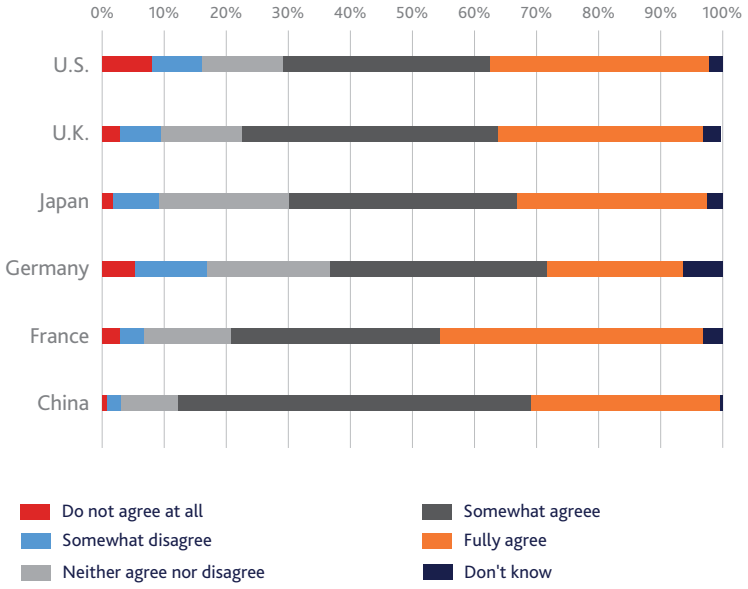


Source: The Geneva Association Global Customer Survey, powered by Dynata

The vast majority of retail insurance customers canvassed agree that their governments should collaborate more with insurers to make insurance products more affordable and available. Levels of agreement are highest in China, France and the U.K. (Figure 12).

FIGURE 12: IMPROVING INSURANCE AFFORDABILITY AND AVAILABILITY THROUGH GOVERNMENT-INSURER COLLABORATION (RETAIL CUSTOMER PERSPECTIVE)

Do you think that your government should collaborate more with insurers to make insurance products more affordable and available?

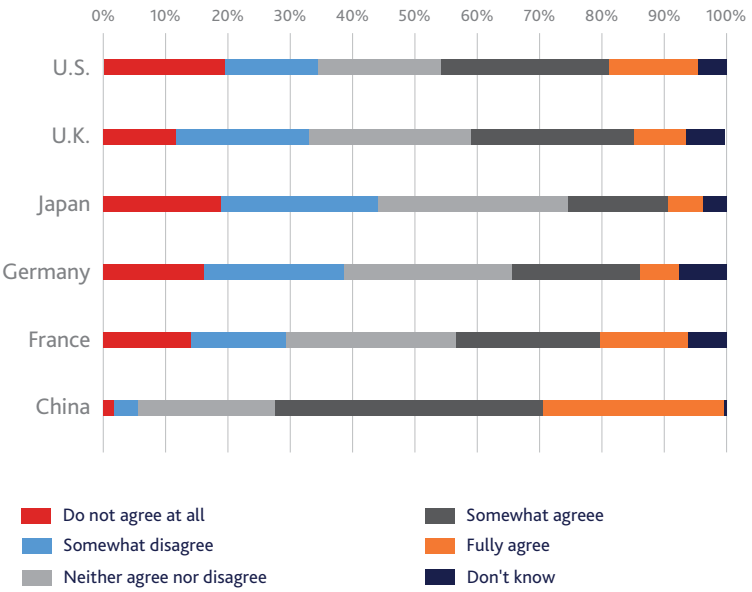


Source: The Geneva Association Global Customer Survey, powered by Dynata

When asked whether it would be appropriate for their governments to spend taxpayers' money to support such collaborations, a different picture emerges. China is the only country where the majority of respondents were in favour. Resistance is most pronounced in Japan, Germany and the U.S. (Figure 13).

FIGURE 13: USE OF TAXPAYERS' MONEY FOR GOVERNMENT-INSURER COLLABORATION (RETAIL CUSTOMER PERSPECTIVE)

Do you agree with your government spending taxpayers' money to support collaborations with insurers?



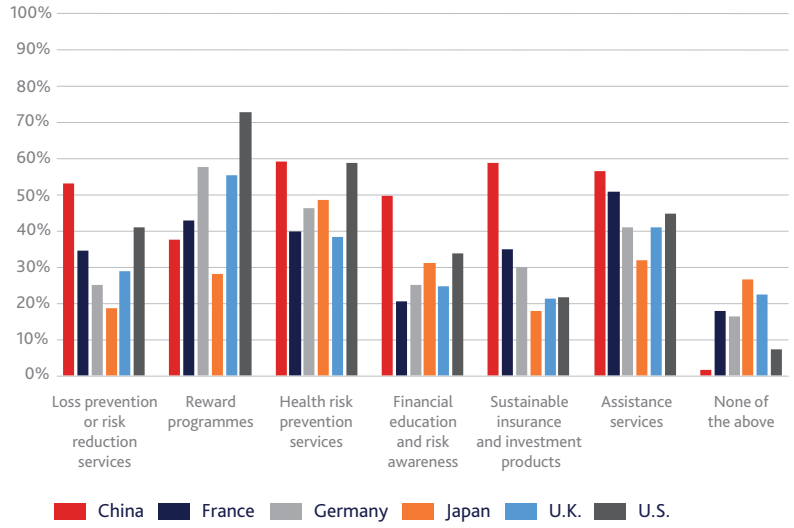
Source: The Geneva Association Global Customer Survey, powered by Dynata

In light of a changing risk landscape and growing challenges to insurability, one of the survey's main objectives was to explore customers' awareness of and appetite for insurance services that go beyond traditional risk transfer and financial loss absorption.

Reward programmes (e.g. safe driving rewards and wellness incentives), health risk prevention services (e.g. regular check-ups and screenings) and post-occurrence assistance services are best known to retail customers in most markets. The U.S. and China generally stand out. The lowest levels of awareness are recorded for specific sustainability-driven propositions as well as property loss prevention and financial education services (Figure 14).

FIGURE 14: AWARENESS OF INSURANCE SERVICES THAT GO BEYOND RISK TRANSFER (RETAIL CUSTOMERS)

Some insurers are offering services beyond paying claims. Of which of the below services have you heard of before?

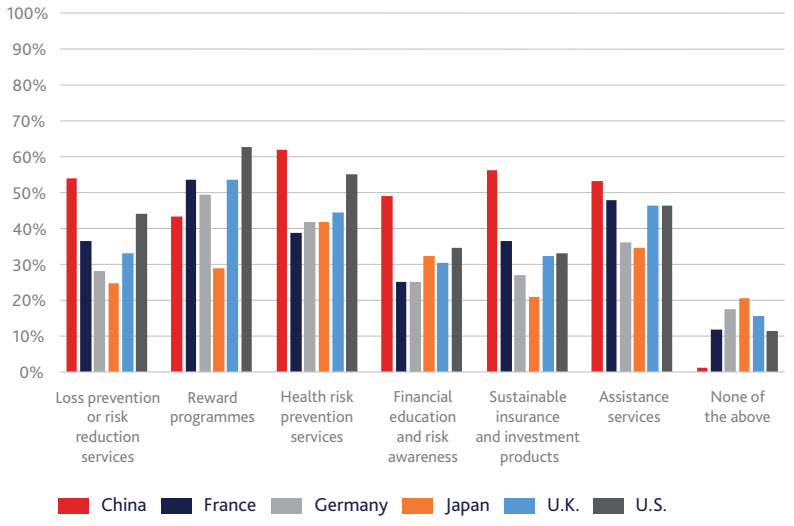


Source: The Geneva Association Global Customer Survey, powered by Dynata

Retail customers are most interested in health risk prevention services and assistance services, especially in China, with respondent shares of 50% or more. Reward programmes are of particular interest to U.S. respondents. In Japan and Germany, interest is lowest across most services. Figure 15 also reveals that there is relatively little appetite for financial education and sustainability-related services. Encouragingly, less than 20% (except for Japan) express no interest in any such services.

FIGURE 15: INTEREST IN INSURANCE SERVICES THAT GO BEYOND RISK TRANSFER (RETAIL CUSTOMERS)

Which of these services would you be interested in, if provided by your insurer?



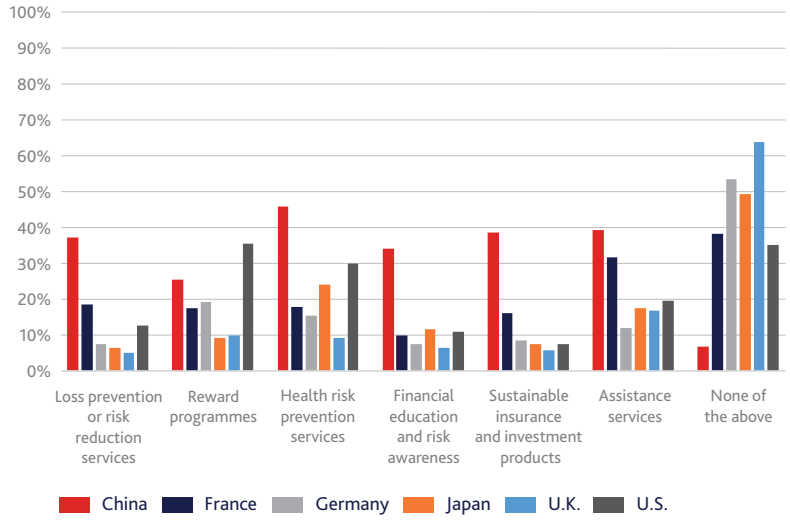
Source: The Geneva Association Global Customer Survey, powered by Dynata

As far as actual usage of risk services is concerned, a heterogeneous picture emerges (Figure 16). China leads the pack with usage levels ranging from about 30–45%, with a particularly strong appetite for health risk prevention services. In the U.S., reward programmes and health risk prevention services are relatively common, at usage levels of about 30–35%. In Germany, the U.K. and Japan, less than 20% of retail customers make use of such services. On average, reward programmes, and health risk prevention and assistance services are most frequently used; (property) loss prevention, financial education and sustainability services least so.

China aside, non-usage levels vary from around 35–65%. In light of relatively low levels (around 10–20%) of non-interest (see Figure 15), a certain potential for risk services seems to exist.

FIGURE 16: USAGE OF INSURANCE SERVICES THAT GO BEYOND RISK TRANSFER (RETAIL CUSTOMERS)

Are you using any of these services currently, if provided by your insurer?

