CASUALTY ACTUARIAL SOCIETY

Canadian Institute of Actuaries | Institut canadien des actuaires

SOCIETY OF ACTUARIES®

12th Survey of Emerging Risks

October 2019

Document 219115

12th Survey of Emerging Risks

AUTHOR Max J. Rudolph, FSA, CFA, CERA, MAAA
Rudolph Financial Consulting, LLC

SPONSOR Joint Risk Management Section of the Canadian Institute of Actuaries, Casualty Actuarial Society, and Society of Actuaries

Caveat and Disclaimer

The opinions expressed and conclusions reached by the author are his own and do not represent any official position or opinion of the Canadian Institute of Actuaries, the Casualty Actuarial Society or the Society of Actuaries or their members. The Canadian Institute of Actuaries, the Casualty Actuarial Society and the Society of Actuaries make no representation or warranty to the accuracy of the information.

CONTENTS

12th Survey of Emerging Risks

The risk landscape is evolving rapidly. The Intergovernmental Panel on Climate Change (IPCC) issued its special report *Global Warming of 1.5 Degrees Centigrade*,[1] bringing the climate change risk closer to policymakers and the general population. At the same time, an extended calm period surrounding the financial markets made some wonder if a Minsky moment was near.[2] Wildfires burned globally, in places and seasons where they have not commonly occurred, and precipitation and storms led to evacuation and deaths. The Middle East continued to feel the effects of several risks, with forced immigration resulting in second-order impacts around the world. The job of the risk manager is not getting any easier. This landscape sets the tone for the most recent iteration of the Survey of Emerging Risks.

Models require assumptions to provide useful results. As historical data becomes less predictable, it becomes an unknown known, where analysts must extrapolate to an uncertain future. This requires common sense and a willingness to accept contrarian input. For actuaries, even assumptions typically assumed to be credible—for example, accident data, mortality and morbidity—may not be stable over the extended time horizon of a policy or product.

For a company, risks can be thought of by where they fall on a distribution shaped like a bell curve, representing the Normal distribution. Those in the middle are more common. You can price for them, and your competitors generally do as well. As you move further to the right (or left), the severity is greater (or less), but frequency is reduced. For insurers, margins of safety are built into the discount rate, assumptions and capital requirements. These are plausible adverse deviations and should be considered during the pricing process. Events occurring in the tails of the distribution (good or bad), which are sometimes called wild risks, are unlikely but have large impact when they occur. These could be more severe events of risks being considered (say, climate change and pandemics) or something that is a total game changer (e.g., a meteor strike or gamma-ray burst). For this survey, most respondents don't consider events that destroy the earth as emerging risks, because there is nothing that can be done to mitigate the risk. Note that a risk like climate change, although it could eliminate a human presence, has many mitigation tools available in today's environment.

Emerging risks have evolving distributions of outcomes. They may become more volatile, experience a discontinuity (tipping point) or change trend and become less stable. Historical examples include a supervolcano (e.g., the 1815 Mount Tambora eruption that caused global famine and the year without a summer[3]) or pandemic (e.g., influenza in 1918 or plague most recently in the late 1800s). Going forward, a cure for cancer may compete with a rise in diabetes for mortality trend, while autonomous cars may make accidents less likely or encourage traffic to move much faster and maintain the previous level of claims.

Emerging risks are interesting to an institutional investor, due to insolvency risk and the role they play. While an individual risk tail event is rarely enough to lead to bankruptcy, clustering of several of these types

[1] Intergovernmental Panel on Climate Change, Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C Approved by Governments, news release, October 8, 2018, https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/.
[2] A Minsky moment occurs when a long period of positive results and calm in the financial markets leads to a reduced perception of risk (stability breeds instability).
[3] The eruption altered the climate as particles suspended in the atmosphere blocked sunlight and lowered temperatures enough to cause crop failures and food shortages.

of events are a risk for even large companies, since many tend to be systemic risks that are not diversifiable. Scenario planning considers multiple tail events occurring in proximity to each other. Changing distributions makes it important to revisit these assumptions regularly.

This survey attempts to track the thoughts of risk managers about emerging risks across time. It is the 12th survey of emerging risks conducted by the Joint Risk Management Section (JRMS), a collaboration of the Canadian Institute of Actuaries (CIA), Casualty Actuarial Society (CAS) and Society of Actuaries (SOA). Trends are as important as absolute responses, helping risk managers contemplate individual risks, combinations of risks, and unintended consequences of actions and inactions. The survey responses, especially the comments, give risk managers a way to anonymously network with peers and share new ways they think about risk. Each survey enhances the knowledge of those who participate by helping them think more deeply about the topic, and it is anticipated that the reader will benefit in this way as well.

In this report, an executive summary contains a high-level overview of the survey, and a results section provides commentary about the survey in its entirety. Appendix I includes definitions for all 23 individual risks. Complete survey results can be found in Appendix II. This appendix allows the reader to scan specific sections or questions, based on the reader's level of interest, and it includes every comment received for the open-ended questions. Appendix III provides a link for those interested in reviewing previous surveys in the series.

Section 1: Executive Summary

In the period prior to the survey's opening, a number of events related to climate change had occurred. The Camp wildfire in California had recently started, and Hurricane Michael had struck the Florida Panhandle with a direct hit. The Intergovernmental Panel on Climate Change (IPCC) report had been released, but the Fourth National Climate Assessment was released just after the survey was closed.[4] These events changed the perception of some risks relative to others. This evolution of risks is captured in the *12th Survey of Emerging Risks*, completed in November 2018. These events are all examples where extra weight was given to them due to their recent occurrence, called recency bias,[5] which has consistently affected the results of this survey, and 2018 was no different.

With a growing global population now greater than 7 billion people, it is important for food production to continue improving. Current challenges include climate tail events, diseases attacking monoculture crops, and regional conflicts. The rotating question in this survey's iteration, where respondents are asked to choose up to three applicable risks, asked which emerging risks would have the greatest role in creating a global famine. Not surprisingly, nearly all the responses came from the Environmental and Geopolitical categories, with *Climate change* and *Loss of freshwater services* the only risks selected by more than 10%.

The responses across all questions highlight a surge of perceived risk from climate change, along with concerns about financial volatility and a steady but large cyber risk. These key findings emphasize a need for a risk team to evolve along with the risks themselves. It can be useful for the risk team to bring in external contrarians who provide differing perspectives due to alternative experience, whether a life expert helping a casualty shop or a retail risk expert providing input to an investment shop.

1.1 SURVEY FRAMEWORK

In addition to the top and top five emerging risks, the survey also looks at the top current risk and risk combinations. Combinations of risks often follow the patterns shown when looking at emerging risks one at a time but sometimes also reflect surprises. Some risks are more common when viewed with others than by themselves. This paper will review these quantitative responses, looking for material changes and trends, in addition to considering qualitative risk assessments and current topics. First, we will review the questions that headline the survey.

In most years, the survey has found evidence of recency bias, the cognitive bias in which responses gravitate toward risks where events highlighting them have occurred recently. This year's results are consistent with these tendencies, driven by extreme weather events and other events in the news.

1.2 TOP FIVE EMERGING RISKS

Each year's data set is fascinating to review both in isolation, given recent events (recency bias), and in the context of longer-term trends and the changing background of the respondents. Figure 1 shows the pattern of responses when respondents were asked to choose their top five emerging risks from among 23 individual risks (and "other"). The risks roll up into five categories (Economic, Environmental, Geopolitical, Societal and Technological). The Geopolitical category of risks decreased (27% of the total chosen when up to five emerging risks were selected), yet maintained the top category response, as Technological retained

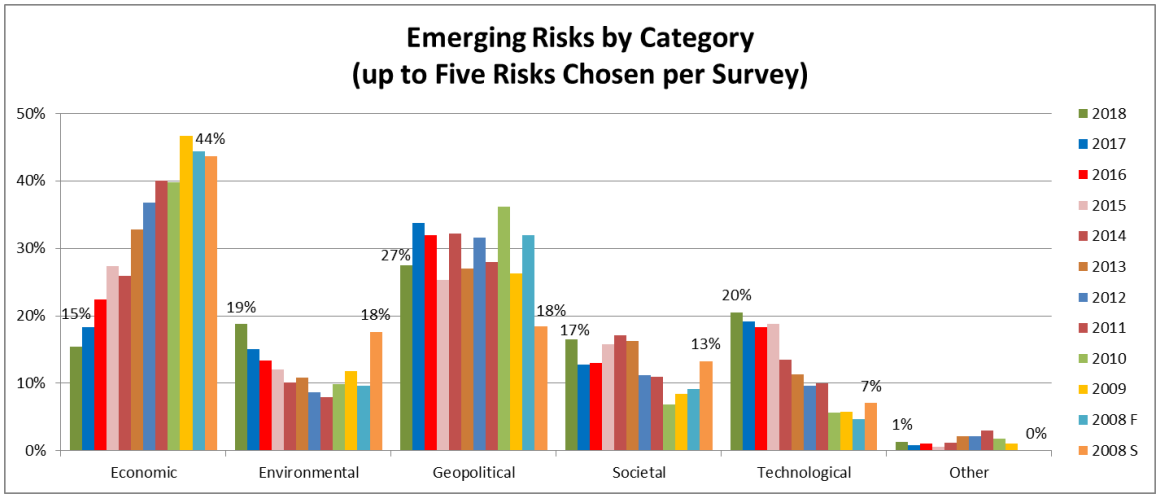
[4] *Fourth National Climate Assessment*, vol. 2, *Impacts, Risks, and Adaptation in the United States*, U.S. Global Change Research Program, November 2018, https://nca2018.globalchange.gov/.

[5] People tend to recall something that has happened more recently more easily than something that occurred in the more distant past. This is recency bias, defined by Daniel Kahneman and Amos Tversky.

second place (20%), just ahead of Environmental (19%), Societal (17%) and Economic (15%). The uppermost choices (although not ranked among the top five risks overall) from the Geopolitical category were *Failed and failing states* (25% of respondents choosing it in their top five, up from 14% in the prior survey) and *Terrorism* (23%, down from 41%).

Figure 1: Emerging Risks by Category (up to Five Risks Chosen per Survey)

% of Responses in Given Year



Risks with new highs across the survey history were *Climate change* (49%), *Loss of freshwater services* (13%), *Natural catastrophe: severe weather* (12%), *Demographic shift* (32%, after recording a low at 23% in the prior survey, and overall fourth choice) and *Technology* (40% and overall third choice). A new low was recorded by *Chinese destabilization* (15%, a new low for the eighth consecutive survey after peaking at 41%), *Asset price collapse* (19%), *Financial volatility* (27%), *Terrorism* (23%) and *Regional instability* (18%).

The reductions in the Economic and Geopolitical categories are the source of gains elsewhere. The financial crisis remains far in the rearview mirror, and international tensions eased.

Cyber/network infrastructure continued in its position at the top of the list of emerging risks, as 56% of respondents listed it as one of their top five emerging risks. It was followed by *Climate change* and *Technology*.

The evolution of the top five risks chosen provides evidence that trends can be relied on in this survey, and the general continuity between survey iterations adds credibility. As shown in Table 1, several risks have been consistently at the top.

Table 1: Top Five Emerging Risks, 2015–2018

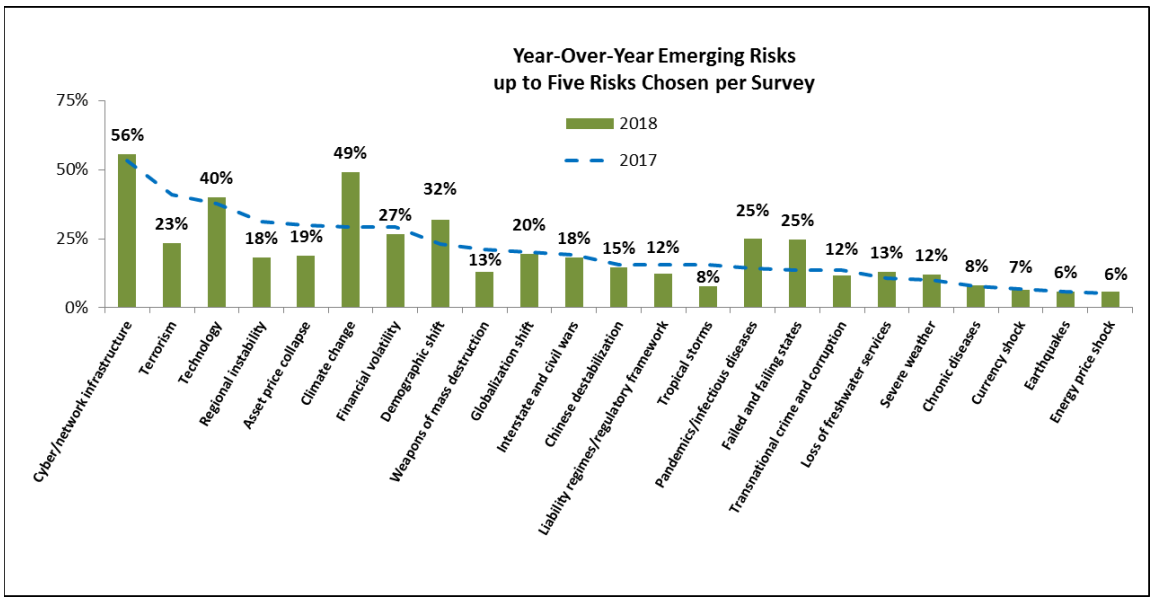
Year	2015	2016	2017	2018
1	Cyber/ interconnectedness of infrastructure	Cyber/ interconnectedness of infrastructure	Cyber/ interconnectedness of infrastructure	Cyber/network infrastructure
2	Financial volatility	Financial volatility	Terrorism	Climate change
3	Terrorism	Terrorism	Technology	Technology
4	Asset price collapse	Technology	Regional instability	Demographic shift
5	Regional instability	Retrenchment from globalization	Asset price collapse	Financial volatility

Four risks increased materially from the previous survey when respondents were asked to choose their top five emerging risks. These included *Climate change, Failed and failing states, Pandemics/infectious diseases* and *Demographic shift*. Several risks were materially lower, including *Asset price collapse* (which fell from 30% to 19%), *Natural catastrophe: tropical storms* (returning to 8% after a spike in the prior survey to 16%), *Terrorism* (23%, down from 41%), *Weapons of mass destruction* (13%, down from 21%) and *Regional instability* (18%, down from 31%). Geopolitical risks were generally down, with *Failed and failing states* the lone increasing risk from that category.

Figure 2 shows the results for the top five emerging risks from the most recent two surveys, listed in order of the risks (and categories), showing the volatility between years.

Figure 2: Year-Over-Year Emerging Risks (up to Five Risks Chosen per Survey)

% of Responses in Given Year



Respondents select from 23 risks in five categories as follows. When a chart shows 24 risks, the last one is *Other*, and the survey asks specifically which risks are missing so they can be considered in the future.

Economic Risks

1. *Energy price shock*
2. *Currency shock*
3. *Chinese destabilization*
4. *Asset price collapse*
5. *Financial volatility*

Environmental Risks

6. *Climate change*
7. *Loss of freshwater services*
8. *Natural catastrophe: tropical storms*
9. *Natural catastrophe: earthquakes*
10. *Natural catastrophe: severe weather (except tropical storms)*

Geopolitical Risks

11. *Terrorism*
12. *Weapons of mass destruction*
13. *Interstate and civil wars*
14. *Failed and failing states*
15. *Transnational crime and corruption*

16. *Globalization shift*
17. *Regional instability*

Societal Risks

18. *Pandemics/infectious diseases*
19. *Chronic diseases*
20. *Demographic shift*
21. *Liability regimes/regulatory framework*

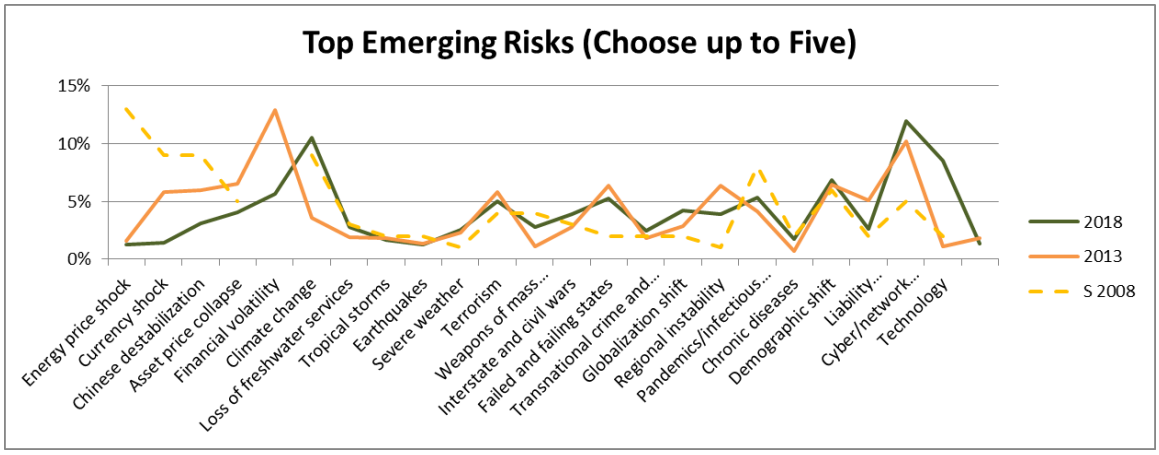
Technological Risks

22. *Cyber/network infrastructure*
23. *Technology*

These results evolve over time, with risk responses ebbing and flowing. Figure 3 shows an example of how the responses for each risk have changed over time, displaying results from spring 2008, 2013 and 2018. (Note that risk number 5, *Financial volatility*, was not added until the 2011 survey.)

Figure 3: Top Emerging Risks (Choose up to Five)

% of Responses in Given Year



1.3 TOP EMERGING RISK

When asked for a single emerging risk from the respondents' top five, the results saw a major change, with *Climate change* advancing from a tie for fifth to a convincing lead at 22%.

The results for the top emerging risk were as follows (60% of respondents selected one of the top five, up from 58% in the previous survey):

1. *Climate change* (22%, up from 7%)
2. *Cyber/network infrastructure* (15%)
3. *Technology* (13%)
4. *Financial volatility* (5%)
5. *Demographic shift* (5%)

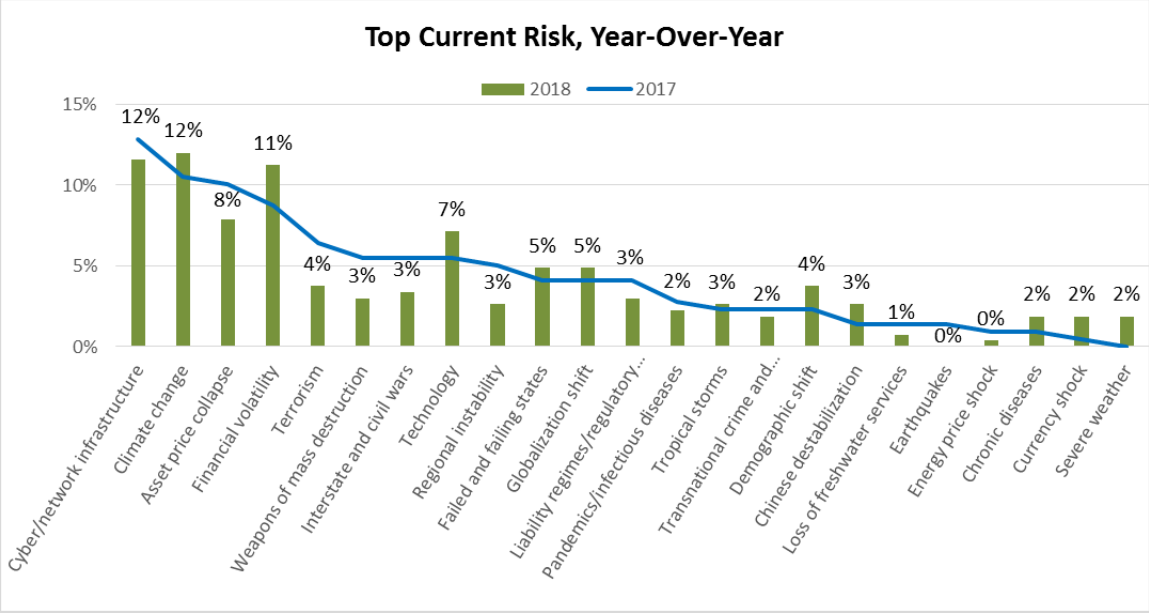
Asset price collapse, *Terrorism* and *Regional instability* dropped out of the top five (including ties). All of the risks except *Natural catastrophe: earthquakes* were selected by at least one respondent as top emerging risk in this survey. The increase in *Climate change* responses led to the highest Environmental category result over the history of the survey (26%, previous high of 12% in 2009, following the United Nations Climate Change Conference in Copenhagen). The Economic category posted its lowest historical result at 13% after a crisis peak of 65% in the very first survey (spring 2008).

1.4 TOP CURRENT RISK

In a close contest, with both results rounding to 12%, *Climate change* edged out *Cyber/network infrastructure* to be the top current risk (see Figure 4). This places the top two risks only slightly ahead of *Financial volatility*.

Figure 4: Top Current Risk, Year-Over-Year

% of Responses in Given Year



1.5 RISK COMBINATIONS

Risk combinations can be insightful, as readers can review which risks other risk managers think could interact in material ways. The top risks chosen in combination were *Climate change, Cyber/network infrastructure* and *Financial volatility*. Interestingly, no combination of these three risks appears in the top ten. Moving into the top five after being unranked in the prior survey, in fourth position, was the combination of *Climate change* and *Loss of freshwater services*. Overall, the Environmental and Societal categories were up, with lower results spread across the other categories. After being included in only one top-five combination in the prior survey, *Climate change* was found in three of the top five and nearly doubled, from 7% to 11%, to now lead risk combinations.

These are the top five combinations that were selected:

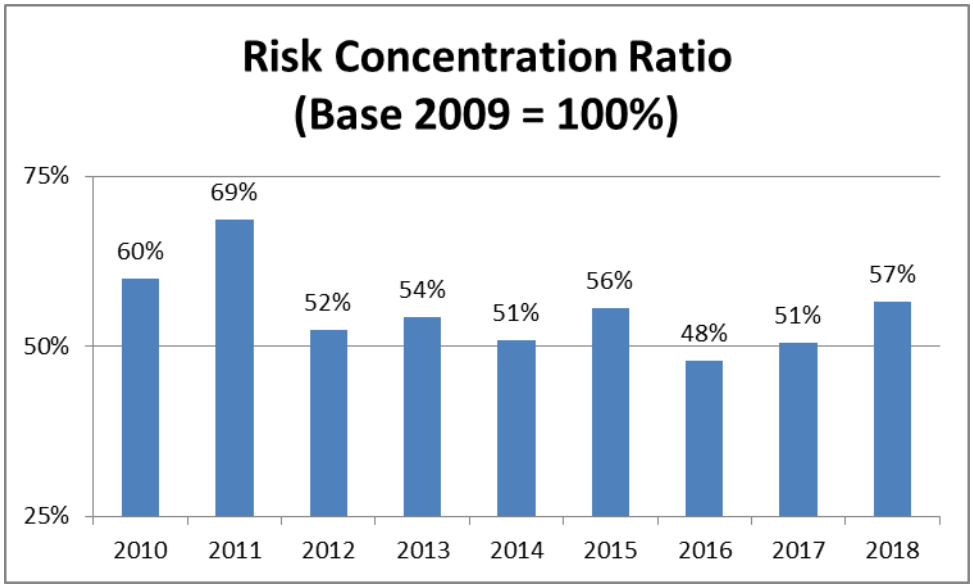
1. *Cyber/network infrastructure* and *Technology*—9%
2. *Asset price collapse* and *Financial volatility*—6%
3. *Climate change* and *Natural catastrophe: severe weather*—4%

4. *Climate change* and *Loss of freshwater services*—4%
5. *Climate change* and *Natural catastrophe: tropical storms*—4%

Results this year for the top five combinations were again more concentrated, with their total adding to 27% after last year's comparable total of 23%.

There are 253 possible two-risk combinations of the 23 risks. As shown in Figure 5, the distribution of results was more concentrated than in the prior year. The period immediately following the financial crisis is likely the extreme case, so 2009 is used as the base year of 100% for the risk concentration ratio. Comparisons are made by ranking the risks and comparing the resulting statistics, looking at the 25th percentile, 50th percentile (median), 75th percentile and total. A higher percentage reflects greater concentration of concerns.

Figure 5: Risk Concentration Ratio (Base 2009 = 100%)



As a relative measure, the risk concentration ratio represents the current feeling among the risk management community. A low risk concentration ratio can be interpreted as reduced risk, or it may mean a greater variety of risks are being considered.

1.6 TRENDING

Figure 6 shows results for this survey by category for the top current risk, the top five emerging risks (as a percentage of the total), the top emerging risk, and combinations. Risk managers are given an option (*Other*) if they feel a risk is not represented in the list; typical references were to political and health/longevity issues. The survey question with the highest response rate includes a data label for each category.

Figure 6: Category Comparison Across Four Questions

% of Responses to Given Question

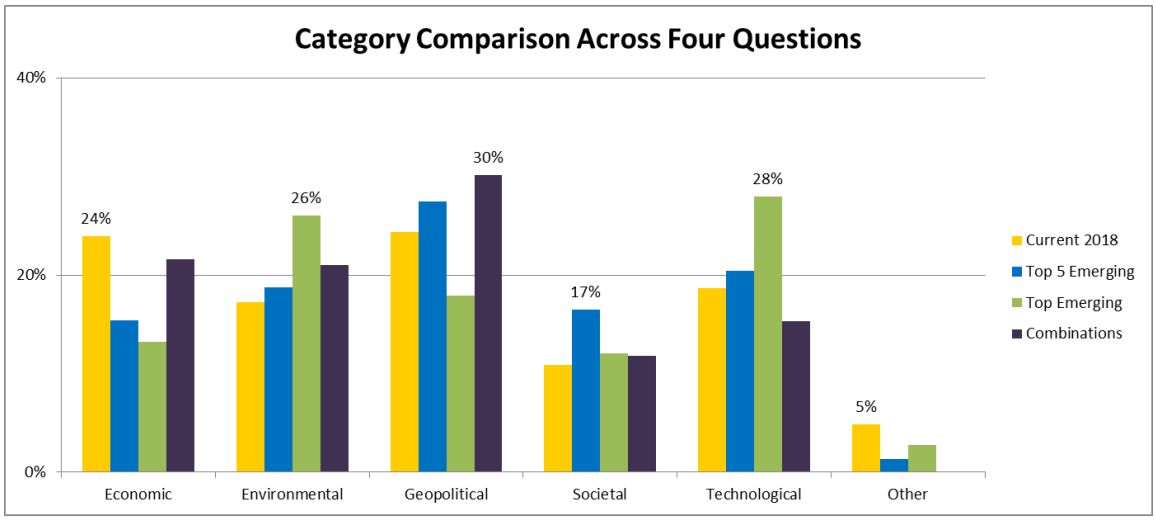
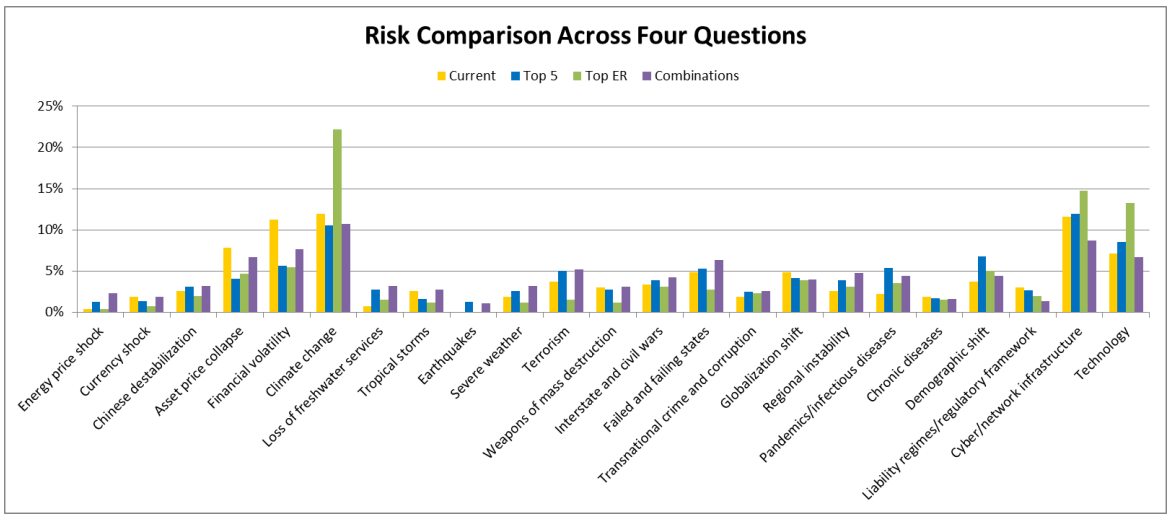


Figure 7 compares the current risk results with the top five, top emerging risk, and combinations at the individual risk level. Hypothesizing why there are discrepancies is useful, and readers may have different viewpoints. The top three risks with the greatest disparity favoring the current risk over the top emerging risk are

- *Financial volatility* (5.8% differential)
- *Asset price collapse* (3.2%)
- *Terrorism* (2.2%)

Figure 7: Risk Comparison Across Four Questions

% of Responses to Given Question



The top three risks with the greatest disparity favoring the top emerging risk over the current risk are

- *Climate change* (10.2%)
- *Technology* (6.1%)
- *Cyber/network infrastructure* (3.2%)

The top three risks (including ties) with the greatest disparity favoring the top five emerging risks over the top emerging risk are

- *Terrorism* (3.5%)
- *Failed and failing states* (2.5%)
- *Pandemics/infectious diseases* (1.8%)
- *Demographic shift* (1.8%)