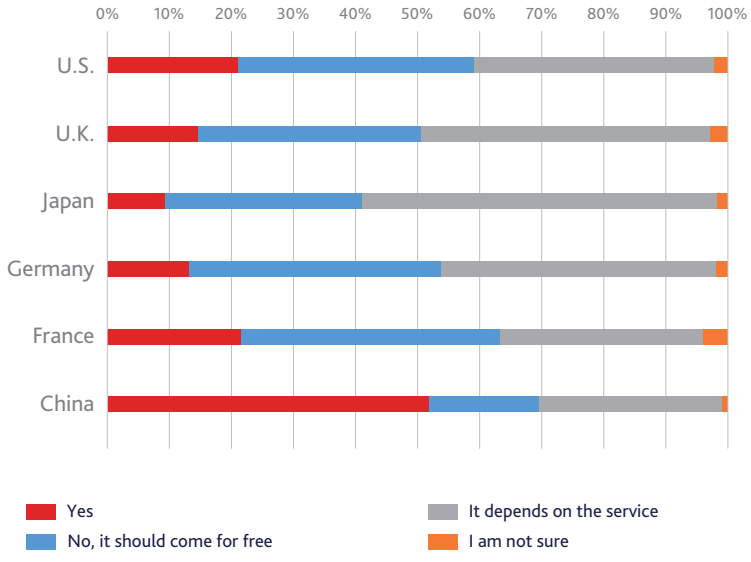


Source: The Geneva Association Global Customer Survey, powered by Dynata

More than 50% of Chinese respondents are willing to pay extra for additional risk services. In other markets, willingness ranges from about 10–20% only. In France, Germany and the U.S., about 40% of surveyed customers expect such services to come for free (Figure 17).

FIGURE 17: WILLINGNESS TO PAY FOR INSURANCE SERVICES THAT GO BEYOND RISK TRANSFER (RETAIL CUSTOMERS)

Would you be willing to pay higher premiums for such additional services?

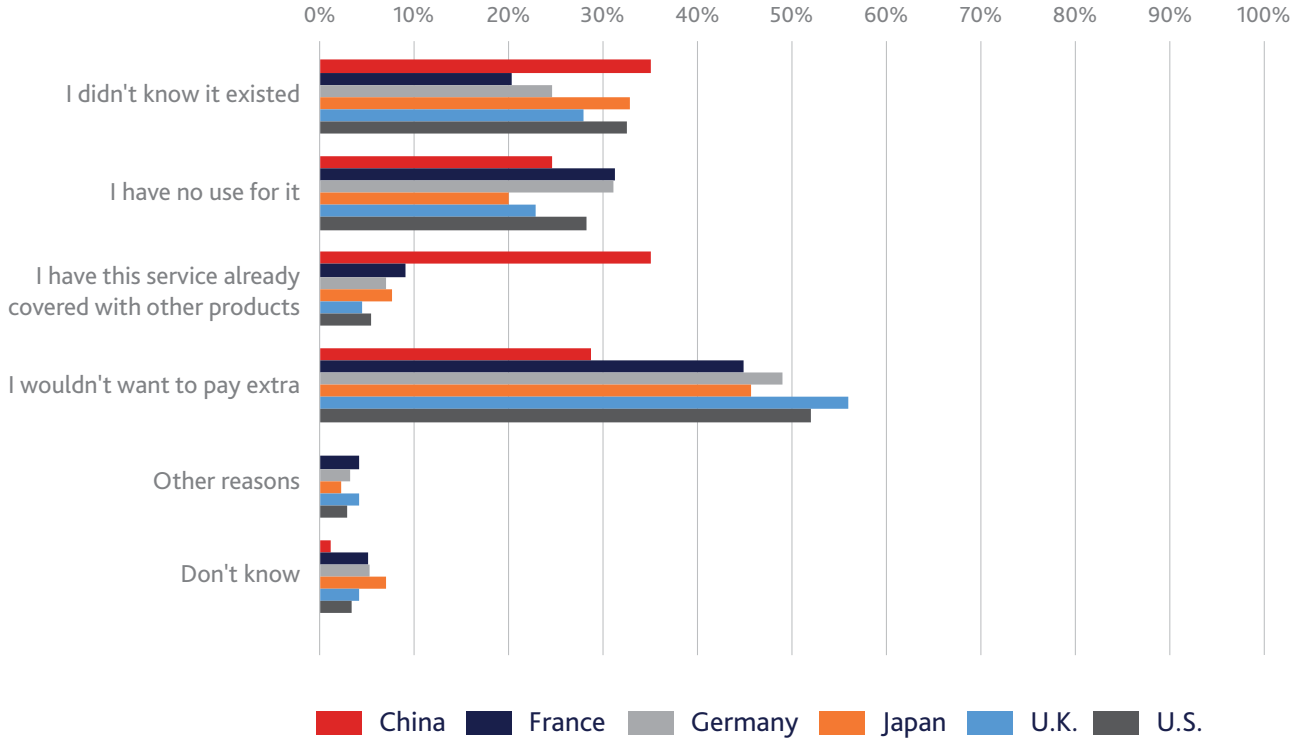


Source: The Geneva Association Global Customer Survey, powered by Dynata

When asked about the reasons for their non-interest in specific risk services, unwillingness to pay extra, lack of awareness and a perceived lack of need are most frequently mentioned (see Figure 18, using sustainable risk and investment services as an example).

FIGURE 18: REASONS FOR LACK OF INTEREST IN ADDITIONAL SERVICES (RETAIL CUSTOMERS)

You just said you are not interested in services related to sustainable insurance and investment products. What are the reasons?



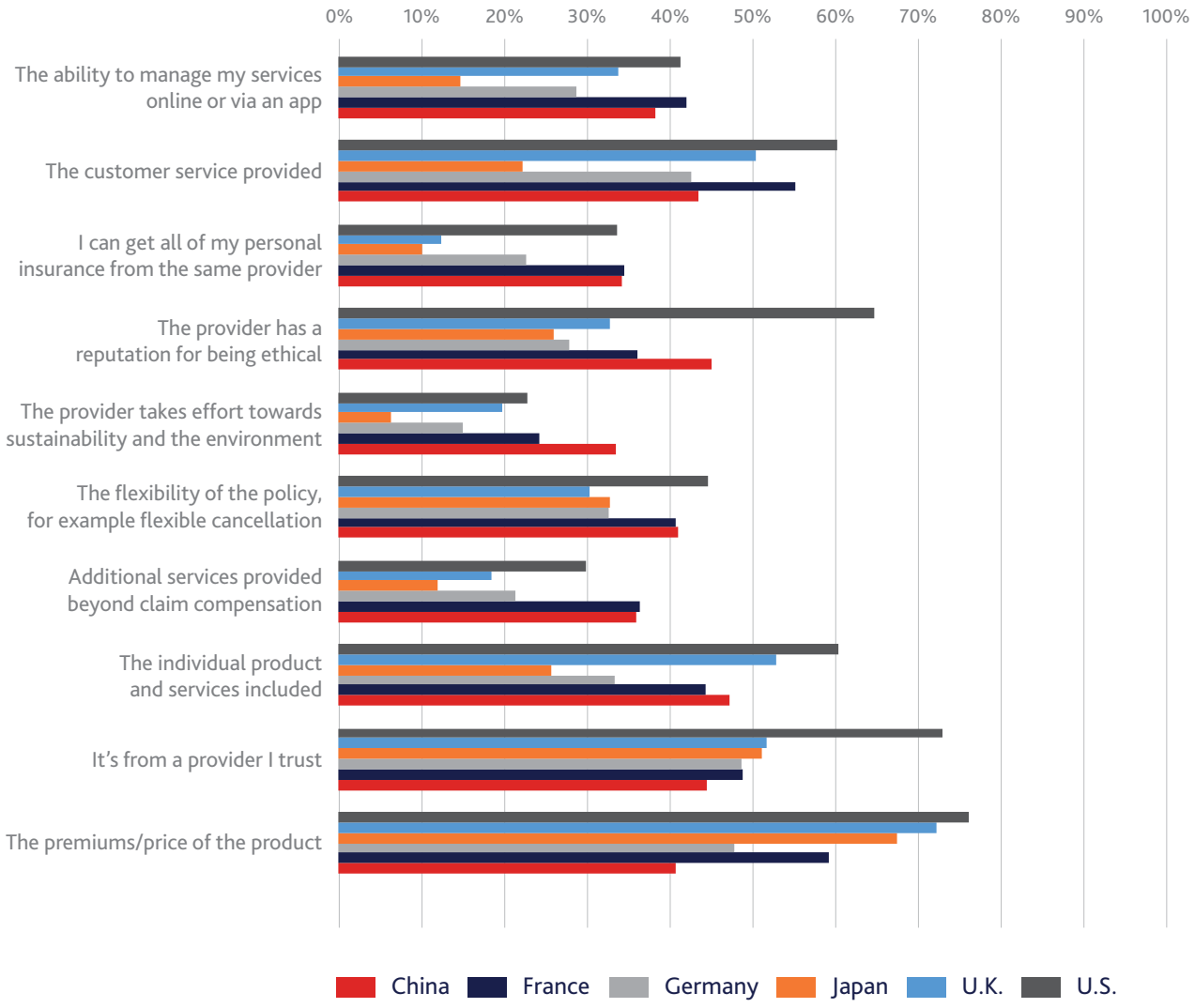
Source: The Geneva Association Global Customer Survey, powered by Dynata

Figure 19 sheds light on the determinants of customers' buying decisions. Strikingly, the provider's ability to offer services beyond claims payments does not rank particularly highly, especially in the U.K., Japan and Germany. The insurer's efforts towards sustainability are least relevant (especially in Germany and Japan).

On average, price (especially in the U.S., U.K. and Japan), trust (in the U.S. in particular) and customer service (which includes claims settlement) matter most to retail customers when it comes to making buying decisions.

FIGURE 19: CURRENT DETERMINANTS OF INSURANCE BUYING DECISIONS (RETAIL CUSTOMERS)

When buying insurance, how important are the below to you? (% of respondents that consider the topic 'very important')