The top three risks with the greatest disparity favoring the top emerging risk over the top five emerging risks are

- *Climate change* (11.7%)
- *Technology* (4.7%)
- *Cyber/network infrastructure* (2.9%)

The top three risks with the greatest disparity favoring the top current risk over the top five emerging risks are

- *Financial volatility* (5.6%)
- *Asset price collapse* (3.8%)
- *Climate change* (1.5%)

The top three risks with the greatest disparity favoring the top five emerging risks over the top current risk are

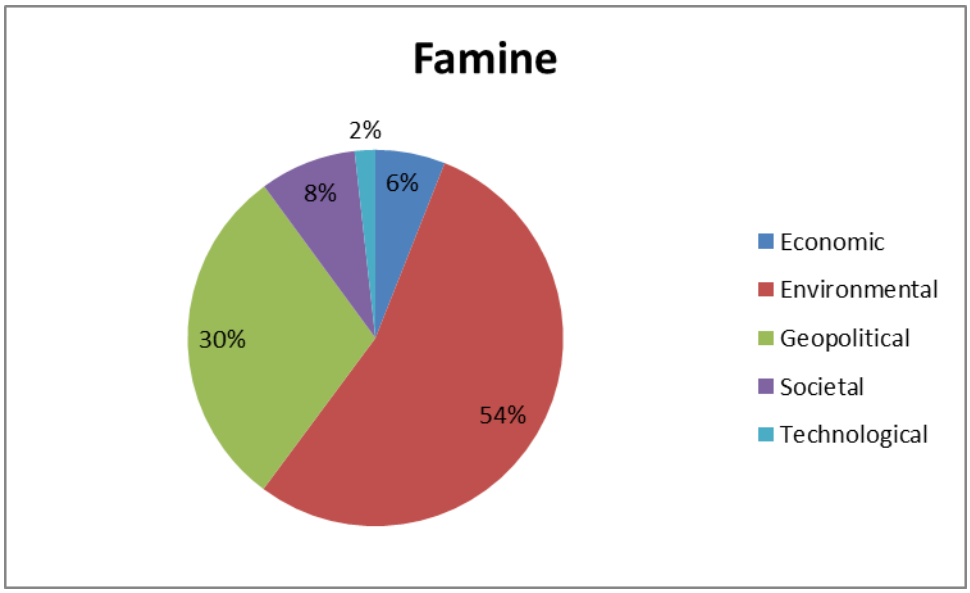
- *Pandemics/infectious diseases* (3.1%)
- *Demographic shift* (3.1%)
- *Loss of freshwater services* (2.0%)

1.7 FAMINE

The downside of nearly all the risks includes difficulty feeding the global population, so a question was formulated to see which risks in particular would have a role in creating a global famine. *Climate change* (24%) and *Loss of freshwater services* (20%) collected nearly half the responses, with Geopolitical risks following the Environmental category. Results by category are shown in Figure 8.

Figure 8: Risk Categories Associated With Global Famine

% of Responses Selected From Category



1.8 EMERGING OPPORTUNITIES

Strategic risk management involves looking past a short time horizon and seeking out opportunities. Respondents were asked which emerging opportunities, either mispriced or to provide diversification, they were monitoring. Some assumed that many asset classes will mean revert from extreme levels. Others shared their search for natural hedges, cyber insurance and catastrophic risk coverage. Still others said they review their reinsurance plan regularly, and many engage with the business lines to provide alternative perspectives about new business lines or potential mergers.

1.9 BUBBLES

Unlike previous surveys, where some respondents argued that there is no such thing as a bubble (that is, market prices are always deemed correct), respondents this time identified potential bubbles. These included a wide variety of asset classes, programs with government subsidies, public pensions, the underwriting cycle, college tuition, student debt and car financing.

1.10 UNKNOWN KNOWNS

Unknown knowns, where the analyst is ignorant of the future event probability distribution, will be a great challenge for the next generation of actuaries. Most respondents suggested they manage the risk using scenario testing or holding additional capital to see which assumptions are material for insolvency. Some of the events shared include the liquidity premium, health system changes and longevity improvements. One respondent noted that assumptions will be stable for shorter time horizons in the future, due to climate change, noting that liabilities should not be guaranteed beyond this period.

1.11 LEADING INDICATORS

As formal risk appetite policies and regulatory processes stabilize, less than half of firms (40%) formally identify emerging risks. An increasing number identify leading indicators for emerging risks (63%); of these,

74% have criteria for action based on them. Examples of the process include tracking geopolitical hot spots and litigation trends.

1.12 RISK VERSUS RETURN

Over half of respondents (60%) said that enterprise risk management (ERM) had a positive effect in their company/industry, and 46% noted that ERM improved returns relative to risk. Examples of positive ERM include analysis of nonfinancial risks and various go/no-go analyses, including more data in the decision-making process. Several respondents noted the importance of the strong risk team as a reminder for management to consider risk, perhaps acting as a second-order impact on decision making.

The respondents who answered *Not sure* about the effect of ERM at their company typically frame the debate in interesting ways. One said, *the benefits are indirect: helping you identify what risks you want to take—and ideally avoid those you don't—and in helping develop preparedness/plans for certain risks.*

Another focused on the cost: *Not clear whether the "risk premium" paid for an ERM framework compared to the additional benefits of managing risks is not entirely clear. Seems like the regulatory emphasis and buzz of ERM creates a need for companies to do something formal to satisfy having an "ERM" function, but the efficiency and effectiveness of having such a function is not always clear. Sometimes seems like a way for senior management to sound like they are fulfilling best practices.*

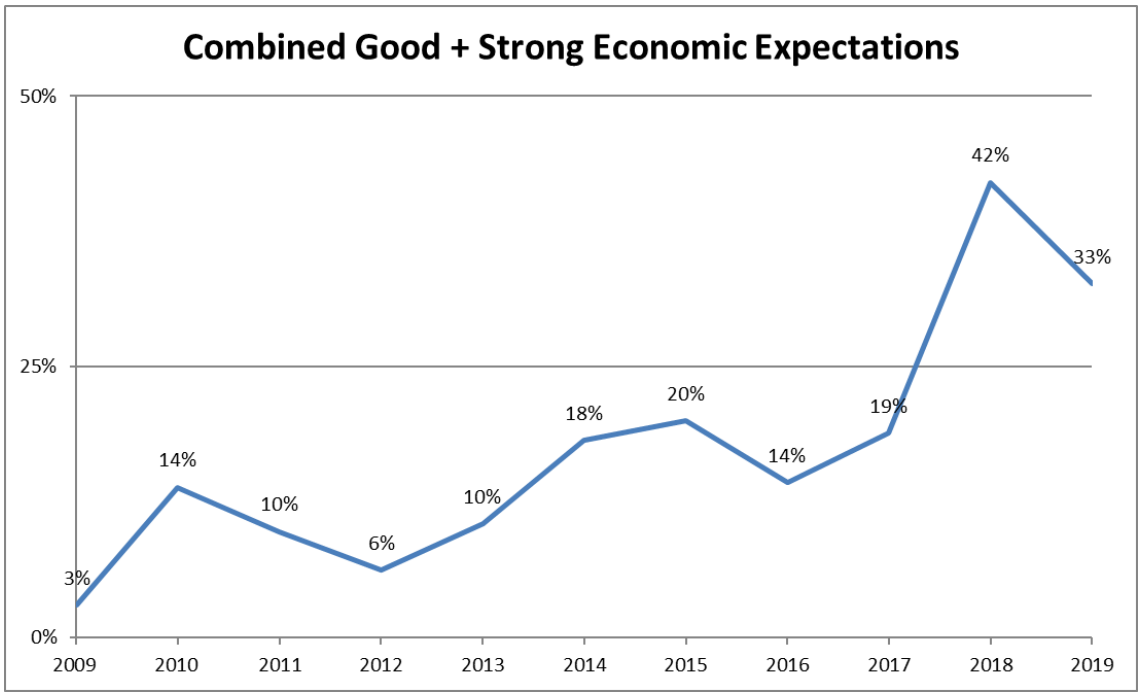
Section C, Question 4, of Appendix II is excellent reading material for both new and experienced risk managers. The quality of these comments is representative of those received throughout the survey, and the reader is encouraged to investigate them.

1.13 ECONOMIC EXPECTATIONS

Respondents are fairly upbeat about global economic expectations, with the second-highest percentage (33%) reporting *good* or *strong* expectations, as shown in Figure 9. Note that the survey closed prior to the volatility encountered by markets in December 2018.

Figure 9: Combined Good + Strong Economic Expectations

% of Responses



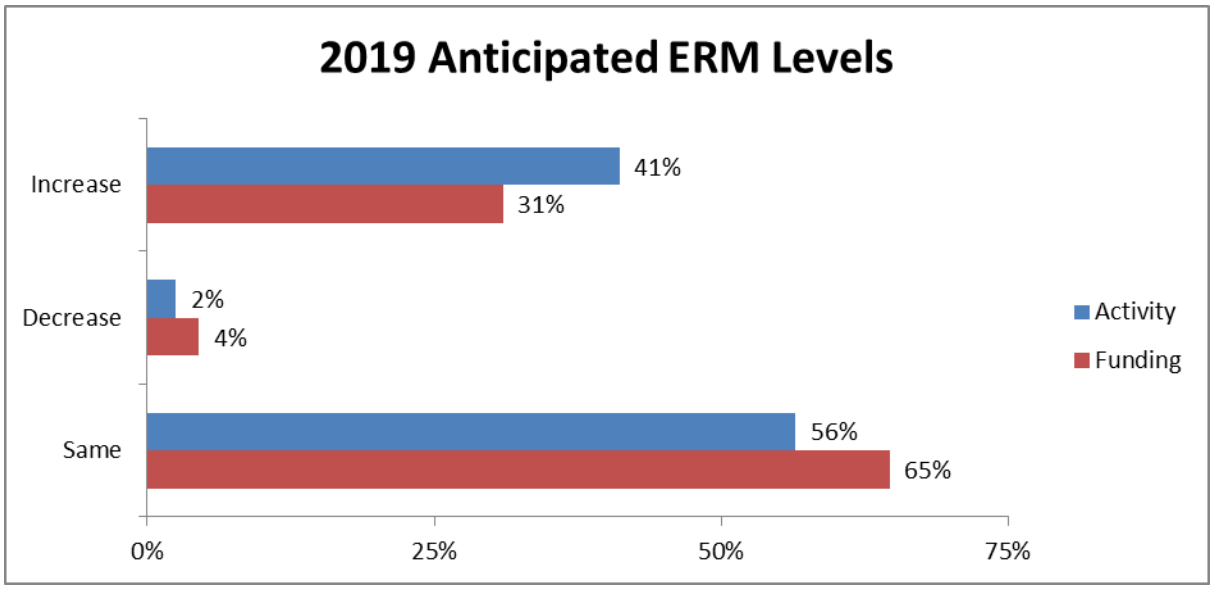
1.14 RISK ACTIVITIES

Risk managers report that cyber risk scenarios have been developed, but there does not appear to be a consistent framework. Respondents make reference to phishing, breaches, malware and how to mitigate the risk by understanding the weaknesses at the point of entry. Some go further, hypothesizing an attack on a cloud service provider or chemical facilities, or emphasize reputation risk. Some use vendors to develop scenarios or submit their plans to external auditors.

Activities related to ERM continued to grow in 2018 (but only 27% of respondents reported experiencing staff growth), with 41% expecting activity growth in 2019. As seen in Figure 10, only 31% of respondents anticipate an increase in funding. Risk managers continue to improve efficiency as actuaries compete with data scientists and other professions.

Figure 10: Anticipated ERM Levels in 2019

% of Responses to Given Question



1.15 STRATEGIC OPPORTUNITY

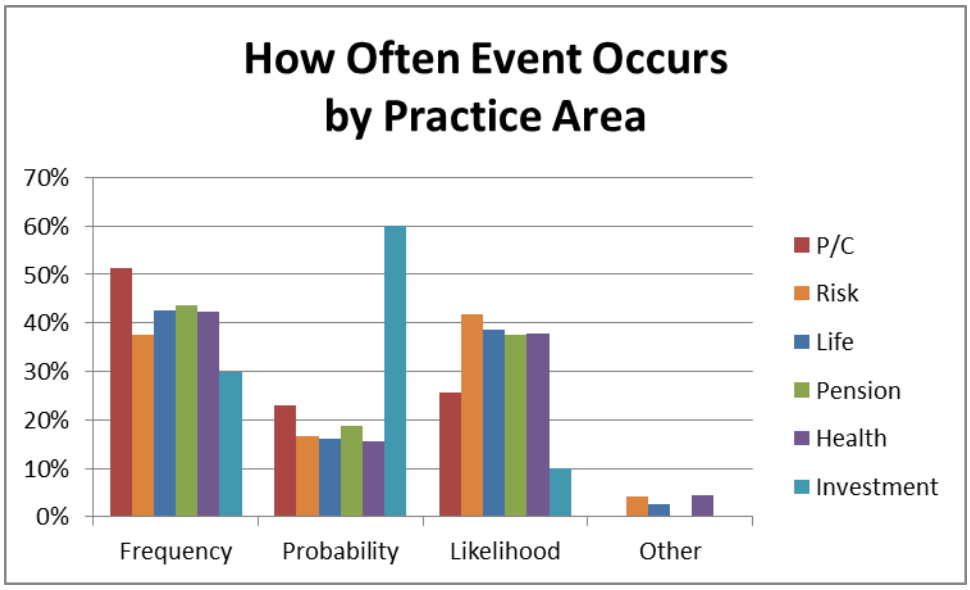
Risk managers reported a higher level of inclusion in decision making surrounding strategic opportunities than in the past (45% have input and a vote, and only 6% have no input). Respondents reported an increasing trend to include the risk team in this process (although sometimes as part of the final due diligence when the decision has already been made), and others mentioned that for small firms, management and the risk team are the same people.

1.16 TERMINOLOGY

Respondents were asked which terms they use to reflect how often an event occurs and how bad the event is. For discussing how often an event occurs, respondents overall favored “frequency” over “likelihood.” However, investment practitioners favored “probability,” as shown in Figure 11. When asked about terms used to describe how bad the event is, results were more stable across practice areas, with “severity” (72%) preferred over “impact” (27%).