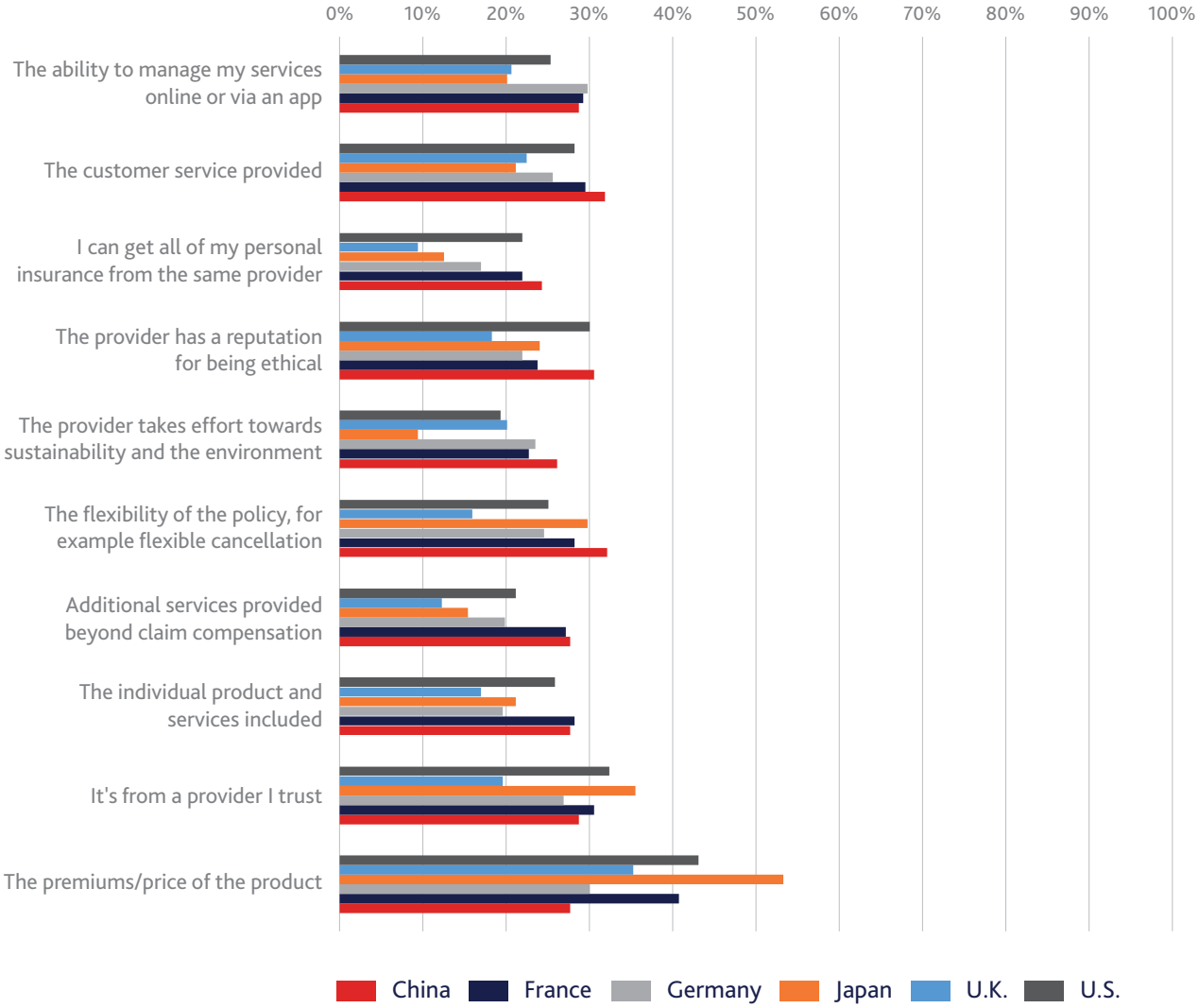


Source: The Geneva Association Global Customer Survey, powered by Dynata

Over the next five years, price will become an even more important factor, especially in Japan, the U.S. and France (for about 40–50% of surveyed retail customers). More than 20% of respondents state that sustainability will significantly gain in relevance for their insurance buying decisions. In five years' time, additional services beyond claims compensation are not expected to be particularly more significant than today, especially in Japan and the U.K. (Figure 20).

FIGURE 20: FUTURE DETERMINANTS OF INSURANCE BUYING DECISIONS (RETAIL CUSTOMERS)

How would you see these things changing for you in terms of importance when choosing an insurer over the next five years? (% of respondents who answered 'will be significantly more important')

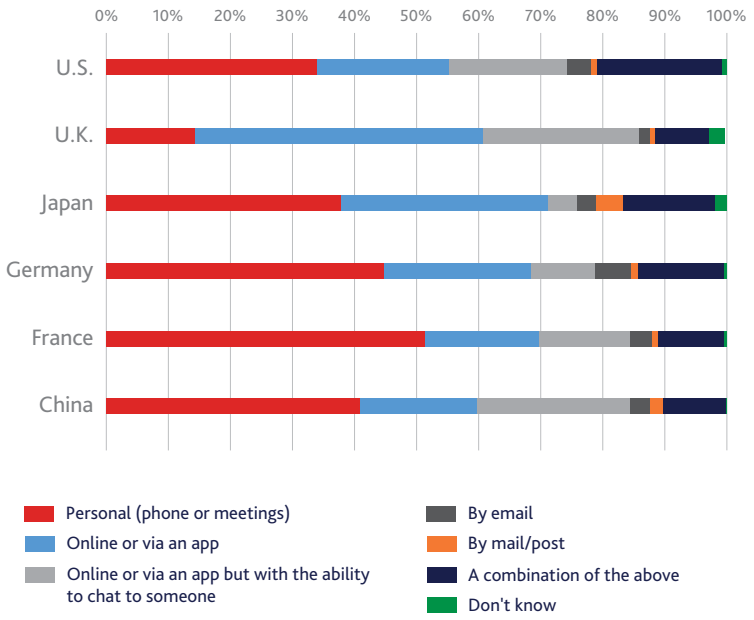


Source: The Geneva Association Global Customer Survey, powered by Dynata

Figure 21 displays retail customers' distribution preferences (which can be considered a proxy for their preferred way of interacting with insurers). Except for the U.K., personal channels remain more popular than digital. There is also a strong appetite for hybrid forms of interaction (up to about 40% in the U.S.). These findings suggest that retail customers continue to expect insurers to deliver their value proposition through a personal interface.

FIGURE 21: PREFERRED WAY OF BUYING INSURANCE (RETAIL CUSTOMERS)

What is your preferred way of buying insurance?



Source: The Geneva Association Global Customer Survey, powered by Dynata

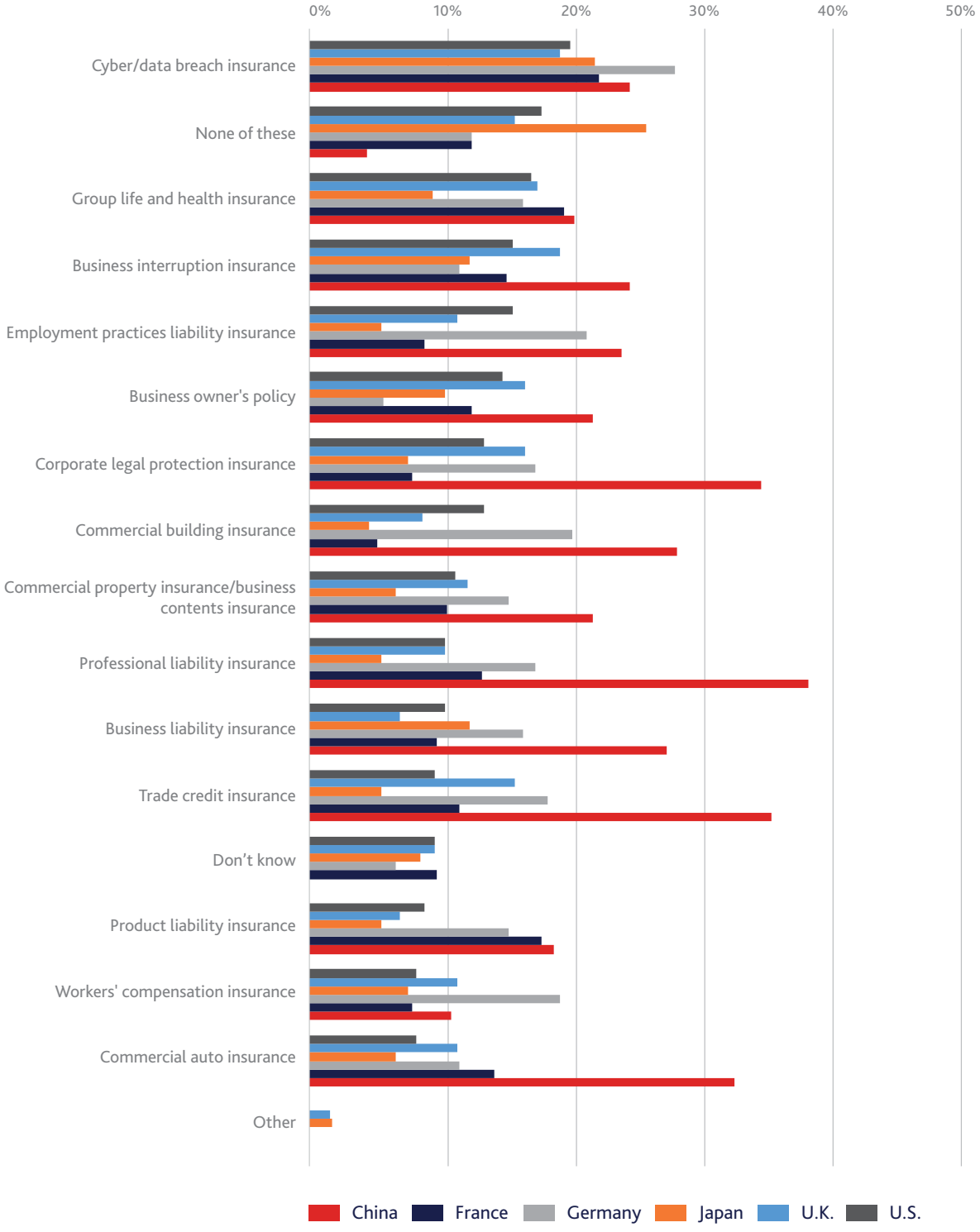
5.2 The commercial customer perspective

Figure 22 shows insurance products which our sample of about 600 SME commercial customers intend to add in the near future.

Chinese businesses stand out for their willingness to buy more insurance, especially professional liability, trade credit and legal protection insurance, with about 30–40% of companies stating this intention. German businesses also display a robust appetite for additional coverage. There is significant interest for additional cyber insurance in particular, from Germany (close to 30%), China, France and Japan (more than 20%).

FIGURE 22: INTEREST IN ADDITIONAL INSURANCE PRODUCTS (COMMERCIAL CUSTOMERS)

Which, if any, insurance products that are not mandatory/required by law do you or your business intend to add in the near future?