Figure 11: Terms Used for Describing How Often Event Occurs, by Practice Area

% of Responses

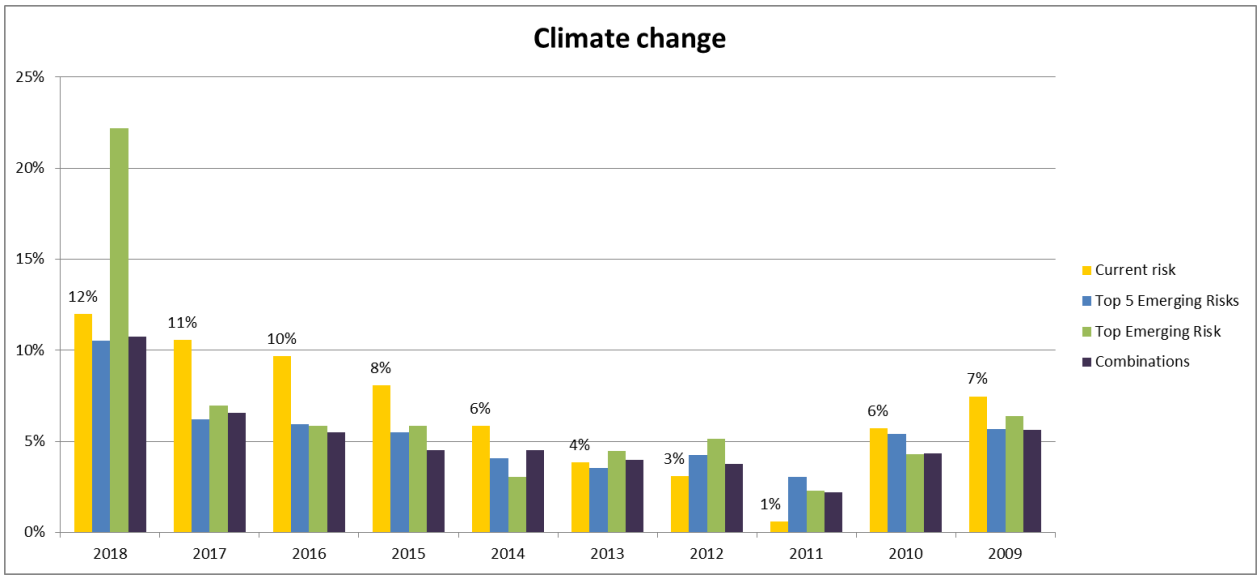


1.17 HIGHLIGHT: CLIMATE CHANGE

While past iterations of the survey have shown an increasing trend toward identifying climate change as a risk, especially for the current-risk question, this survey also showed an increase in the percentage identifying climate change as the top emerging risk: up from 7% in 2017 to 22%, an unprecedented level. For all four questions (current, top-five emerging, top emerging and combinations), response rates for *Climate change* reached their highest response levels across all survey iterations. There is much for risk managers to consider with *Climate change*, as it has impacts on operational, financial and strategic risks. In the current survey it is now the most widely selected of the emerging risks across all questions, except when five are chosen, where it is second to *Cyber/network infrastructure*. As risk managers think about the environmental ecosystem across long time horizons, this trend is likely to continue. Figure 12 shows the progression of response rates for this risk for all questions since 2009.

Figure 12: Response Rates for Climate Change, by Survey Question

% of Responses



Section 2: Top Takeaways

While this report provides many additional nuggets of information to those who read it in its entirety, those who scan the executive summary will find the primary trends and conclusions. The following lists provide interesting tidbits intended to prompt you to read or scan additional sections of the report. Reviewers with different backgrounds and experience from the researcher may highlight alternative comments. For those interested, the entire data set is reproduced in Appendix II.

2.1 WHAT RISK MANAGERS ARE THINKING

- The *Climate change* risk increased to the first- or second-ranked risk across all questions, with an increase from 7% to 22% for top emerging risk.
- By category, Technological risks continue to be highly ranked. *Cyber/network infrastructure* risk concerns have stabilized but remain at the top of the rankings, joined by an increasingly cited *Technology* risk.
- The Geopolitical category maintained its top ranking for top five emerging risks but dropped from the prior survey.
- The Economic category fell once again, offset generally by increases in the Environmental, Societal and Technological categories. The Geopolitical category experienced movement within individual risks but overall had steady results.
- *Climate change, Cyber/network infrastructure* and *Technology* risks were ranked highest for top emerging risk. *Currency shock, Asset price collapse, Financial volatility*, *Globalization shift*, *Chronic diseases* and *Liability regimes/regulatory framework* are ranked highest as a current risk. *Natural catastrophe: earthquakes, Pandemics/infectious diseases* and *Demographic shift* are higher under the question about the top five emerging risks. Combinations are highest for the remaining 11 risks.
- *Technology* risk continues to move up the rankings and is now in the top five for current risk, emerging risks, top emerging risk and combinations. This risk highlights the insurance industry's unique role in risk management, not only managing its own risks but seeking out and accepting the risks of others to help businesses increase resilience.
- Global economic expectations remain high, with 33% of respondents expecting 2019 to be good or strong.

2.2 LEADING-EDGE ACTIONABLE PRACTICES

- Enterprise risk management (ERM) has had a positive effect for many, with improved returns relative to risk when the culture encourages engaged discussions. Some insurance risk managers regularly review their reinsurance programs for efficiency.
- Risk management is moving toward strategic planning in best-practice companies.
- Risk managers consider it their job to present scenarios that cover a range of possible outcomes.
- Concerns were expressed around assets that are overvalued due to government intervention and subsidization, and risk managers had specific concerns about the value received from the college experience (especially the student debt program).
- Risk managers prefer frequency/severity terms over alternative suggestions.
- Historical data that is not predictive, the unknown known, is expected to create havoc for assumption setting across long time horizons. Risk managers shared concerns about liquidity, climate change and mortality/morbidity. These concerns should be evaluated for both assets and liabilities.

2.3 CONCLUSIONS

Companies often perceive risk managers in one of two ways. Risk managers can be seen as a regulatory cost center, completing checklists and called on the carpet when something goes wrong, or they can proactively help a company develop plans for how the company wants to evolve over a stated time horizon. When risk managers participate strategically in a company's business plans, the company becomes more resilient. This does not mean that nothing ever goes wrong, but scenarios have been developed in advance for many situations that could stress a firm. The company generally understands the type of outcomes that are positive and which are negative. The risk team has previously brainstormed these scenarios and so is used to having decision makers communicate with each other. Consequently, when an event occurs, the risk team joins with others in senior management to address it. This allows a company to react quicker and recover faster than it would have otherwise.

Tail events, from both previously managed and emerging risks, must be considered from all perspectives—as operational, financial, reputation and strategic risks. Financial risks should broadly consider portfolios of liabilities, assets and a combination of both to manage asset-liability management risk. This year's survey saw one risk, *Climate change*, surge as responses increased across current, top-five emerging, top emerging and combination risks. In particular, the share of respondents ranking *Climate change* as the top emerging risk increased from 7% to 22% in this iteration of the survey, a percentage increase unprecedented for a risk already receiving over 5% of responses.

Climate risks seem to have reached an awareness tipping point for many risk managers. Events like wildfires and storm intensity seem to be happening with greater frequency, and scientists regularly share reports that indicate events could get much worse as ocean acidity rises, temperatures rise, ice and permafrost melts and the earth's fluid currents (e.g., Arctic jet stream, Gulf stream) weaken. Assumptions historically collected in stable environments now seem more uncertain, requiring a greater margin of safety. These unknown knowns should initiate a revisiting of any products sold with long time horizon guarantees by insurers, as claims may increase for liabilities (e.g., due to drought and hurricanes) and asset risk (e.g., mortgages in coastal urban areas).

Emerging risks are a critical component of a healthy ERM process, and readers of this report will play a critical role in developing a game plan. New and evolving risks can be hard to quantify, especially over long time horizons. Risk and return should be balanced and managed, taking an owner's mentality across a long life cycle.

Section 3: Background

This research project was sponsored by the JRMS of the CIA, CAS and SOA.[6] A survey was developed and made available through an email link to members of the JRMS. Others were invited to participate using the International Network of Actuarial Risk Managers (INARM) Listserv, membership distribution lists of several SOA sections, and social media such as Twitter and LinkedIn groups related to risk management. A total of 267 responses were received. This represents a material percentage relative to the number distributed (more than 2,500 to JRMS). This is the 12th survey completed. Many questions generate sustained trends that suggest conclusions, but the results continue to evolve as the time since the financial crisis lengthens and geopolitical changes occur. The previous surveys were distributed in April 2008, November 2008, December 2009, October 2010, October 2011, October 2012, October 2013, October 2014, November 2015, November 2016 and November 2017. The current-year survey was conducted in November 2018. All articles, podcasts and previous research reports can be found at:

https://www.soa.org/resources/research-reports/2015/research-emerging-risks-survey-reports/

April 2008—First survey

- Article: pages 18–21 of *International News*, August 2008 issue http://soa.org/library/newsletters/international-section-news/2008/august/isn-2008-iss45.pdf
- Article (reprint): pages 17–20 of *Risk Management*, March 2009 issue http://soa.org/library/newsletters/risk-management-newsletter/2009/march/jrm-2009-iss15.pdf

November 2008—Second survey

- Research report: https://www.soa.org/research-reports/2009/research-2009-emerging-risks-survey/

December 2009—Third survey

- Research report: https://www.soa.org/research-reports/2010/research-2009-emerging-risks-survey/
- Article: pages 12–14 of *The Actuary*, August/September 2010 issue http://www.soa.org/library/newsletters/the-actuary-magazine/2010/august/act-2010-vol7-iss4.pdf

October 2010—Fourth survey

- Research report: https://www.soa.org/research-reports/2011/research-2010-emerging-risks-survey/
- Article: pages 6–9 of *Risk Management*, August 2011 issue http://www.soa.org/library/newsletters/risk-management-newsletter/2011/august/jrm-2011-iss22-rudolph.pdf

[6] This section has been updated with new information but is otherwise consistent with prior surveys.

October 2011—Fifth survey

- Research report: https://www.soa.org/research-reports/2012/research-2011-emerging-risks-survey/

October 2012—Sixth survey

- Research report: https://www.soa.org/research-reports/2013/research-2012-emerging-risks-survey/
- Article: pages 12–17 of *Risk Management*, August 2013 issue https://soa.org/Library/Newsletters/Risk-Management-Newsletter/2013/august/jrm-2013-iss27.pdf

October 2013—Seventh survey

- Research report: https://www.soa.org/research-reports/2014/2013-emerging-risks-survey/
- Article: pages 34–35 of *Risk Management*, August 2014 issue https://www.soa.org/globalassets/assets/library/newsletters/risk-management-newsletter/2014/august/jrm-2014-iss30.pdf

October 2014—Eighth survey

- Research report: https://www.soa.org/research-reports/2015/2014-emerging-risks-survey/
- Article: pages 5–6 of *Risk Management*, April 2016 issue https://www.soa.org/globalassets/assets/library/newsletters/risk-management-newsletter/2016/april/rm-2016-iss-35.pdf

November 2015—Ninth survey

- Research report: https://www.soa.org/research-reports/2016/2015-emerging-risks-survey/

November 2016—Tenth survey

- Research report: https://www.soa.org/research-reports/2017/10th-emerging-risks-survey/
- SOA News Canada blog, September 2017: https://www.soa.org/Files/Research/Projects/erm-lessons-master.pdf
- Summary of findings: https://www.soa.org/Files/Research/Projects/10th-emerging-risks-survey-summary.pdf

November 2017—Eleventh survey

- Research report and Research Insights podcast: https://www.soa.org/resources/research-reports/2018/11th-emerging-risk-survey/
- SOA News Canada blog, February 2019: https://blog.soa.org/2019/02/22/how-a-risk-team-adds-value/
- Key findings: https://www.soa.org/globalassets/assets/Files/resources/research-report/2018/11th-emerging-risk-survey.pdf

Rather than developing a unique set of emerging risks for consideration when the survey was first developed, the research team chose one originally created by the World Economic Forum (WEF). The WEF reports (annually since 2007) can be found at www.weforum.org. The 23 risks used in this survey are described in detail in Appendix I. They differ slightly from those in previous years. Some definitions were updated for consistency and to reflect current common risk definitions. *Chinese economic hard landing* was renamed *Chinese destabilization* to broaden the risk. The former risk name *Cyber/interconnectedness of infrastructure* was changed to *Cyber/network infrastructure* to clarify that it would include infrastructure grids for such things as power, finance and internet. Technological risks evolve more quickly than other categories so will be expected to be listed here more often than most other risks. Each risk has been categorized as either Economic (five risks), Environmental (five), Geopolitical (seven), Societal (four) or Technological (two). The current survey continues this evolution, adding and subtracting a few questions while leaving the core of the survey intact. Responses to open-ended questions have been minimally edited.

Note that individual results have generally been rounded to the nearest 1%, so stated totals may not add up to exactly 100%. (Charts reflect the actual splits.)

Research reports do not create themselves in isolation, and the researcher thanks Dave Ingram, Steve Hodges, Victor Chen, Jan Schuh and Ronora Stryker for their help designing and implementing the questionnaire, along with gleaning information from the results. Of course, all errors and omissions remain the responsibility of the researcher.

3.1 RESEARCHER

The researcher for this project is Max J. Rudolph. Additional related articles and presentations can be found at his website or LinkedIn profile. His contact information is

Max J. Rudolph, FSA, CFA, CERA MAAA
Rudolph Financial Consulting, LLC
5002 S. 237th Circle
Elkhorn, NE 68022
402-895-0829
max.rudolph@rudolph-financial.com
www.rudolph-financial.com
Twitter: @maxrudolph

Section 4: Results

The *12th Survey of Emerging Risks*, sponsored by the JRMS, includes sections covering current risk, emerging risks, leading indicators, methodology, predictions and current topics. Highlights of each section are presented here, with complete results found in Appendix II. Respondents submitted a total of 267 surveys (up from 222 in the prior survey). The survey requests individual rather than formal company responses. It uses an anonymous electronic format that encourages the expression of opinions. Many multiple-choice format questions are followed up with questions asking "why" or "provide examples," allowing expansion of the concept and additional learning for readers of the results. In some cases, the written responses have been sorted based on the answer to the corresponding multiple-choice question. Readers are encouraged to review all of the comments, compiled in Appendix II, and determine their own conclusions.

The analysis includes partially completed surveys, with percentages adjusted for the number completing each question. Answers of *Not sure* and *Not applicable* were typically excluded from percentages, except when these responses were considered meaningful. The responses were very thought-provoking for the researcher, as occurs each year.