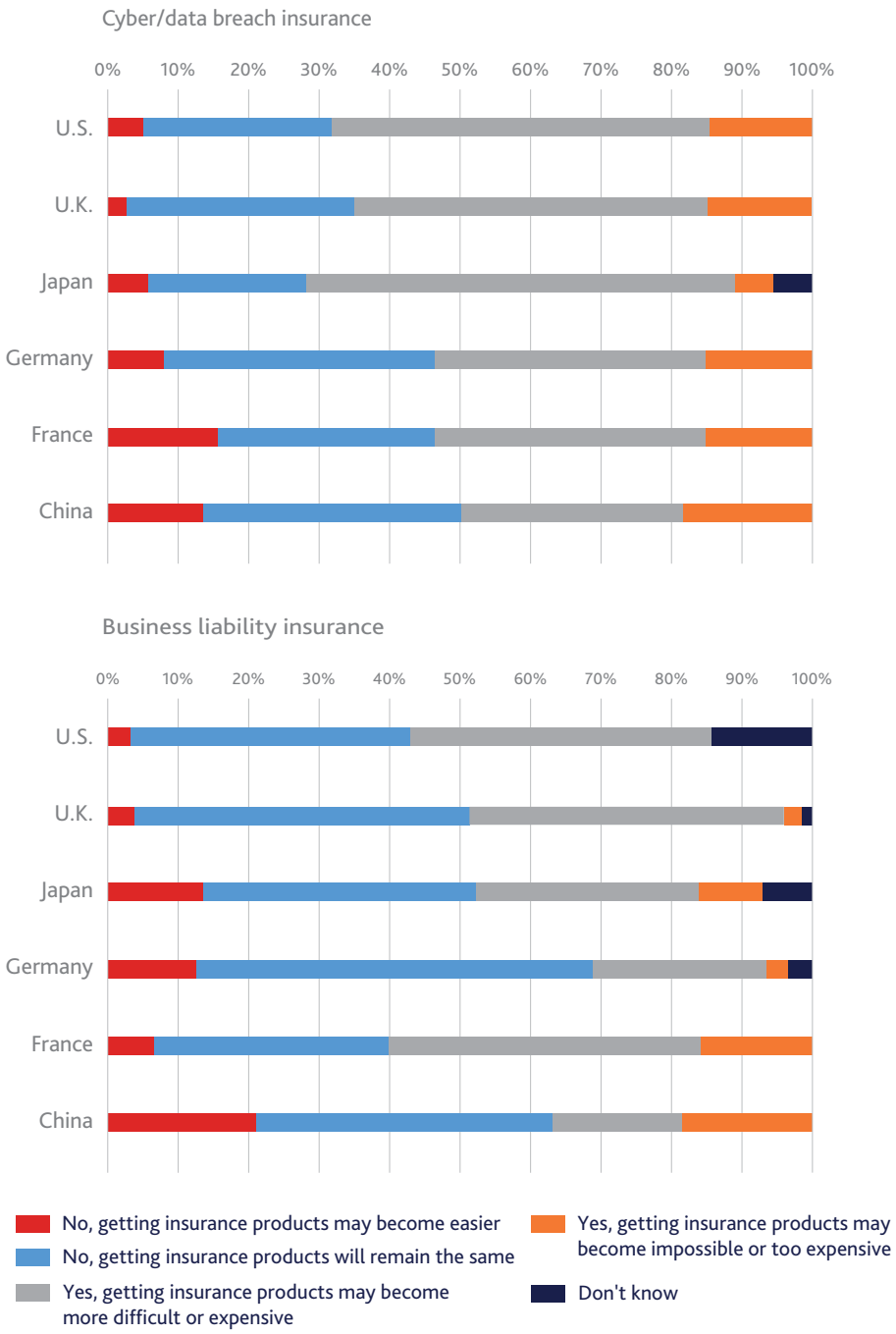


Source: The Geneva Association Global Customer Survey, powered by Dynata

In terms of future availability and affordability of cover, respondents are most concerned about the prospects for cyber and business liability insurance. On cyber, more than 70% of Japanese businesses express concerns, in the U.S. and the U.K. about 65%. On business liability, almost 60% of U.S. and French respondents are worried; German businesses are less concerned (Figure 23).

FIGURE 23: CONCERNS ABOUT THE FUTURE INSURABILITY OF RISKS (COMMERCIAL CUSTOMERS)

Are you concerned going forward that it may become more difficult or even impossible to get insurance for some of these risks?

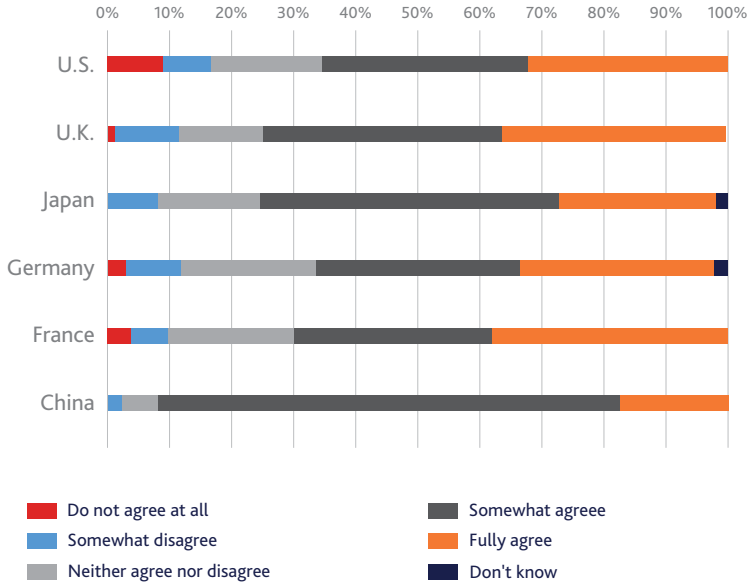


Source: The Geneva Association Global Customer Survey, powered by Dynata

Across all countries, at least two thirds of canvassed firms believe that their governments should collaborate more with insurers to ease product affordability and availability issues (Figure 24). This opinion is strongest in China (more than 90% of respondents).

FIGURE 24: IMPROVING INSURANCE AFFORDABILITY AND AVAILABILITY THROUGH GOVERNMENT-INSURER COLLABORATION (COMMERCIAL CUSTOMER PERSPECTIVE)

When you think about the role of your government in the insurance market, how much do you agree or disagree with the following? 'The government should collaborate more with insurers to make insurance products more affordable and available'

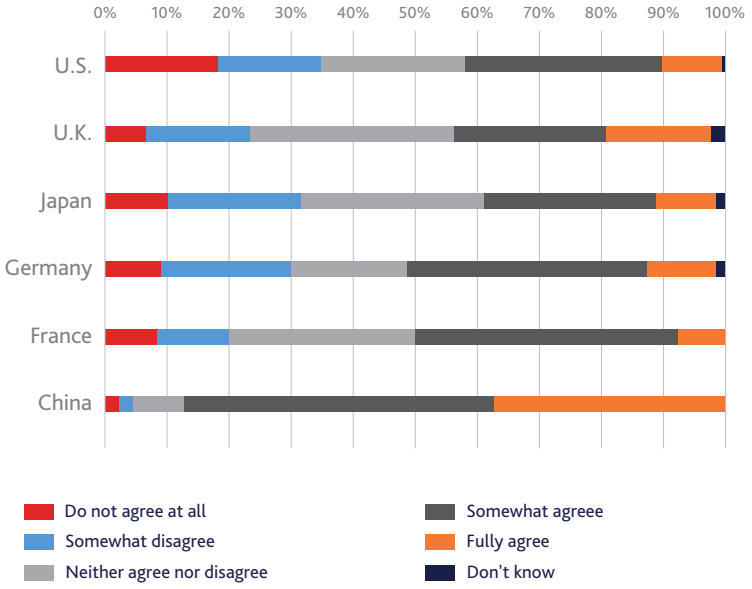


Source: The Geneva Association Global Customer Survey, powered by Dynata

Almost 90% of Chinese companies think that it is worth spending taxpayers' money on such collaborations. In all other countries, only about 40–50% of respondents share this opinion (Figure 25).

FIGURE 25: USE OF TAXPAYERS' MONEY FOR GOVERNMENT-INSURER COLLABORATION (COMMERCIAL CUSTOMER PERSPECTIVE)

When you think about the role of your government in the insurance market, how much do you agree or disagree with the following? 'It is fine to spend taxpayers' money to support collaboration between government and insurers'



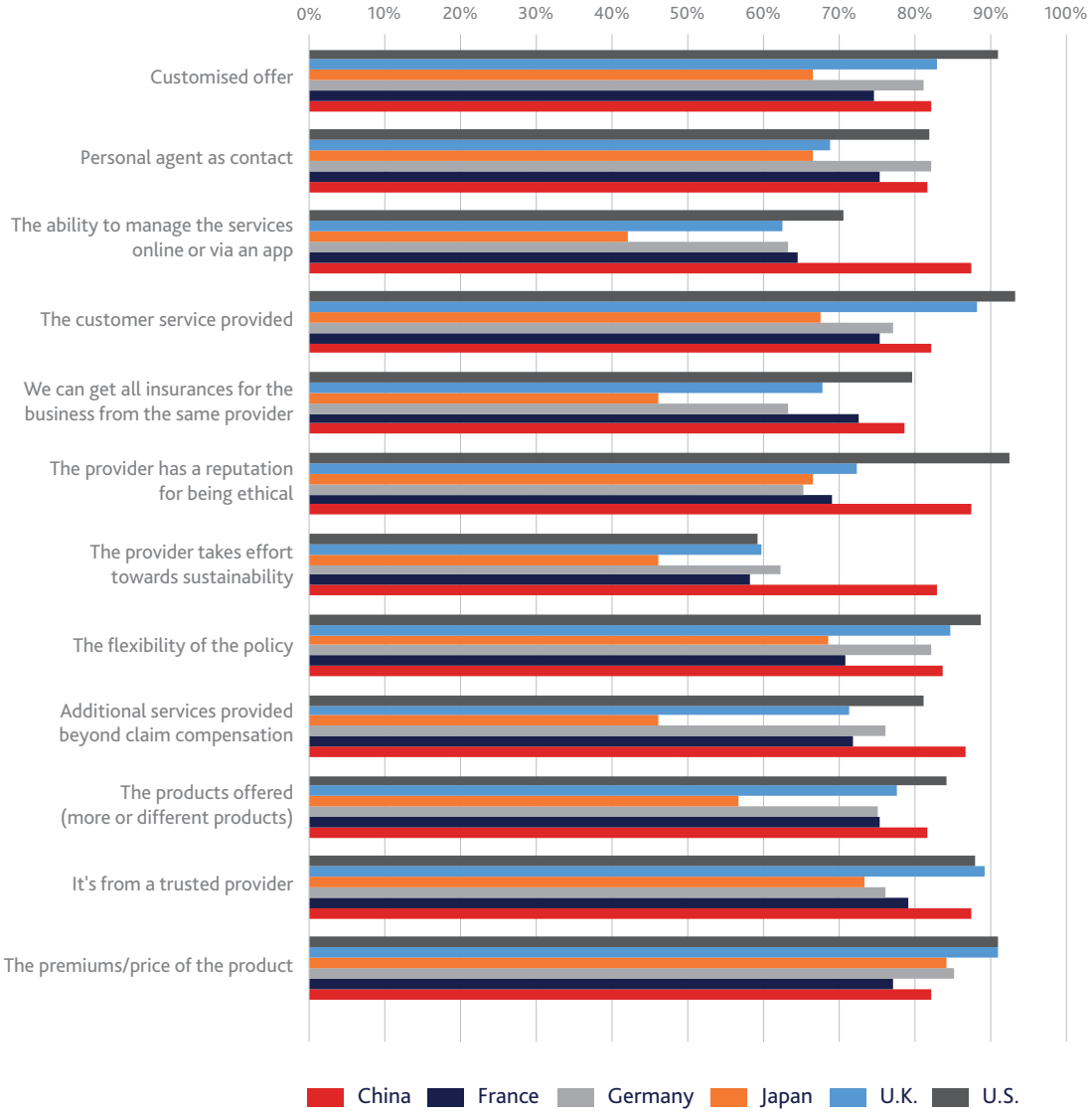
Source: The Geneva Association Global Customer Survey, powered by Dynata

Figure 26 sheds light on the determinants of commercial customers' buying decisions. Price and trustworthiness of the provider rank highest, especially in the U.S. (about 80–90% of respondents). Customer service and flexibility of the policy follow, again, most notably in the U.S.

Similar to the retail survey results, additional services beyond claims payments do not rank prominently. Dedicated efforts towards sustainability are ranked lowest.