4.1 WHAT CHANGES IN RESPONSES MEAN

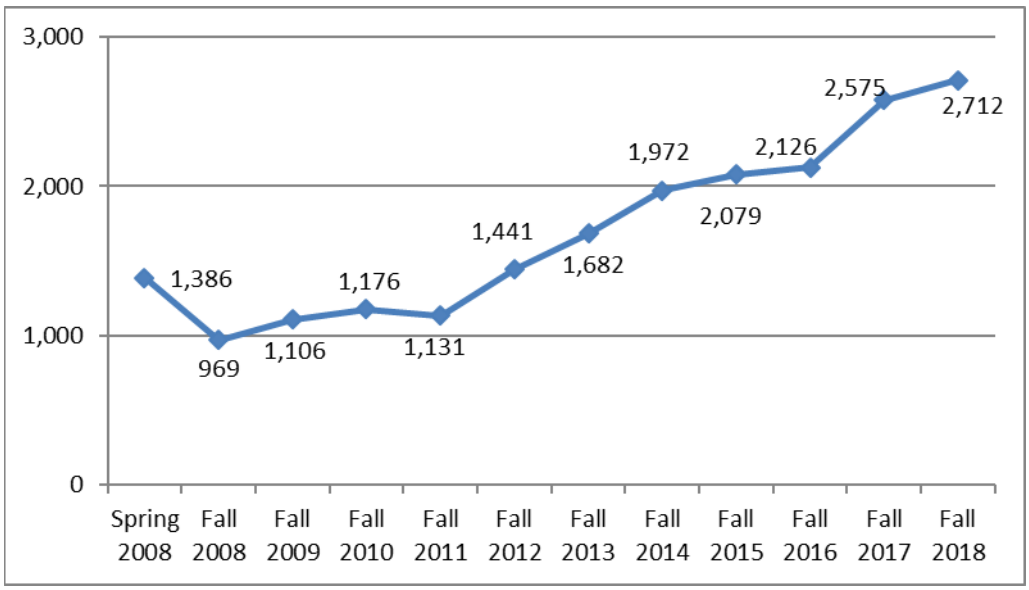
Note that each survey is taken at a different point in history, so the same risk managers do not necessarily respond. This year, 38% of respondents reported that they also participated last year. Repeat respondents might change their responses based on new or recent experiences. Increases and decreases in response rates reflect the respondents' relative perception of the risk, not actual changes in assessment of the risk itself. A risk may not have changed at all, but another risk may be perceived as higher or lower, and that affects the relative importance of other risks.

It can be confusing to talk about percentage changes when survey results are reported in percentages, so changes are always reported as absolute percentage point changes. For example, if the previous survey reported a 10% response rate and this year's response rate is 15%, this is a 5% change (not 50%).

4.2 HISTORY

As in previous reports, the survey results show that current values of the Standard & Poor's 500 (S&P 500) equity index (Figure 13), the price of a barrel of oil (Figure 14) and the exchange rate of the Euro relative to the U.S. dollar (Figure 15) seem to anchor perceptions of risk. Results have evolved over time, often led by recent news topics. Only economic factors are shown here, and the researcher would be interested in suggestions of other metrics that are considered drivers of perceptions of emerging risks. As described below, the first survey was conducted in April 2008 (spring) and all subsequent surveys have been in the fall.

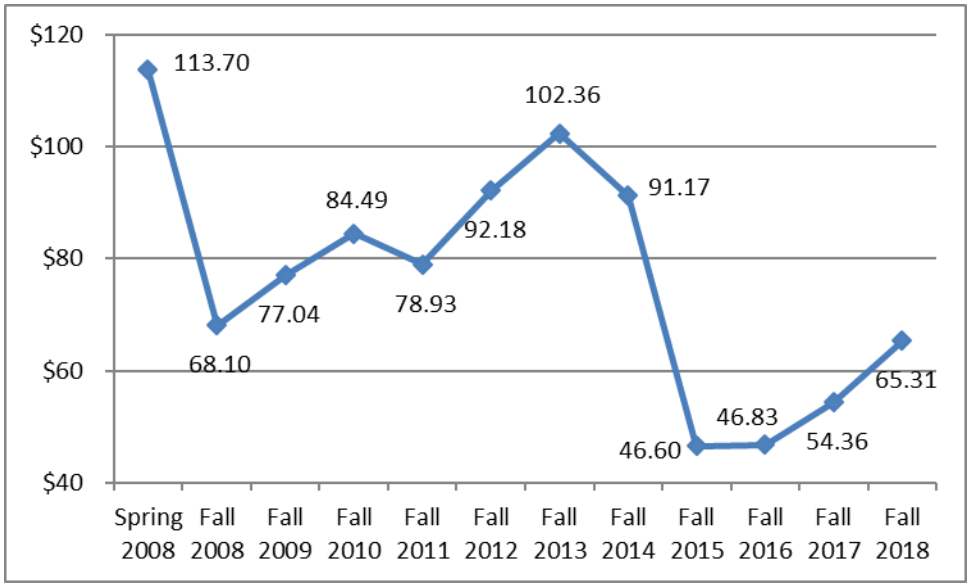
Figure 13: S&P 500, 2008–18



S&P Dow Jones Indices LLC, S&P 500 [SP500], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/SP500, August 22, 2019.

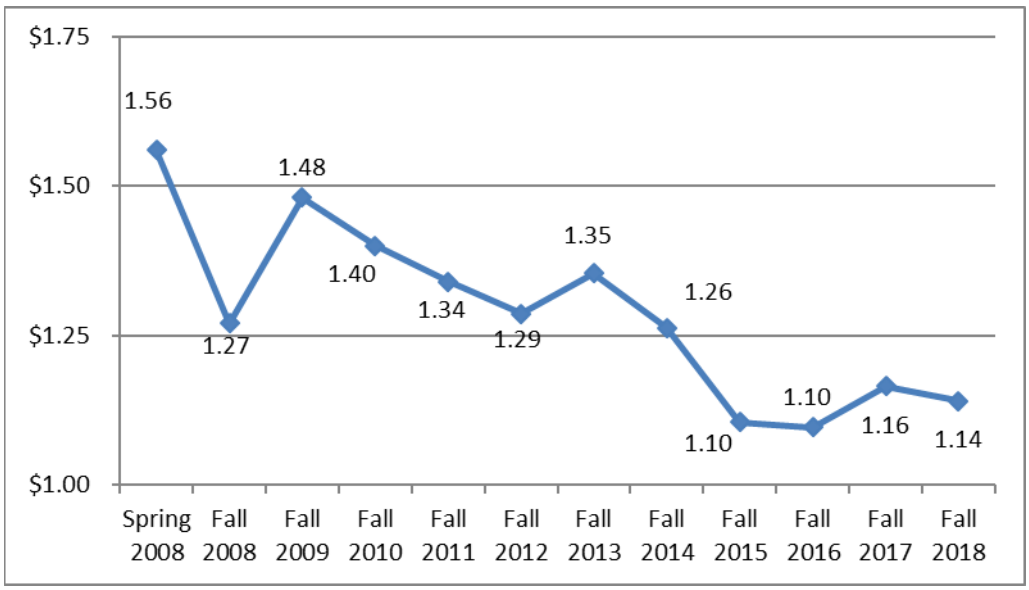
Figure 14: Price of Oil, 2008–18

$ per barrel



Source: U.S. Energy Information Administration, Cushing, OK WTI Spot Price FOB, http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D

Figure 15: Exchange Rate, Euros per U.S. Dollar, 2008–18



Source: Board of Governors of the Federal Reserve System, Foreign Exchange Rates (H.10): Historical Rates for the EU Euro, http://www.federalreserve.gov/releases/h10/Hist/dat00_eu.htm

Recency bias influences the results of any survey. The geopolitical environment continued to evolve as populists proceeded to seek out power at the highest levels, while climate change seemed to hit a tipping point in risk managers' consciousness as the impacts were felt regularly in the developed world. North Korea, Venezuela and Syria continued as hot spots, while the earth warmed and financial markets stayed relatively calm. The following information provides context to previous surveys. Note that these responses are to a question asking for respondents' top five emerging risks. For example, in Survey 1 listed immediately below, *Oil shock* was listed by 57% of respondents as one of their five. (Ed. note: Some risk names have evolved over time; e.g., *Oil shock* is now *Energy price shock*.)

Survey 1 (April 2008)

1. *Oil shock* (57% of respondents)
2T. *Climate change* (40%)
2T. *Asset price collapse* (40%)
4. *Currency trend* (38%)

With oil at historic highs, it was the predominant emerging risk in the initial survey. The second survey was completed in early November 2008, shortly after troubles surfaced at Lehman Brothers, AIG and the mortgage giants Fannie Mae and Freddie Mac. By the end of October 2008, from the previous survey, the S&P 500 had dropped 30%, the price of a barrel of oil had decreased 40%, and the U.S. dollar had strengthened 23%. The top four emerging risks from this second iteration of the survey were as follows:

Survey 2 (November 2008)

1. *Asset price collapse* (64%)
2. *Currency trend* (48%)
3. *Oil price shock* (39%)
4. *Regional instability* (34%)

Systemic risk was perceived to be very high at the time, with asset values in free fall. Oil prices had fallen, U.S. currency was considered a safe harbor, and Barack Obama had just been elected to his first term as U.S. president. The third survey was in December 2009, by which time the S&P 500 had increased 14%, the price of a barrel of oil was up 13% and the U.S. dollar had weakened 17%. The economy had begun to recover. For the first time, the top four emerging risks included *Chinese economic hard landing.*

Survey 3 (December 2009)

1. *Currency trend* (66%)
2. *Asset price collapse* (49%)
3. *Oil price shock* (45%)
4. *Chinese economic hard landing* (33%)

The indicators had not changed materially by late 2010 as the European debt crisis ramped up. The stock market was up 6%, the price of oil was up 10%, and the dollar had further strengthened by 6%. Most of the top-five results continued to come from the Economic category. *International terrorism* and *Failed and failing states* made their first appearance among the top five.

Survey 4 (October 2010)

1. *Currency trend* (49%)
2. *International terrorism* (43%)
3. *Chinese economic hard landing* (41%)
4. *Oil price shock* (40%)
5. *Failed and failing states* (38%)

In late 2011, the U.S. stock market was down 4% overall and volatile during the year, the price of oil was down 7%, and the dollar had further strengthened against the euro by 4%. Several major events occurred, including the Japanese earthquake/tsunami and the Arab Spring.

Some of the risks were updated for the 2011 survey. One risk was moved to a different category, two were combined, and one was added. (These changes, along with others since then, are described in Appendix I. Comparisons were adjusted for trending purposes.) Most of the top-six results continued to come from the Economic category. A new risk, *Financial volatility*, resonated with risk managers, as they made it their top selection. This was the first time that *Cybersecurity/interconnectedness of infrastructure* appeared in the top five and the last time (to date) that *Oil price shock* (or *Energy price shock*) has appeared.

Survey 5 (October 2011)

1. *Financial volatility* (68%)
2. *Failed and failing states* (42%)
3. *Cybersecurity/interconnectedness of infrastructure* (38%)
4. *Chinese economic hard landing* (32%)
5. *Oil price shock* (32%)
6. *Regional instability* (32%)

In 2012, equity markets surpassed the levels of spring 2008 for the first time (up 27% since the previous survey), while oil prices rebounded (17%) and the dollar strengthened (4%).

Survey 6 (October 2012)

1. *Financial volatility* (62%)
2. *Regional instability* (42%)
3. *Cybersecurity/interconnectedness of infrastructure* (40%)
4. *Failed and failing states* (33%)

5. *Chinese economic hard landing* (31%)

Equity markets (17%) and oil prices (11%) continued their upward trend in 2013, while the dollar reversed course and weakened (5%) versus the euro. Natural disasters were prominent, including Hurricane Sandy in the United States and Typhoon Haiyan in Asia.

Survey 7 (October 2013)

1. *Financial volatility* (59%)
2. *Cybersecurity/interconnectedness of infrastructure* (47%)
3. *Asset price collapse* (30%)
4. *Demographic shift* (30%)
5. *Failed and failing states* (29%)
6. *Regional instability* (29%)

By the fall of 2014, the dollar had started to strengthen against the euro (7%), the stock market was up (17%), and the price of oil had started to go down (12%). Much stronger moves in oil and the dollar occurred after the survey closed, leaving the geopolitical crisis in Eurasia as a top concern. An Ebola outbreak in Africa raised concerns of a pandemic.

Survey 8 (October 2014)

1. *Cybersecurity/interconnectedness of infrastructure* (58%)
2. *Financial volatility* (44%)
3. *International terrorism* (41%)
4. *Regional instability* (37%)
5. *Asset price collapse* (31%)

Fall 2015 saw the dollar strengthen relative to the euro (up 14%), which also drove the price of oil down (by 49%), since it is primarily transacted in dollars. The U.S. stock market increased by 5%, and cyber risk seemed to be constantly in the news.

Survey 9 (November 2015)

1. *Cybersecurity/interconnectedness of infrastructure* (65%)
2. *Financial volatility* (45%)
3. *Terrorism* (37%)
4. *Asset price collapse* (31%)
5. *Regional instability* (26%)

The fall 2016 survey occurred during a period of transition, with the survey completed immediately following the U.S. presidential election, and the metrics were stable. The top three risks remained the same. *Retrenchment from globalization* made the largest move, as voters around the world considered populist candidates and causes. The top catastrophic events in 2016 were earthquakes, wildfires and flooding, due to tropical storms (e.g., Hurricane Matthew) and thunderstorms.[7]

Survey 10 (November 2016)

1. *Cyber/interconnectedness of infrastructure* (53%)
2. *Financial volatility* (44%)

[7] Swiss Re, "Preliminary Sigma Estimates for 2017: Global Insured Losses of USD 136 Billion Are Third Highest on Sigma Records," news release, December 20, 2017, http://www.swissre.com/media/news_releases/nr20171220_sigma_estimates.html.

3. *Terrorism* (39%)
4. *Technology* (34%)
5. *Retrenchment from globalization* (30%)

The fall 2017 survey capped a period of calm following the global financial crisis nearly 10 years ago, while geopolitical tensions continued to be high. Natural disasters, some driven by record warming, included Hurricanes Harvey, Irma and Maria, along with atmospheric rivers on the West Coast of the United States and wildfires. Earthquakes in Mexico, Cyclone Debbie in Australia, European temperature extremes and Asian flooding all contributed to worldwide risk events.

Survey 11 (November 2017)

1. *Cyber/interconnectedness of infrastructure* (53%)
2. *Terrorism* (41%)
3. *Technology* (38%)
4. *Regional instability* (31%)
5. *Asset price collapse* (30%)

The personal impact of climate change was highlighted in 2018 by wildfires, flooding, heat waves and storm concentrations felt as Hurricane Michael, heavy winter storms and nor'easters. Geopolitical tensions remained high, although events in North Korea and Syria received less attention in the press. The Mueller investigation in the United States was nearing its conclusion.

Survey 12 (November 2018)

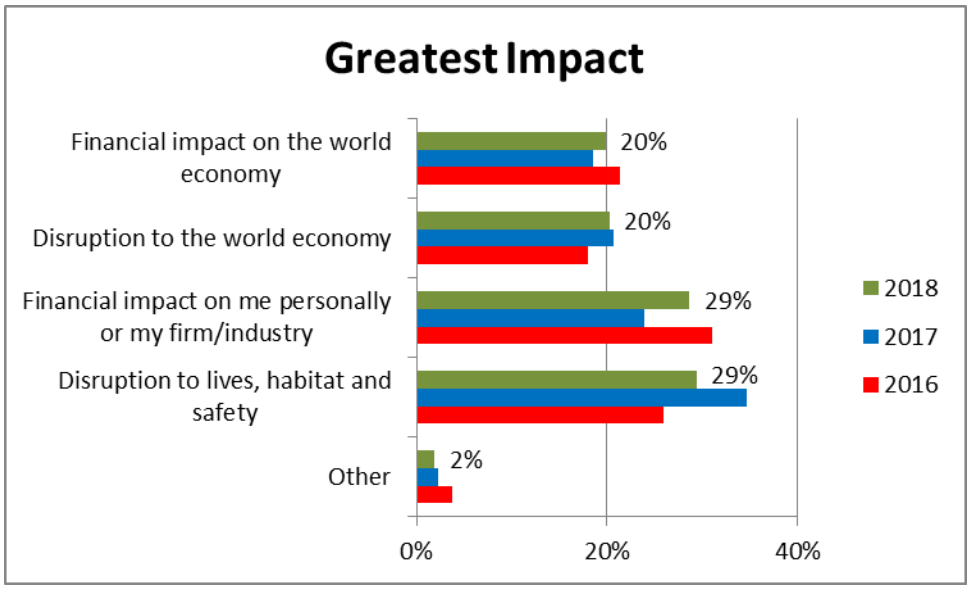
1. *Cyber/network infrastructure* (56%)
2. *Climate change* (49%)
3. *Technology* (40%)
4. *Demographic shift* (32%)
5. *Financial volatility* (27%)

4.3 INTRODUCTORY QUESTIONS

Respondents have varying definitions of the greatest "strategic impact related to risk." Among the response options for defining strategic impact, four were selected by at least 20% of respondents. As shown in Figure 16, the most commonly selected definition was *Disruption to lives, habitat and safety* (29%), remaining the top response by a small amount.

Figure 16: Definitions of Strategic Impact

% of Responses



Respondents also were asked to consider 23 risks and identify the risk with the greatest strategic impact. Complete definitions of the risks are provided in Appendix I, but they are also listed here for convenience.

Economic Risks

1. *Energy price shock*
2. *Currency shock*
3. *Chinese destabilization*
4. *Asset price collapse*
5. *Financial volatility*

Environmental Risks

6. *Climate change*
7. *Loss of freshwater services*
8. *Natural catastrophe: tropical storms*
9. *Natural catastrophe: earthquakes*
10. *Natural catastrophe: severe weather*

Geopolitical Risks

11. *Terrorism*
12. *Weapons of mass destruction*
13. *Interstate and civil wars*
14. *Failed and failing states*
15. *Transnational crime and corruption*
16. *Globalization shift*
17. *Regional instability*

Societal Risks

18. *Pandemics/infectious diseases*
19. *Chronic diseases*
20. *Demographic shift*
21. *Liability regimes/regulatory framework*

Technological Risks

22. *Cyber/network infrastructure*
23. *Technology*

4.4 CURRENT RISK

Each year a benchmarking question is asked about the top current risk. When the respondents answer this question, they are reminded of recency cognitive bias, an anchoring effect identified in prior surveys. In the field of behavioral finance, it is thought that recognizing our shortcomings will help us to overcome them.

Changes to risk names and definitions since the original WEF-defined risks are documented in Appendix I. The 23 emerging risks used in this iteration of the survey were reviewed. Names were changed for two risks, and six risks had their definitions updated. Some of the changes were to clarify that the earthquakes risk includes volcanic activity and to include antimicrobial resistance along with pandemic risks. Minor changes were made to the definitions of several other risks.

The distribution of results by category follows, along with prior-year results.

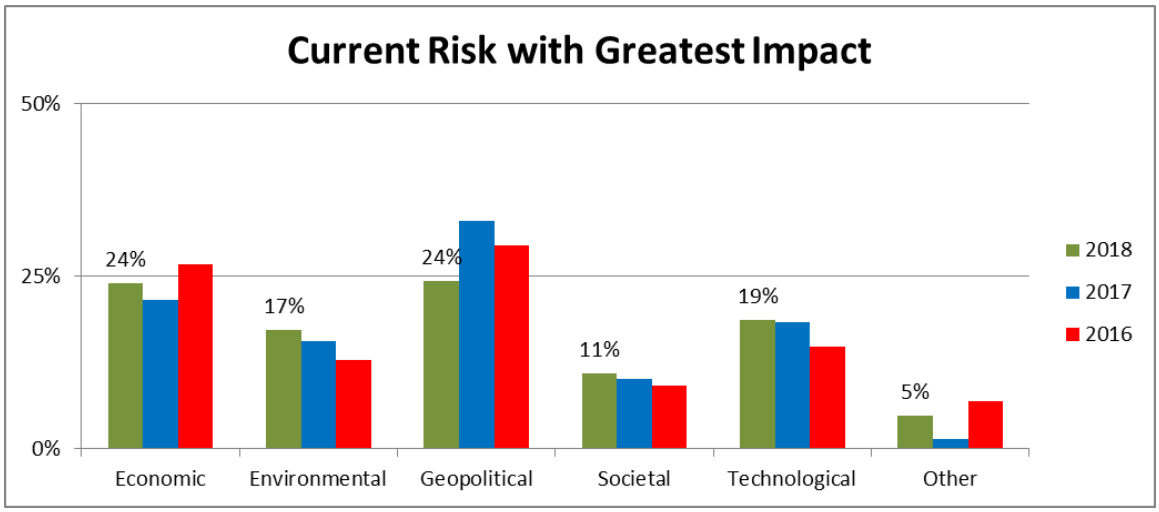
- Economic 24%/22%/27% (2018/2017/2016 surveys)[8]
- Environmental 17%/16%/13%
- Geopolitical 24%/33%/29%
- Societal 11%/10%/9%
- Technological 19%/18%/15%
- Other 5%/1%/7%

As shown in Figure 17, the Geopolitical category maintained its top ranking for the risk currently having the greatest impact, closely followed by the Economic category. All categories except Geopolitical increased this year. The Economic category increased by 2 percentage points,[9] rising for the first time since 2011. Each of the other categories grew by small amounts, with Other making a jump to 5% due to political concerns. (Many responses in this group could have been allocated to *Globalization shift*, so that risk is underreported.)

[8] All tables include the most recent results, starting with the current survey and working backward, as shown here.
[9] Throughout this report a percentage point change means an absolute increase or decrease (e.g., a 2 percentage point increase from 22% is 24%) and does not reflect a percent change (e.g., a 2% increase from 22% is 22.4%).

Figure 17: Current Risk with Greatest Impact

% of Responses in Given Year



From an individual risk perspective, *Climate change* took over the top spot, with 12% selecting it as having the most impact, edging out *Cyber/network infrastructure*, which fell to second position. The top gainer was *Financial volatility* (increase from 9% to 11%). *Terrorism* fell the most, from 6% to 4%.

All risks except *Natural catastrophe: earthquakes* were chosen as the top current risk by at least one respondent.

Figure 18 shows how current risks can change between surveys. Interestingly, each of the three risks chosen least in the prior survey showed increases. Data labels reflect 2018 results.

Figure 18: Top Current Risk, Year-Over-Year

% of Responses in Given Year

The top three current risks were separated by a total of two responses. These were the top five current risks chosen:

1. *Climate change* (12%)
2. *Cyber/network infrastructure* (12%)
3. *Financial volatility* (11%)
4. *Asset price collapse* (8%)
5. *Technology* (7%)

4.5 SECTION A: EMERGING RISKS

Emerging risks in this survey are probed from several perspectives; top-five, top, and combinations. Respondents look at each type using a separate question.

4.5.1 Top Five: Environmental and Societal Risks Surge

After choosing which risk has the greatest current impact, respondents chose up to five emerging risks that "you feel will have the greatest impact over the next few years." The WEF suggests a reasonable time horizon of 10 years, but that is not required here. The data is compared across surveys and considers recent events as part of the analysis. Each survey has come at a unique time in history.

While 80% of respondents chose the full complement of five risks, the average number selected was down slightly to 4.68. Percentages reported for this survey are based on the number of respondents who answered the specific survey question. This allows consistent comparison with previous and subsequent survey iterations.

The Geopolitical category maintained its lead (27% of the total selections came from this category), despite placing no individual risks higher than seventh (*Failed and failing states*), with the Technological category in second place, followed by Environmental, Societal and Economic. The results distributed by category (using percentages of total responses) are as follows:

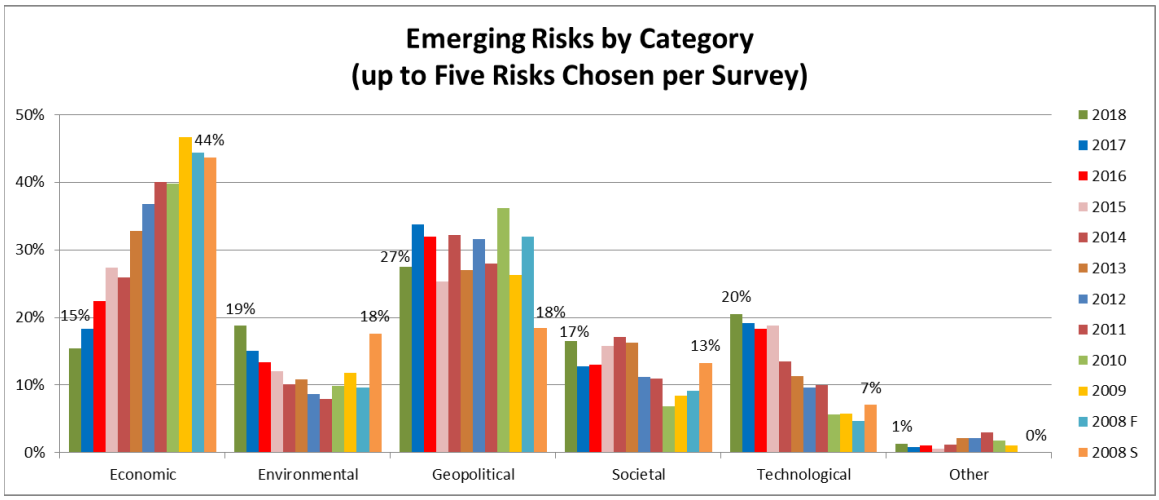
1. Geopolitical 27%/34%/32% (2018/2017/2016 surveys)
2. Technological 20%/19%/18%
3. Environmental 19%/15%/13%
4. Societal 17%/13%/13%
5. Economic 15%/18%/22%

Over the past two surveys, the Economic category has fallen to fifth, passed by the Environmental and Societal categories.

As Figure 19 shows, each category has its own story across the history of the survey. Technological and Environmental risks have grown materially over time, and Economic risks have received less attention of late, while Geopolitical and Societal risks appear to have their own cycles.

Figure 19: Emerging Risks, by Category (up to Five Risks Chosen per Survey)

% of Total Responses in Given Year



There were material increases in several individual risks. *Climate change* was selected by 49% of respondents, up from 29% in 2017, becoming the second-highest choice. Both *Failed and failing states* and *Pandemics/infectious diseases* nearly doubled, from 14% to 25%. *Demographic shift* also increased (from 23% to 32%) and now is included in the top five.

Material decreases occurred in five risks. *Terrorism* fell by 18%, while *Regional instability* fell by 13% and *Asset price collapse* by 11%. *Natural catastrophe: tropical storms* gave back its large gains of the prior survey, down 8% (from 16%), despite Hurricane Michael's recent destruction, and *Weapons of mass destruction* fell 8% as North Korea was perceived to be a lower risk.

The top five specific responses were spread across the Economic, Environmental, Societal and Technological categories. Multiple responses—up to five—were encouraged. The percentages shown here use the number of respondents in the divisor, so totals are much greater than 100%. The top five total 204%, and each risk was selected on at least 25% of the surveys.

1. 56%/53% (2018/2017) *Cyber/network infrastructure*
2. 49%/29% *Climate change*
3. 40%/38% *Technology*
4. 32%/23% *Demographic shift*
5. 27%/29% *Financial volatility*

Trends of at least two consecutive years may act as a leading indicator. Increasing trends include *Climate change* (five years), *Loss of freshwater services* (four years), *Technology* (three years) and *Natural catastrophe: severe weather* (two years). Decreasing trends include *Chinese destabilization* (eight years) and *Financial volatility* (three years).

One method for analyzing this data over time is to highlight those risks reported in the current survey that are above long-term averages. For this purpose, the data was analyzed as a percentage of all responses. Three of the five primary categories were higher than their average over the 12 survey cycles. Environmental (19% vs. 12% average), Societal (17% vs. 13% average) and Technological (20% vs. 12% average) each satisfied this criterion, while Economic (15% vs. 33% average) and Geopolitical (27% vs. 29% average) were lower. Among individual risks, 8 of the 23 had above-average results. The greatest positive differential was 6% for *Technology*, just ahead of 5% for *Climate change.* Several other risks were above

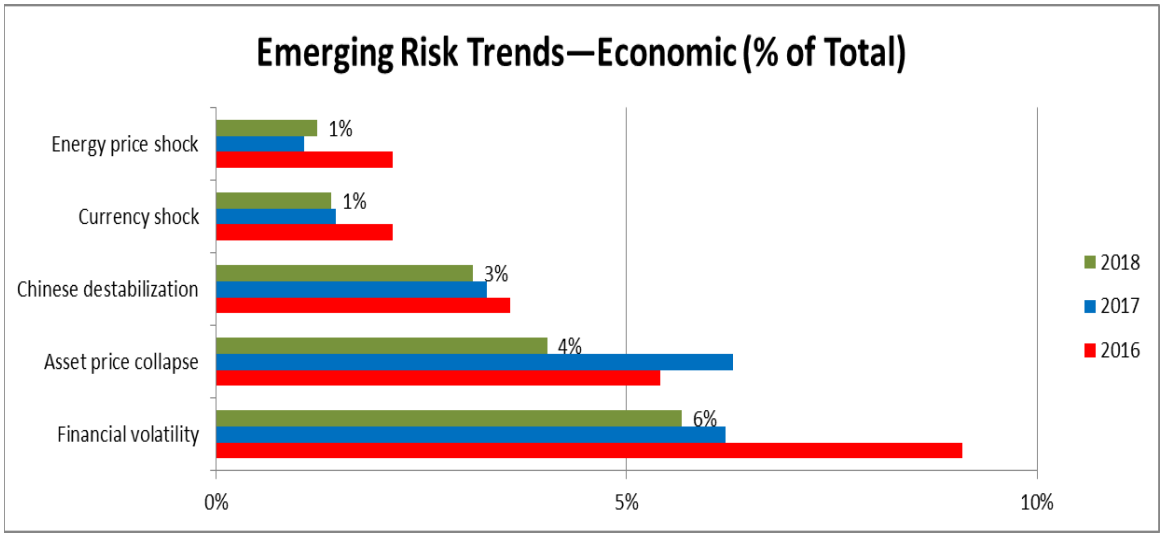
average by more than 1%, with *Cyber/network risks* higher by 3% and *Natural catastrophe: severe weather* up by 2%. Seven trended below average, led by 5% for *Currency shock* and 4% for *Energy price shock* and *Financial volatility*. All five risks in the Economic category were again below their long-term average, while in the Environmental category, three out of five were above their longer-term average.

Figures 20 through 24 show recent trends when respondents chose (up to) five emerging risks. The denominator in the percentages is the total number of responses received, rather than the number of respondents. This allows a comparison to the top current and emerging risk categories.

Economic risks were selected less often than in the previous survey, except for *Energy price shock*, as shown in Figure 20.