FIGURE 26: CURRENT DETERMINANTS OF INSURANCE BUYING DECISIONS (COMMERCIAL CUSTOMERS)

When buying insurance products for your business, how important are the below to you? (% who responded 'very important')

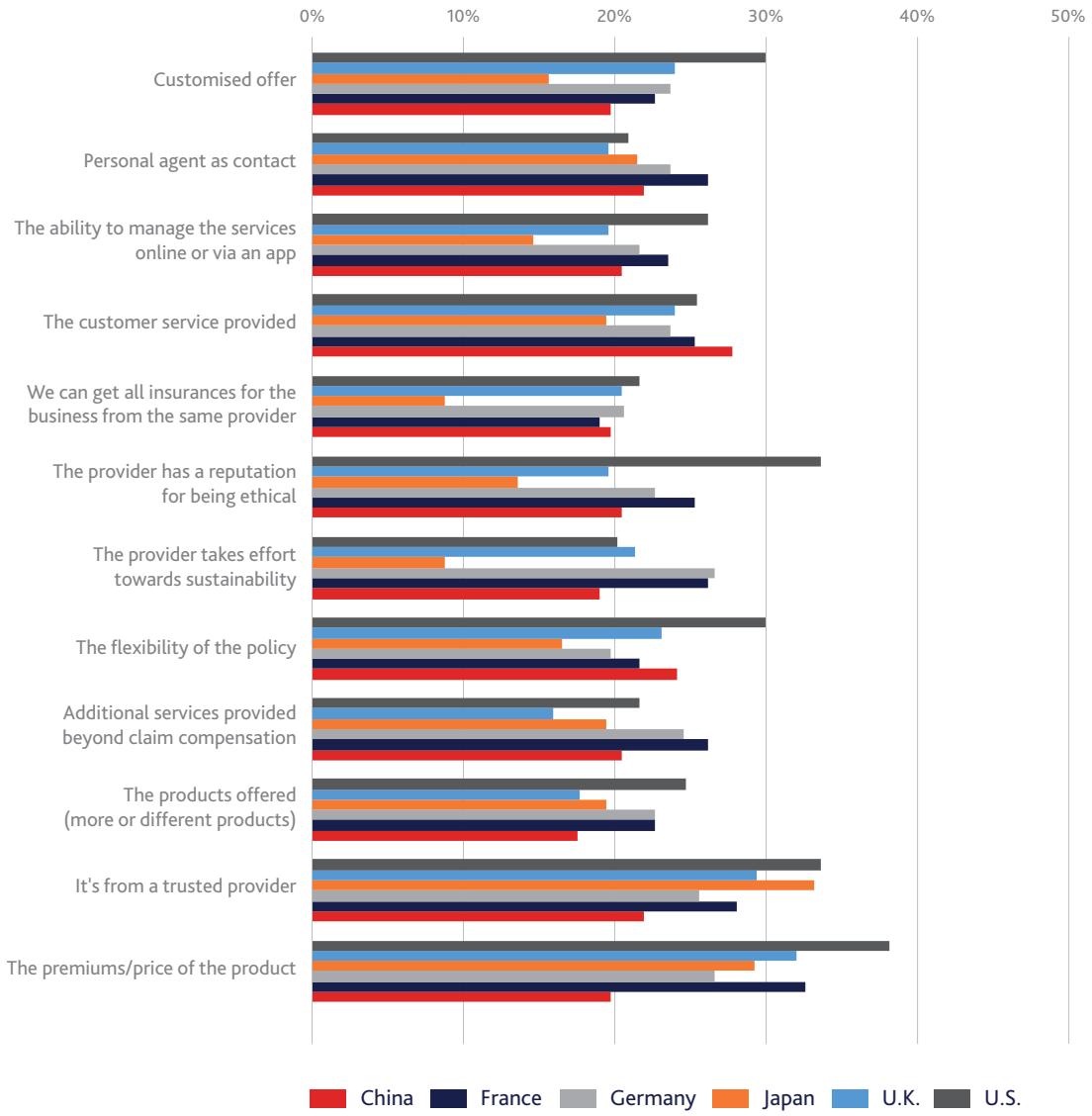


Source: The Geneva Association Global Customer Survey, powered by Dynata

Over the next five years, price is the criterion that is expected to gain most in importance, particularly in the U.S., France and the U.K. The ethical reputation and trustworthiness of the provider is also expected to increase in importance in the U.S. Sustainability initiatives will increasingly determine buying decisions, specifically of German and French businesses (Figure 27).

FIGURE 27: FUTURE DETERMINANTS OF INSURANCE BUYING DECISIONS (COMMERCIAL CUSTOMERS)

How would you see these things changing for you in terms of importance when choosing an insurer over the next five years? (% who responded 'will be significantly more important')

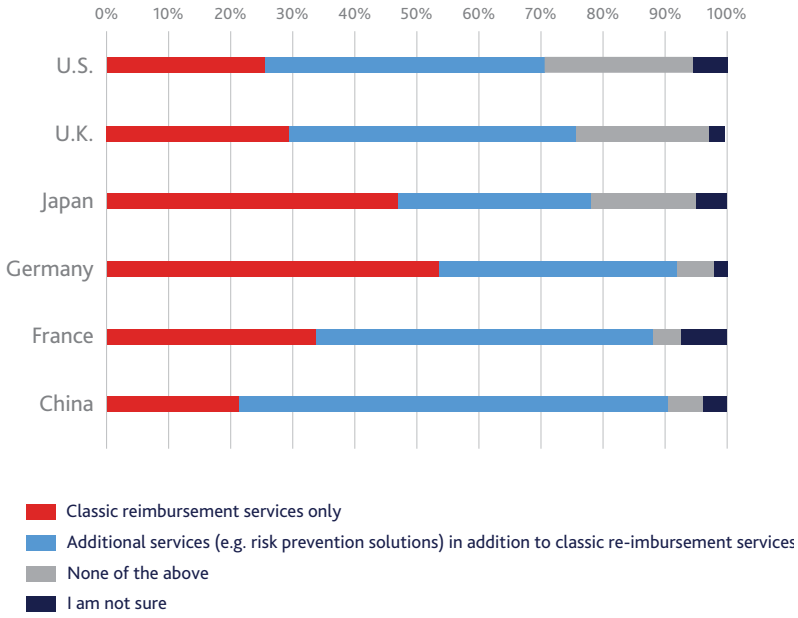


Source: The Geneva Association Global Customer Survey, powered by Dynata

Figure 28 offers insights about customers' general appetite for additional services beyond paying claims. More than 70% of all corporate respondents are using such services in addition to traditional risk transfer, with China leading the pack (about 90%). German and Japanese businesses are most reliant on classic reimbursement services only (about 50%).

FIGURE 28: USAGE OF INSURANCE SERVICES THAT GO BEYOND PAYING CLAIMS (COMMERCIAL CUSTOMERS)

Some insurers are offering services beyond paying claims. Which of the following is your business currently using?

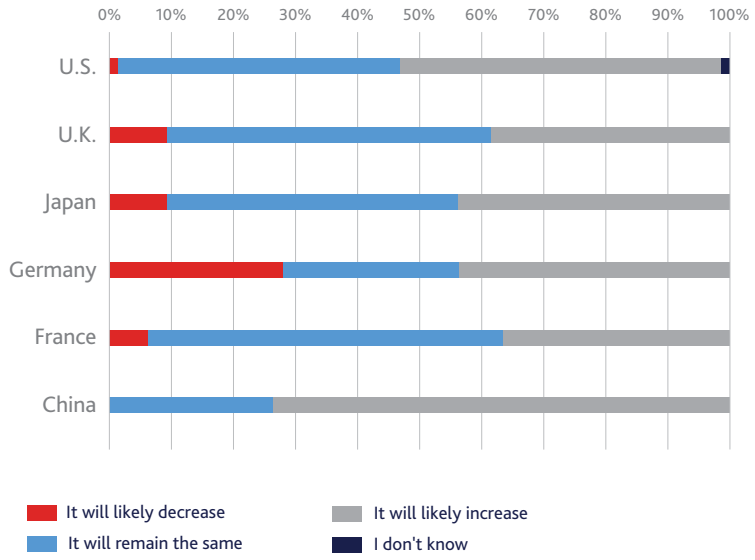


Source: The Geneva Association Global Customer Survey, powered by Dynata

Going forward, the majority of commercial customers in China and the U.S. expect an increased usage of additional services (Figure 29).

FIGURE 29: FUTURE USAGE OF ADDITIONAL INSURANCE SERVICES (COMMERCIAL CUSTOMERS)

Do you expect your business' usage of additional services (e.g. risk prevention solutions) to change over the next five years or so?

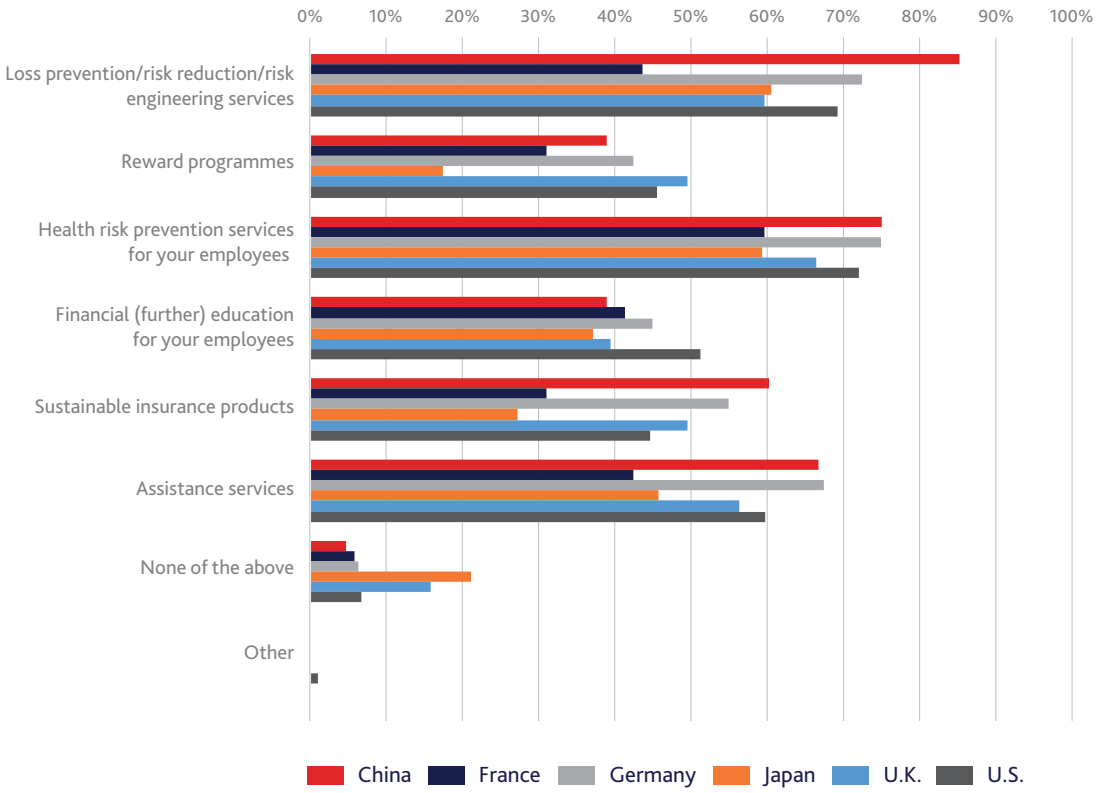


Source: The Geneva Association Global Customer Survey, powered by Dynata

Figure 30 gives an indication of businesses' interest in specific additional services. In general, there is a strong interest in property loss prevention, employee health risk prevention and post-event assistance services (35% and more), most notably in China (especially for loss prevention, almost 70% of respondents) and Germany (especially for employee health risk prevention, close to 60% of respondents). In these two countries, there is also a solid interest in sustainable products (about 45–50%), but considerably less so in Japan and France.

FIGURE 30: INTEREST IN ADDITIONAL INSURANCE SERVICES (COMMERCIAL CUSTOMERS)

Which of these services would you be interested in getting for your business, if provided by your insurer?



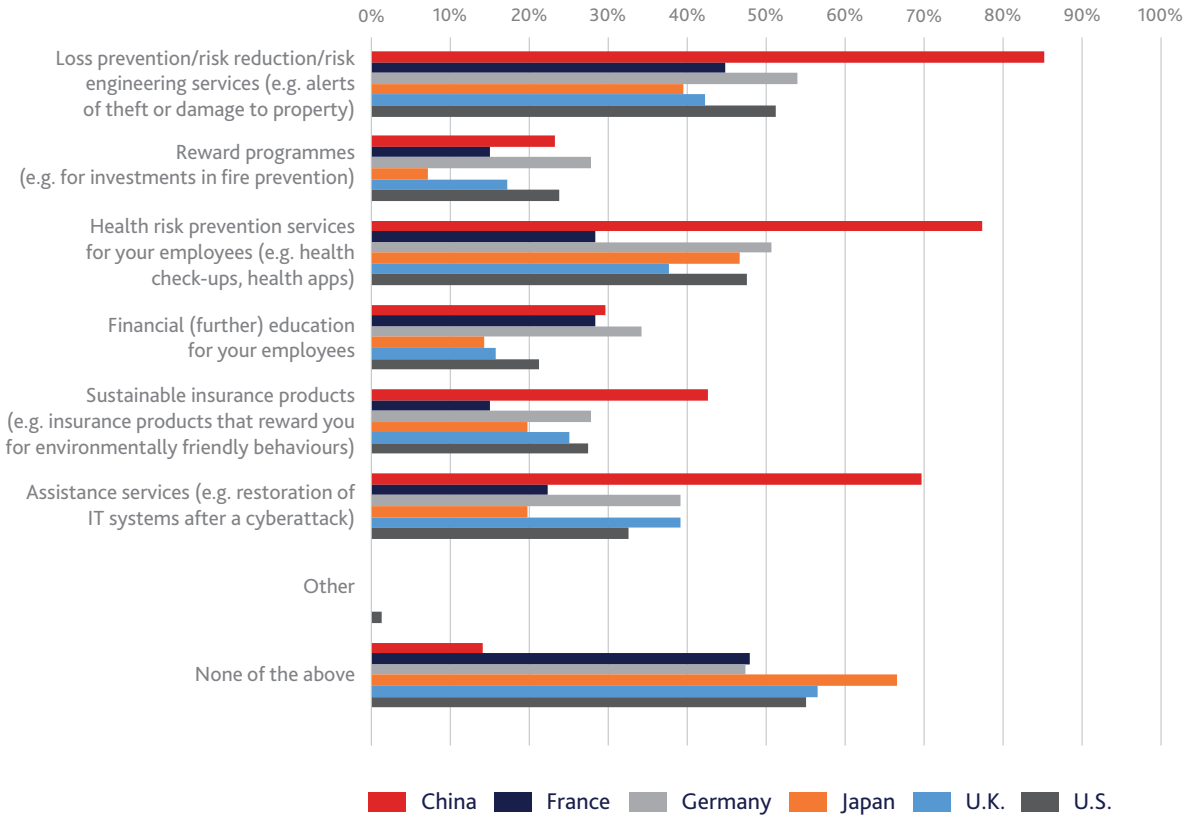
Source: The Geneva Association Global Customer Survey, powered by Dynata

In terms of actual usage, Chinese businesses stand out, with more than 40–50% of respondents using property loss prevention, employee health risk prevention and assistance services. Usage by German and U.S. companies is solid, too (about 25–35%). Take-up in Japan is lowest for most services, with more than 40% not using any such services (Figure 31).

Relatively high levels of non-usage and strong levels of interest (Figure 30) suggest significant potential for such services. This is also true for sustainability-related services, in particular in Germany, the U.K. and the U.S.

FIGURE 31: CURRENT USAGE OF ADDITIONAL INSURANCE SERVICES (COMMERCIAL CUSTOMERS)

Is your business currently using any of these services provided by an insurer?

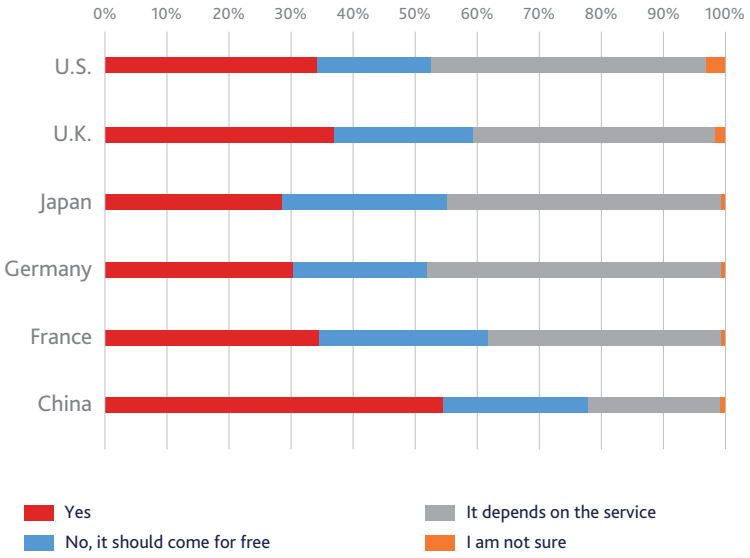


Source: The Geneva Association Global Customer Survey, powered by Dynata

Figure 32 indicates businesses' willingness to pay extra for additional services. Rates are highest in China and lowest in Japan and Germany.

FIGURE 32: WILLINGNESS TO PAY FOR ADDITIONAL INSURANCE SERVICES (COMMERCIAL CUSTOMERS)

Would you or your company be willing to pay higher premiums for such additional services?

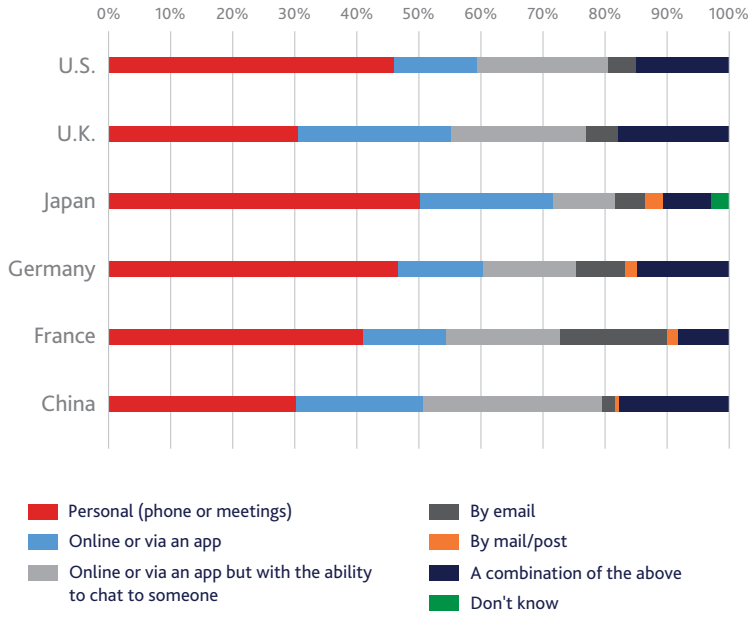


Source: The Geneva Association Global Customer Survey, powered by Dynata

Figure 33 exhibits commercial buyers' distribution preferences, again as a proxy for their preferred way of interacting with insurers.

For businesses in all markets, except for China and the U.K., personal channels are most preferred (around 40–50%). In the U.K., Japan and China, about 20–25% opt for online-only interaction, in the other markets even less. Hybrid approaches are popular in all markets, but least so in Japan. The personal element in value creation by commercial insurance therefore seems to be here to stay.

FIGURE 33: PREFERRED WAY OF BUYING INSURANCE (COMMERCIAL CUSTOMERS)



Source: The Geneva Association Global Customer Survey, powered by Dynata

6 Conclusions

Conclusions

Stronger focus on risk prevention, advanced technologies and alternative sources of capital may enable insurers to maintain insurability in the face of larger and less familiar risks.

The future promises elevated complexity, uncertainty and vulnerability due to geopolitical power shifts, rapid technological transformation, increasing interconnectivity and consequential dissemination of risk. Arising systemic risks, both tangible and intangible, cannot be diversified using traditional risk transfer mechanisms. The world was made aware of these limits to insurability during the COVID-19 pandemic. Even if not systemic in nature, intangible risks, which are growing rapidly in the digital economy, also pose fundamental insurability challenges, primarily due to the asymmetric distribution of information between insurers and insureds as well as fundamental difficulties in loss prediction and loss measurement.

These challenges necessitate some creative thinking about the insurance industry's non-risk-bearing contributions to customers and society at large. We have shone the spotlight on additional risk services, product innovation in the context of sustainability and engagement with the public sector. Having said this, a stronger focus on risk prevention, advanced technologies and alternative sources of capital may enable insurers to maintain insurability even in the face of larger and less familiar risks. The robust development of global non-life insurance penetration (premiums as a share of GDP) over the past 10 years bodes well for the prospects of risk transfer.

The voice of the customer corroborates the main conclusions of this report: people and businesses are concerned about the future availability and affordability of certain types of insurance. They also want their insurers to collaborate more with governments to mitigate emerging insurability issues.

However, the survey results also suggest a sober and realistic perspective on additional risk services offered by insurers. On the one hand, levels of customer interest are significantly higher than levels of actual usage, indicating a certain potential for such services. On the other hand, the results suggest that that the current and future role of additional risk services as a determinant of insurance purchasing decisions should not be overestimated.

Risk transfer is expected to remain at the core of insurers' customer and societal value. Having said this, insurers should respond to the increasing challenges to insurability by providing a broader spectrum of risk services in order to contain the cost of risk and respond to evolving customer needs. The determination and creativity with which they do so will allow insurers to convince customers of the value of these propositions and to monetise them.

References

AAE. 2023. *Sustainable Products in Insurance.*

Aggarwal, S., N. Kumar, M. Alhussein, and G. Muhammad. 2021. Blockchain-based UAV Path Planning for Healthcare 4.0: Current challenges and the way ahead. *IEEE Network* 35 (1): 20–29.