Figure 20: Emerging Risk Trends: Economic Risks

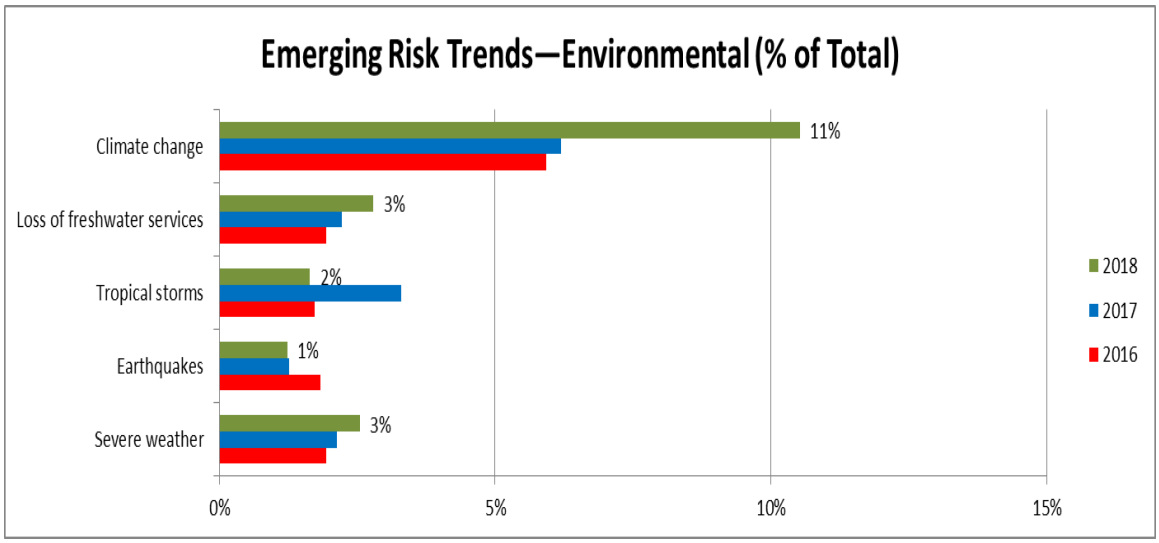
% of Total Responses



As shown in Figure 21, Environmental risks were selected more often, except for *Natural catastrophes: tropical storms* and *Natural catastrophe: earthquakes.*

Figure 21: Emerging Risk Trends: Environmental Risks

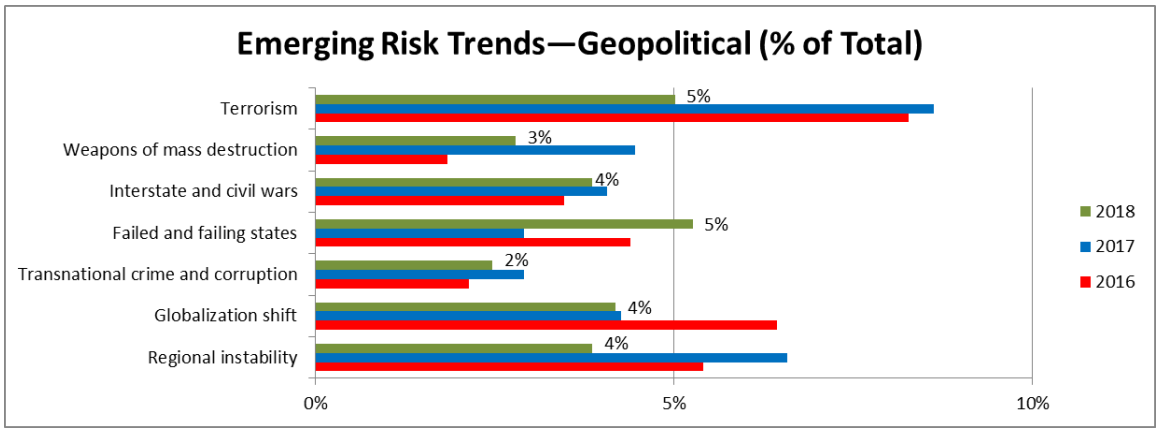
% of Total Responses



In the Geopolitical category, the rate of selection decreased for six of seven risks—some materially, as shown in Figure 22. However, *Failed and failing states* we selected more often.

Figure 22: Emerging Risk Trends: Geopolitical Risks

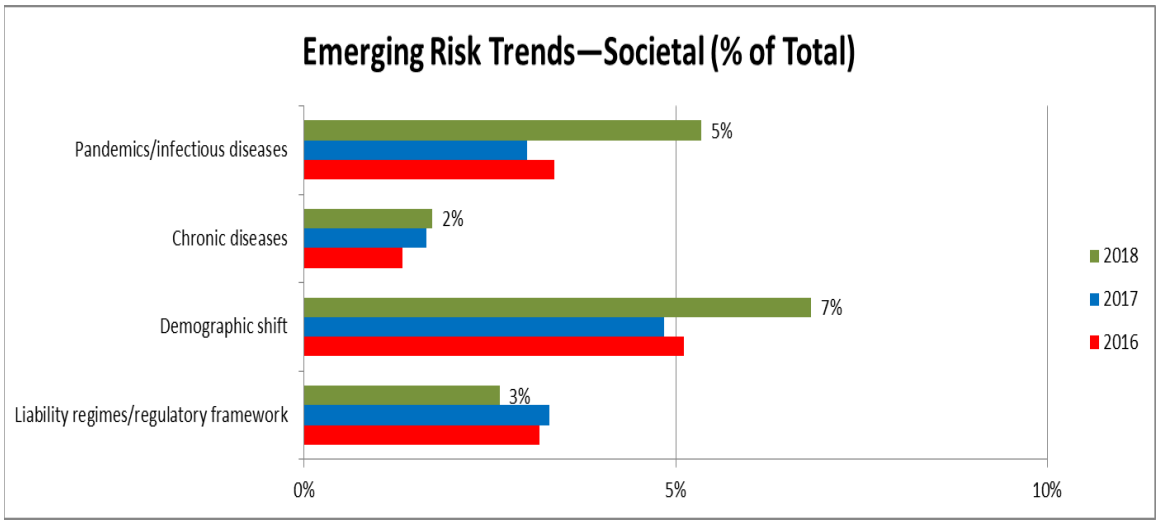
% of Total Responses



All of the Societal risks except *Liability regimes/regulatory* framework were selected more often, as shown in Figure 23.

Figure 23: Emerging Risk Trends: Societal Risks

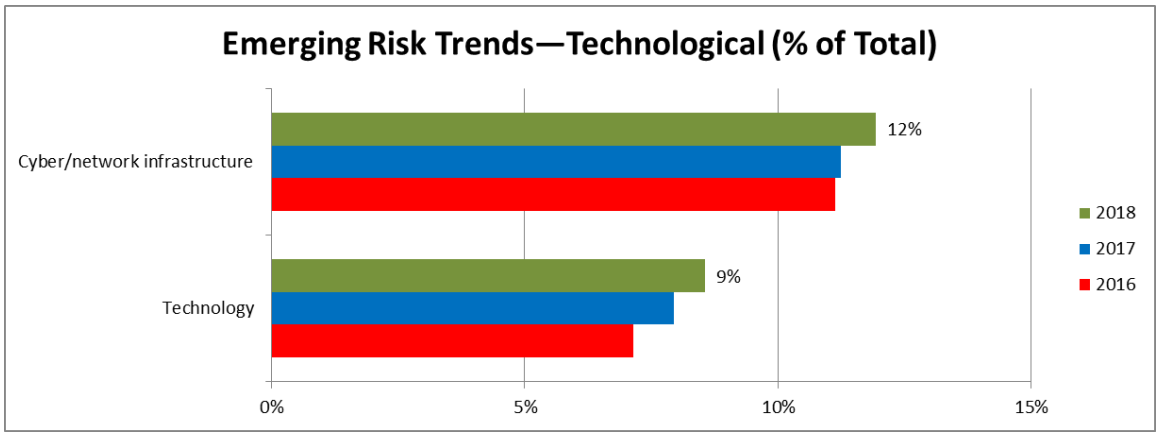
% of Total Responses



Both of the Technological risks were selected more than in 2017, as seen in Figure 24. In addition, *Technology* and *Cyber/network infrastructure* remained in the top three overall selections.

Figure 24: Emerging Risk Trends: Technological Risks

% of Total Responses



Some of the changes over time are highlighted in Figures 25 and 26. It is interesting to see how certain risks have become relatively more or less widely cited by respondents over time. Note that these charts list the risks in order as presented in the survey, not sorted as in some others. The data labels presented in Figure 26 are from 2018, with risks sorted based on 2017 results.

Figure 25: Top Emerging Risks (up to Five Risks Chosen)

% of Responses in Given Year

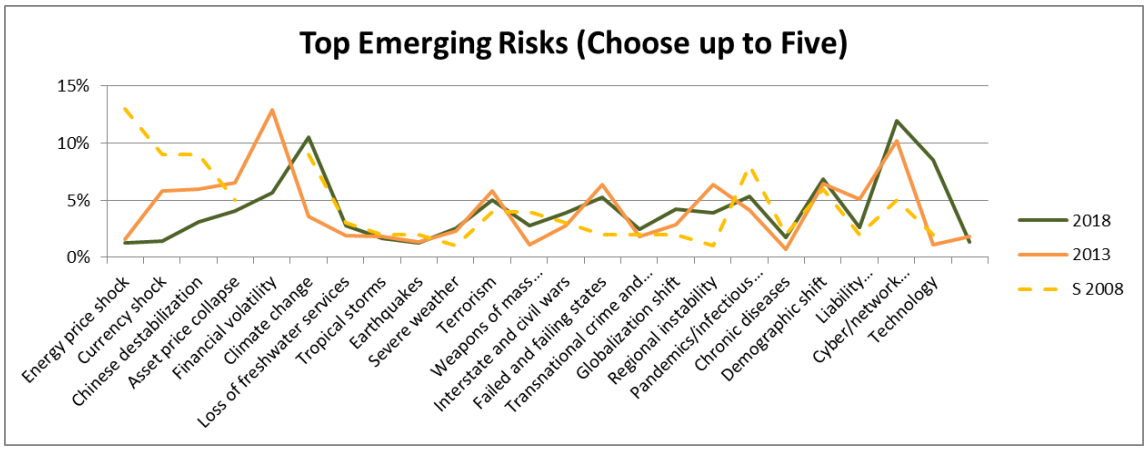
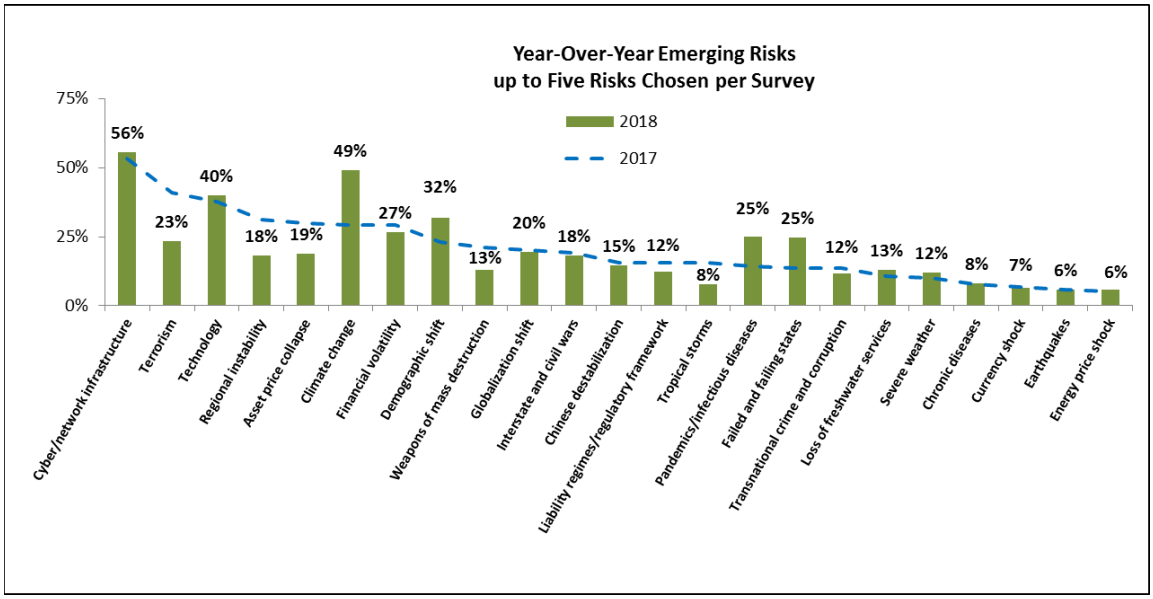


Figure 26: Year-Over-Year Emerging Risks (up to Five Risks Chosen)

% of Responses in Given Year



4.5.2 Top Emerging Risk: *Cyber/Network Infrastructure*

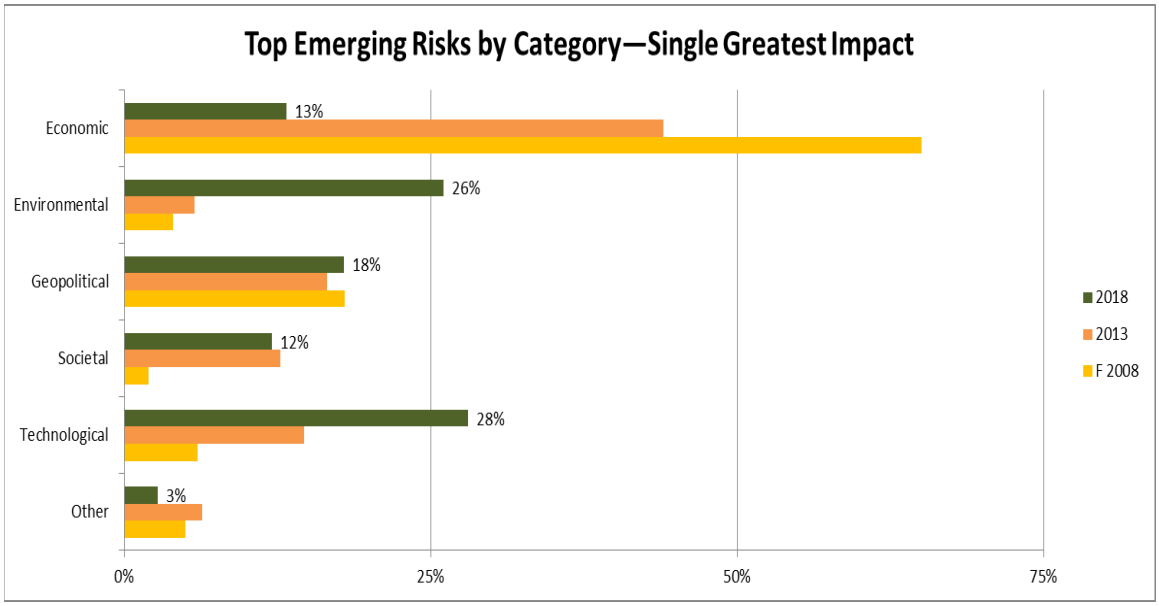
Respondents were asked to state the single emerging risk they expected to have the greatest impact. The responses to this question tend to be volatile and likely represent a recency bias, based on events that occurred in 2018. That volatility between years resulted in entire categories of risks shifting in prominence. The Technological category moved into the top spot, selected by 28%, closely followed by the Environmental category, which moved from last to second based on *Climate change* increasing from 7% to 22%. The Geopolitical and Economic categories dropped to third and fourth place overall as *Terrorism* fell from 9% to 2% and *Asset price collapse* fell from 12% to 5%. Societal risks were selected least frequently, despite the rise in the percentage selecting *Pandemics/infectious diseases*, up from 0.5% to 4%.