Alex Research. 2017. The 2017 ALEX *Benefits Communication Survey*.

Allianz. 2020. *Allianz Risk Barometer.*

Angeles, M.R., S. Wanni Arachchige Dona, N. Hall, J.J. Watts, A. Peeters, and M. Hensher. 2021. Impacts of Chronic Disease Prevention Programs Implemented by Private Health Insurers: A systematic review. *BMC Health Services Research* 21: 1–17.

Aon. 2019. *Intangible Assets Financial Statement Impact Comparison Report.*

AXA XL. 2018. *Guide to Government Pools.*

Bain & Co. 2023. *Customer Behavior and Loyalty in Insurance: Global edition 2023*

Baranchuk, A., M.M. Refaat, K.K. Patton, M.K. Chung, K. Krishnan, and V. Kutyifa. 2018. American College of Cardiology's Electrophysiology Section Leadership. Cybersecurity for cardiac implantable electronic devices: What should you know? *Journal of the American College of Cardiology* 71 (11): 1284–1288.

Bartolini, D.N., C. Benavente-Peces, and A. Ahrens. 2019. Using Risk Assessments to Assess Insurability in the Context of Cyber Insurance. In *E-Business and Telecommunications: 14th International Joint Conference, ICETE 2017, Madrid, Spain, July 24–26, 2017, Revised Selected Paper 14* (pp. 337–345). Springer International Publishing.

Berliner, B. 1982. *Limits of Insurability of Risks.* Prentice Hall.

Biener, C., M. Eling, and J.H. Wirfs. 2015. Insurability of Cyber Risk: An empirical analysis. *The Geneva Papers on Risk and Insurance—Issues and Practice* 40: 131–158.

Boodhun, N., and M. Jayabalan. 2018. Risk Prediction in Life Insurance Industry Using Supervised Learning Algorithms. *Complex & Intelligent Systems* 4 (2): 145–154.

Brand Finance. 2022. *Global Intangible Finance Tracker.*

Braun, A. 2016. Pricing in the Primary Market for Cat Bonds: New empirical evidence. *Journal of Risk and Insurance* 83 (4): 811–847.

Braun, A., and M. Fischer. 2018. Determinants of the Demand for Political Risk Insurance: Evidence from an international survey. *The Geneva Papers on Risk and Insurance—Issues and Practice* 43: 397–419.

Braun, A., S. Ben Ammar, and M. Eling. 2019. Asset Pricing and Extreme Event Risk: Common factors in ILS fund returns. *Journal of Banking and Finance* 102: 59–78.

Carleton, T., and M. Greenstone. 2021. Updating the United States Government's Social Cost of Carbon. *Becker Friedman Institute for Economics Working Paper No. 2021-04*

Carter, L. 2020. Mobilizing Insurance Investment in Sustainable Infrastructure: The role of the United Nations. *Invest4Climate Knowledge Series.* United Nations Development Programme.

Carter, R.A. 2012. Flood Risk, Insurance and Emergency Management in Australia. *Australian Journal of Emergency Management* 27 (2): 20–25.

Charpentier, A. 2008. Insurability of Climate Risks. *The Geneva Papers on Risk and Insurance—Issues and Practice 33*: 91–109.

Chubb. 2020. *Pandemic Business Interruption Program.* https://about.chubb.com/content/dam/chubb-sites/chubb/about-chubb/stories/pdf/pandemic-business-interruption-program.pdf

Chua, A.Y., S. Kaynak, and S.S. Foo. 2007. An Analysis of the Delayed Response to Hurricane Katrina through the Lens of Knowledge Management. *Journal of the American Society for Information Science and Technology* 58 (3): 391–403.

CII. 2021. *Systemic Risks and the Insurance Sector.*

Citi GPS and Cambridge Center for Risk Studies. 2021. *Systemic Risk – Systemic solutions for an increasingly interconnected world.*

Courbage, C., and M. Golnaraghi. 2022. Extreme Events, Climate Risks and Insurance. *The Geneva Papers on Risk and Insurance—Issues and Practice* 47 (1): 1–4.

CRO Forum. 2023. *Emerging Risks Initiative.*

David, G., A. Smith-McLallen, and B. Ukert. 2019. The Effect of Predictive Analytics-driven Interventions on Healthcare Utilization. *Journal of Health Economics* 64: 68–79.

Deloitte. 2019. *Predictive Analytics in Health Care: Emerging value and risks.*

Desai, V.M. 2011. Mass Media and Massive Failures: Determining organizational efforts to defend field legitimacy following crises. *Academy of Management Journal* 54 (2): 263–278.

Eckert, C., and N. Gatzert. 2017. Modeling Operational Risk Incorporating Reputation Risk: An integrated analysis for financial firms. *Insurance: Mathematics and Economics* 72: 122–137.

EIOPA. 2022. *The Dashboard on Insurance Protection Gap for Natural Catastrophes in a Nutshell.*

Eling, M. 2022. Framework für Nachhaltigkeit aus Perspektive der Assekuranz. *I.VW HSG Schriftenreihe, No.70.*

Eling, M., and M. Lehmann. 2018. The Impact of Digitalization on the Insurance Value Chain and the Insurability of Risks. *The Geneva Papers on Risk and Insurance—Issues and Practice* 43 (3): 359–396.

Eling, M., and W. Schnell. 2016. What Do We Know About Cyber Risk and Cyber Risk Insurance? *The Journal of Risk Finance* 17 (5): 474–491.

Eling, M., M. Elvedi, and G. Falco. 2022. The Economic Impact of Extreme Cyber Risk Scenarios. *North American Actuarial Journal.*

FAO, IFAD and WFP. 2015. *Achieving Zero Hunger: The critical role of investments in social protection and agriculture.*

Ferrara, E., S. Cresci, and L. Luceri. 2020. Misinformation, Manipulation, and Abuse on Social Media in the Era of COVID-19. *Journal of Computational Social Science* 3: 271–277.

Fitch Wire. 2023. *Recent ILS Cyber Bond Issuance Encouraging for (Re) Insurers.* https://www.fitchratings.com/research/insurance/recent-ils-cyber-bond-issuance-encouraging-for-re-insurers-31-01-2023.

Gallagher Re. 2023. *Reinsurance Market Report*.

Gardener, N.J. 2008. Business Continuity and the Link to Insurance: A pragmatic approach to mitigate principal risks and uncertainties. In *Institution of Chemical Engineers Symposium Series* 154: 990. Institution of Chemical Engineers.

Gatzert, N., P. Reichel, and A. Zitzmann. 2020. Sustainability Risks & Opportunities in the Insurance Industry. *Zeitschrift für die gesamte Versicherungswissenschaft* 109: 311–331.

Gatzert, N., J.T. Schmit, and A. Kolb. 2016. Assessing the Risks of Insuring Reputation Risk. *Journal of Risk and Insurance* 83 (3): 641–679.

Hartwig, R., and R. Gordon. 2020. Uninsurability of Mass Market Business Continuity Risks from Viral Pandemics. *American Property Casualty Insurance Association.*

Herweijer, C., N. Ranger, and R.E. Ward. 2009. Adaptation to Climate Change: Threats and opportunities for the insurance industry. *The Geneva Papers on Risk and Insurance—Issues and Practice* 34: 360–380.

Hofmann, S.Z. 2022. Build Back Better and Long-Term Housing Recovery: Assessing community housing resilience and the role of insurance post disaster. *Sustainability* 14 (9): 5623.

IEP. 2023. *Global Peace Index.*

IBM. 2022. *Cost of a Data Breach Report 2022.*

Institute and Faculty of Actuaries. 2017. *The Future of Insurance: A STEEP change.*

IPCC. 2022. *Climate Change 2022: Impacts, adaptation and vulnerability.*

IRGC. 2010. *The Emergence of Risks: Contributing factors.*

IRGC. 2016. *Risk and Opportunity Governance of Autonomous Cars.*

ISO. ISO 31000: Risk management guidelines www.iso.org/iso-31000-risk-management.html; and https://www.iso.org/obp/ui/#iso:std:iso:guide:73:ed-1:v1:en

ITRC. 2022. *Identity Theft Resource Center's 2021 Annual Data Breach Report Sets New Record for Number of Compromises.* https://www.idtheftcenter.org/post/identity-theft-resource-center-2021-annual-data-breach-report-sets-new-record-for-number-of-compromises/

Jarzabkowski, P., K. Chalkias, E. Cacciatori, and R. Bednarek. 2018. *Between State and Market: Protection gap entities and catastrophic risk.* Cass Business School.

Kamiya, S., J.K. Kang, J. Kim, A. Milidonis, and R.M. Stulz. 2021. Risk Management, Firm Reputation, and the Impact of Successful Cyberattacks on Target Firms. *Journal of Financial Economics* 139 (3): 719–749.

Kousky, C. 2019. The Role of Natural Disaster Insurance in Recovery and Risk Reduction. *Annual Review of Resource Economics* 11: 399–418.

KPMG. 2022. *Social Inequality as a Business Risk.*

Kron, W. 2005. Flood Risk = Hazard • Values • Vulnerability. *Water International* 30: 58–68.

Kurzweil, R. 2001. The Law of Accelerating Returns. In *Alan Turing: Life and legacy of a great thinker,* pp. 381–416. Berlin, Heidelberg: Springer.

Lin, X., A. Bruhn, and J. William. 2019. Extending Financial Literacy to Insurance Literacy: A survey approach. *Accounting & Finance* 59: 685–713.

Lockton. 2021. *Building Cyber Resilience Against Ransomware.*

Lloyd's. 2023a. *Lloyd's New Data Tool Highlights Vulnerability of the Global Economy to Extreme Weather.* https://www.lloyds.com/about-lloyds/media-centre/press-releases/lloyds-new-data-tool-highlights-vulnerability-of-the-global-economy-to-extreme-weather

Lloyd's. 2023b. *Lloyd's Systemic Risk Scenario Reveals Global Economy Exposed to $3.5trn from Major Cyber Attack.* https://www.lloyds.com/about-lloyds/media-centre/press-releases/lloyds-systemic-risk-scenario-reveals-global-economy-exposed-to-3.5trn-from-major-cyber-attack

Lyubchich, V., N.K. Newlands, A. Ghahari, T. Mahdi, and Y.R. Gel. 2019. Insurance Risk Assessment in the Face of Climate Change: Integrating data science and statistics. *Wiley Interdisciplinary Reviews: Computational Statistics* 11 (4): e1462.

MarkLogic and Marketforce. 2019. *Value-added Services: Towards a new insurance model.*

Marsh. 2018. *Business Interruption: Risk managed or long-term stakeholder value loss?*

McAfee. 2020. *The Hidden Costs of Cybercrime.*

McKinsey. 2020. *Climate Change and P&C Insurance: The threat and opportunity.* https://www.mckinsey.com/industries/financial-services/our-insights/climate-change-and-p-and-c-insurance-the-threat-and-opportunity

McKinsey. 2021a. *How Top Tech Trends Will Transform Insurance.* https://www.mckinsey.com/industries/financial-services/our-insights/how-top-tech-trends-will-transform-insurance

McKinsey. 2021b. *How Data and Analytics are Redefining Excellence in P&C Underwriting.* https://www.mckinsey.com/industries/financial-services/our-insights/how-data-and-analytics-are-redefining-excellence-in-p-and-c-underwriting

Mills, E., and E. Lecomte. 2005. *Availability and Affordability of Insurance Under Climate Change: A growing challenge for the US.* Boston: Ceres.

Munich Re. 2023. *Climate Change and La Niña Driving Losses: The natural disaster figures for 2022.* https://www.munichre.com/en/company/media-relations/media-information-and-corporate-news/media-information/2023/natural-disaster-figures-2022.

NAIC. 2017. *Insurance Disaster Response Plan.*

Nzuki, R. 2021. Combating Climate Change through Public-Private Partnership Funding. *SNV.* 15 November. https://snv.org/update/combating-climate-change-through-public-private-partnership-funding/.

OECD. 2003. *Emerging Systemic Risks in the 21st Century: An agenda for action.*

OECD. 2020. *Sustainable Cyber Insurance Markets.*

Otto, F.E. et al. 2023. Climate Change Increased Extreme Monsoon Rainfall, Flooding Highly Vulnerable Communities in Pakistan. *Environmental Research: Climate* 2 (2): 025001.

Pimentel, D. 2006. Soil Erosion: A food and environmental threat. *Environment, Development and Sustainability* 8 : 119–137. https://doi.org/10.1007/s10668-005-1262-8

Pnevmatikakis, A., S. Kanavos, G. Matikas, K. Kostopoulou, A. Cesario, and S. Kyriazakos. 2021. Risk Assessment for Personalized Health Insurance Based on Real-world Data. *Risks* 9 (3): 46.

PRI Association. 2018. *PRI Reporting Framework—Main definitions.*

Pugnetti, C. et al. 2022. Leading the Green Insurance Revolution. *ZHAW Department Banking, Finance, Insurance Working Paper Series.*

Reimers, I., and B.R. Shiller. 2019. The Impacts of Telematics on Competition and Consumer Behavior in Insurance. *The Journal of Law and Economics* 62 (4): 613–632.

Renn, O. 2020. Risk Governance: From knowledge to regulatory action. In *Knowledge for Governance. Knowledge and Space,* ed. J. Glückler, G. Herrigel, and M. Handke, vol. 15. Cham: Springer.

Richter, A., and T. Wilson. 2020. COVID-19: Implications for insurer risk management and the insurability of pandemic risk. *The Geneva Risk and Insurance Review.*

Rzevski, G. 2015. Complexity as the Defining Feature of the 21st Century. *International Journal of Design & Nature and Ecodynamics* 10 (3): 191–198.

Schäfer, L., K. Warner, and S. Kreft. 2019. Exploring and Managing Adaptation Frontiers with Climate Risk Insurance. *Loss and Damage from Climate Change: Concepts, Methods and Policy Options* 317–341.

SCOR. 2020. *Insuring More Cancer Survivors through Inclusive Underwriting.* 4 February.

Sølvsten, S. 2022. Loss Prevention Technologies' Effect on Property Damage Cost and Financial Savings. *WTW.* 22 April. https://www.wtwco.com/en-kw/insights/2022/04/loss-prevention-technologies-effect-on-property-damage-cost-and-financial-savings

Stahel, W.R. 2003. The Role of Insurability and Insurance. *The Geneva Papers on Risk and Insurance—Issues and Practice* 28 (3): 374–381.

Stoian, A., N. Vintila, F. Iorgulescu, C.O. Cepoi, and A. Dina Manolache. 2021. How Risk Aversion and Financial Literacy Shape Young Adults' Investment Preferences. *MPRA Archive.*

Stricker, L., C. Pugnetti, J. Wagner, and A. Zeier Röschmann. 2022 Green Insurance: A roadmap for executive management. *Journal of Risk and Financial Management* 15 (5): 221

Sturm, P. 2013. Operational and Reputational Risk in the European Banking Industry: The market reaction to operational risk events. *Journal of Economic Behavior & Organization* 85: 191–206.

Subroto, A., and A. Apriyana. 2019. Cyber Risk Prediction through Social Media Big Data Analytics and Statistical Machine Learning. *Journal of Big Data* 6 (1): 50.

Surminski, S., and P. Hudson. 2017. Investigating the Risk Reduction Potential of Disaster Insurance across Europe. *The Geneva Papers on Risk and Insurance—Issues and Practice* 42: 247–274.

Swiss Re. 2017. *Commercial Insurance – Innovating to expand the scope of insurability.* Sigma No. 5.

Swiss Re. 2020. *Data-driven Insurance: Ready for the next frontier?* Sigma No. 1.

Swiss Re. 2021a. *Four Challenges Shaping the Future of Corporate Insurance.* https://corporatesolutions.swissre.com/insights/knowledge/four-challenges-shaping-future-of-corporate-insurance.html

Swiss Re. 2021b. *More Risk: The changing nature of P&C insurance opportunities to 2040.* Sigma No. 4.

Swiss Re. 2022a. *Swiss Re Expects Rise in Demand and Prices to Continue Driven by Increasing Exposures and Risk.* https://www.swissre.com/press-release/Swiss-Re-expects-rise-in-demand-and-prices-to-continue-driven-by-increasing-exposures-and-risk/65699a23-a369-4e2f-934d-e223bb6e8c30

Swiss Re. 2022b. *Natural Catastrophes in 2021: The floodgates are open.* Sigma no. 1

Swiss Re. 2023. *Word Insurance – Stirred, and not shaken.* Sigma No. 3.

The Economist. 2020. *The Threat of Irrelevance Spurs Insurers to Consider New Ideas.* 18 June. https://www.economist.com/finance-and-economics/2020/07/18/the-threat-of-irrelevance-spurs-insurers-to-consider-new-ideas

The Geneva Association. 2016. An Integrated Approach to Managing Extreme Events and Climate Risks. Authors: Maryam Golnaraghi, Swenja Surminski and Kai-Uwe Schanz. https://www.genevaassociation.org/sites/default/files/research-topics-document-type/pdf_public/20160909_ecoben4_final_1.pdf

The Geneva Association. 2020a. *An Investigation into the Insurability of Pandemic Risk.* Author: Kai-Uwe Schanz. October. https://www.genevaassociation.org/publication/socio-economic-resilience/investigation-insurability-pandemic-risk

The Geneva Association. 2020b. *Building Flood Resilience in a Changing Climate: Insights from the United States, England and Germany.* Authors: Maryam Golnaraghi, Swenja Surminski and Carolyn Kousky. June. https://www.genevaassociation.org/publication/climate-change-and-environment/building-flood-resilience-changing-climate-insights

The Geneva Association. 2020c. *The Role of Insurance in Mitigating Social Inequality.* Author: Kai-Uwe Schanz. August. https://www.genevaassociation.org/sites/default/files/research-topics-document-type/pdf_public/social_inequality_report_web_final.pdf

The Geneva Association. 2021a. *Digital Entrepreneurship and the Supportive Role of Insurance.* Author: Darren Pain. September. https://www.genevaassociation.org/sites/default/files/digital_entrepreneurship_30_09_2021.pdf

The Geneva Association. 2021b. *Mapping a Path to Cyber Attribution Consensus.* Authors: Rachel Anne Carter and Julian Enoizi. March. https://www.genevaassociation.org/sites/default/files/cyber-attribution_web_final.pdf

The Geneva Association. 2021c. *From Risk Transfer to Risk Prevention: How IoT is reshaping business models in insurance.* Authors: Isabelle Flückiger and Matteo Carbone. May. https://www.genevaassociation.org/publication/new-technologies-and-data/risk-transfer-risk-prevention-how-iot-reshaping-business

The Geneva Association. 2021d. *Climate Change Risk Assessment for the Insurance Industry.* Author: Maryam Golnaraghi. February. https://www.genevaassociation.org/publication/climate-change-and-environment/climate-change-risk-assessment-insurance-industry

The Geneva Association. 2021e. *Public-Private Solutions to Pandemic Risk.* Author: Kai-Uwe Schanz. April. https://www.genevaassociation.org/publication/socio-economic-resilience/public-private-solutions-pandemic-risk

The Geneva Association. 2022a. T*he Role of Insurance in Promoting Social Sustainability.* Author. Kai-Uwe Schanz. November. https://www.genevaassociation.org/publication/socio-economic-resilience/insurance-promoting-social-sustainability

The Geneva Association. 2022b. *Insurance Development in Emerging Markets: The role of public policy and regulation.* Authors. Dennis Noordhoek, Bill Marcoux and Kai-Uwe Schanz. June. https://www.genevaassociation.org/sites/default/files/research-topics-document-type/pdf_public/emerging_markets_web.pdf

The Geneva Association. 2022c. *Financial Wellbeing: Is it the key to reinventing life insurance?* Authors: Adrita Bhattacharya-Craven, Richard Jackson, Kai-Uwe Schanz. May. https://www.genevaassociation.org/publication/health-and-ageing/financial-wellbeing-it-key-reinventing-life-insurance

The Geneva Association. 2023a. *Cyber Accumulation Risk: Fully tackling the insurability challenge.* Author: Darren Pain. November.

The Geneva Association 2023b. *The Return of Inflation: What it means for insurance.* Authors: Kai-Uwe Schanz and Pieralberto Treccani. January. https://www.genevaassociation.org/publication/socio-economic-resilience/return-of-inflation-what-it-means-for-insurance

The Geneva Association. *Managing Risks and Investing in Climate Tech for Industrial Decarbonisation: What can re/insurers offer as risk managers and investors to help expedite market adoption and wide-scale deployment?* Author: Maryam Golnaraghi. Forthcoming.

Thornton, P.K., P.G. Jones, P.J. Ericksen, and A.J. Challinor. 2011. Agriculture and Food Systems in Sub-Saharan Africa in a 4 C+ World. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 369 (1934): 117–136.

UNDRR. 2015. *Global Assessment Report on Disaster Risk Reduction 2015: Making development sustainable, the future of disaster risk management.* https://www.undrr.org/publication/globalassessment-report-disaster-risk-reduction-2015

United States Environmental Protection Agency. 2023. *Learn About Heat Islands.* https://www.epa.gov/heatislands/learn-about-heat-islands

USSIF. 2018. *Report on US Sustainable, Responsible and Impact Investing Trends*.

Van Hulle, K. 2020. Pandemics and Insurability. *White Paper for BIPAR*.

Walker, W.E., P. Harremoës, J. Rotmans, J.P. Van Der Sluijs, M.B., Van Asselt, P. Janssen, and M.P. Krayer von Krauss. 2003. Defining Uncertainty: A conceptual basis for uncertainty management in model-based decision support. *Integrated Assessment* 4 (1): 5–17.

Walker, W.E., R.J. Lempert, and J.H. Kwakkel. 2012. Deep Uncertainty. *Delft University of Technology* 1 (2).

WEF. 2022. *The Global Risks Report 2022 – 17th edition.*

WEF. 2023. *The Global Risks Report 2023 – 18th edition.*

World Meteorological Organization. 2021. Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes (1970–2019). *WMO-No. 126*.

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