1. 28%/26%/24% Technological
2. 26%/9%/8% Environmental
3. 18%/32%/29% Geopolitical
4. 13%/20%/27% Economic
5. 12%/11%/8% Societal

Figure 27 compares the top emerging risks at the category level from the fall 2008, 2013 and 2018 surveys. The chart shows how the top risk category has shifted since the financial crisis. While the Geopolitical category has been fairly stable, risk perceptions in the Economic category have fallen dramatically, feeding increases for the Environmental and Technological categories.

Figure 27: Emerging Risk With Greatest Impact, by Category

% of Responses in Given Year



The top emerging risk was *Climate change*. Although it surged past *Cyber/network infrastructure*, the latter risk plus *Technology*, in third place, explain the Technology category's top ranking. Here are the leading responses, ordered by the category ranking:

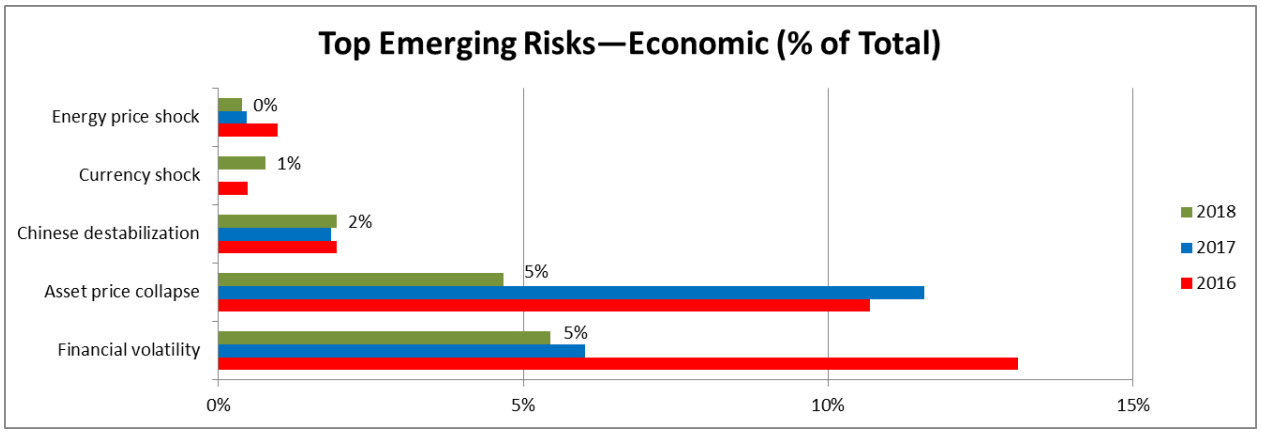
1. 22%/7%/6% *Climate change*
2. 15%/16%/17% *Cyber/network infrastructure*
3. 13%/10%/7% *Technology*
4. 5%/6%/13% *Financial volatility*
5. 5%/3%/3% *Demographic shift*

For each risk category, Figures 28 through 32 show the top emerging risk within the category for the most recent three surveys. Note that the *x*-axis for each chart is chosen to highlight the data and is not consistent between categories. Data labels are rounded to the nearest percentage point and are shown for the most recent survey.

As shown in Figure 28, the Economic category shows generally decreasing responses in recent years.

Figure 28: Top Emerging Risks—Economic

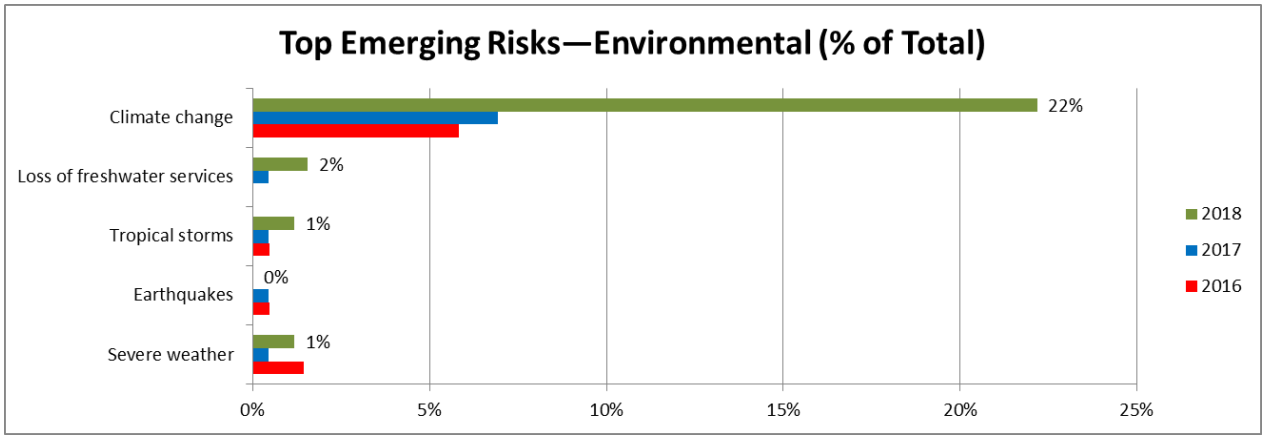
% of Total Responses



Environmental category risks, shown in Figure 29, remain small and increasing, except for *Climate change*, which became the top overall risk. *Loss of freshwater services*, much like *Demographic shift*, may increase as risk managers consider longer time horizons.

Figure 29: Top Emerging Risks—Environmental

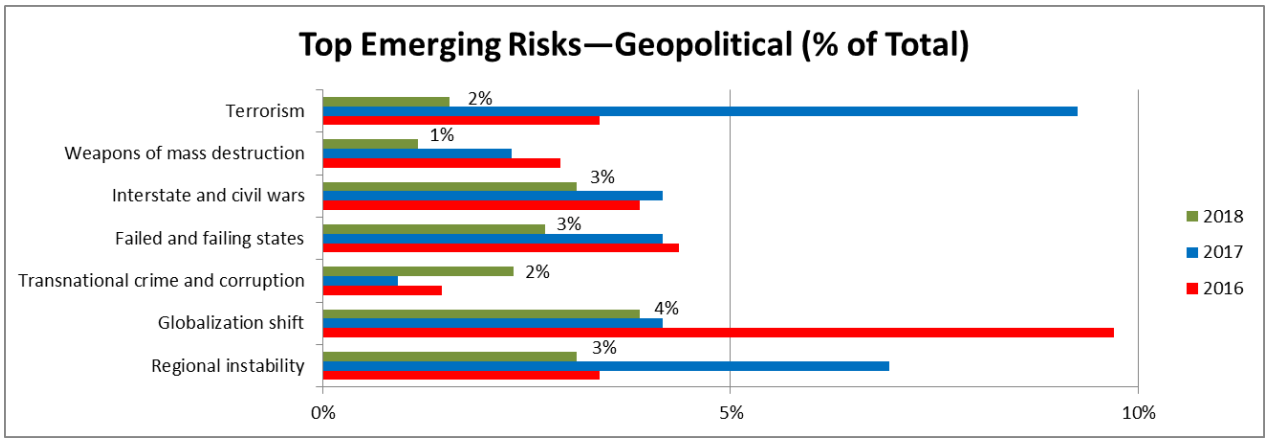
% of Total Responses



Geopolitical risks tend to be the most volatile in the survey, so it is not surprising to see in Figure 30 that many of these risks whipsaw, with 2018 being a down year except for the percent of respondents selecting *Transnational crime and corruption*.

Figure 30: Top Emerging Risks—Geopolitical

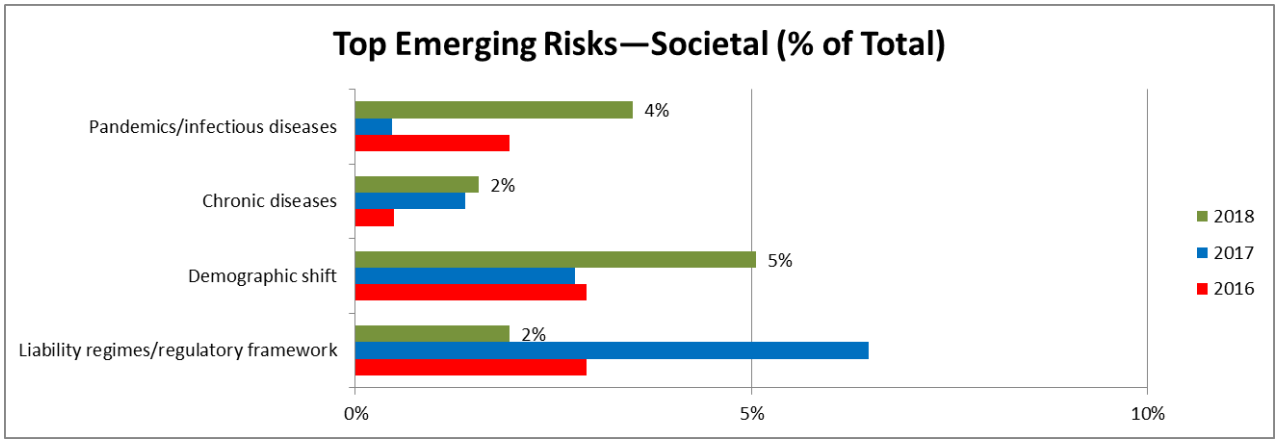
% of Total Responses



The changes in the Societal category results, shown in Figure 31, were up, except for *Liability regimes/regulatory framework*. *Pandemics/infectious diseases* rebounded, likely due to the Ebola crisis unfolding in Congo.

Figure 31: Top Emerging Risks—Societal

% of Total Responses



In the Technological category, shown in Figure 32, *Technology* is increasing in the share of respondents who identify it as the top risk. This year, the response rate for *Technology* neared that for *Cyber/network infrastructure*.

Figure 32: Top Emerging Risks—Technological

% of Total Responses

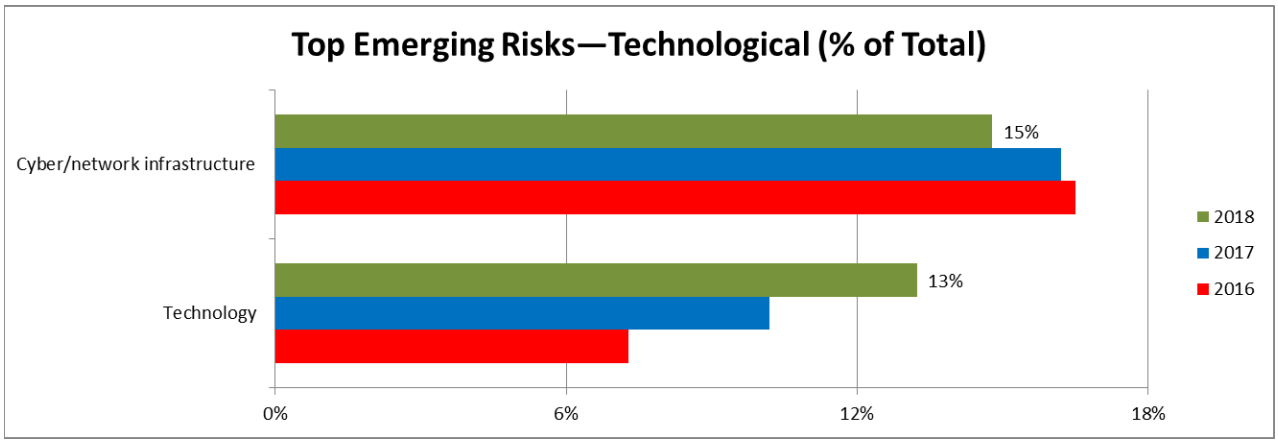
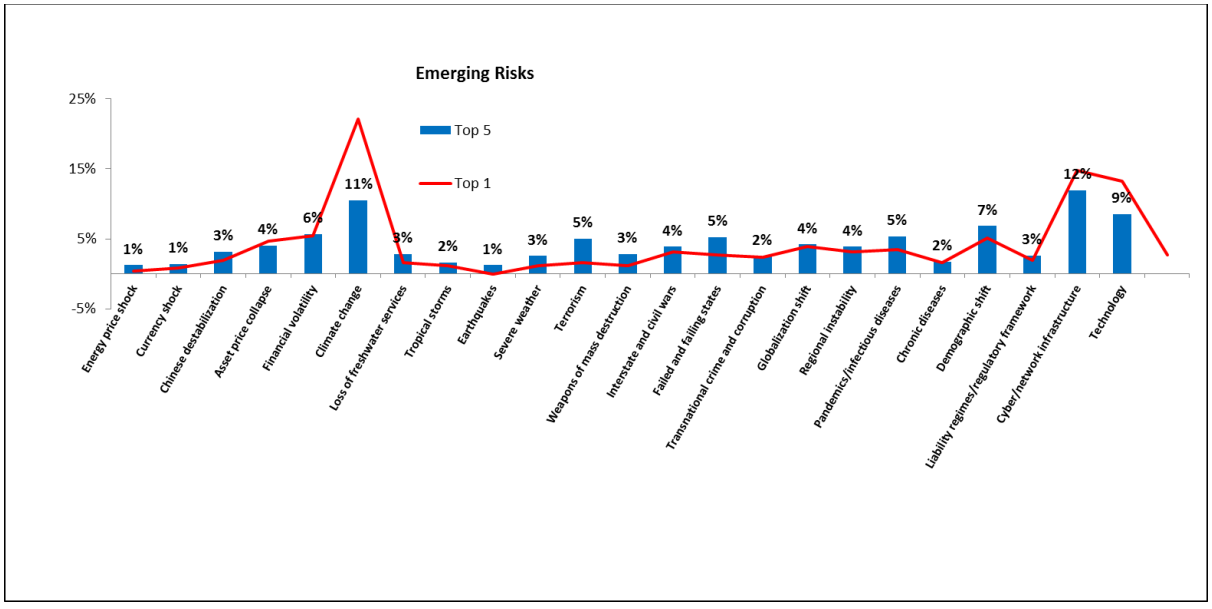


Figure 33 compares the percentages selecting each risk as the top risk with the percentages selecting each risk as one of the five top risks. For several risks, these two measures of perceived importance vary. If we use the highest absolute positive differential to mark the importance of being the top overall risk relative to inclusion in the top five list, that risk was *Climate change*, at 12%. The greatest negative differential was *Terrorism*, at −3%.

Figure 33: Emerging Risks Selected for Top Five and Top Risk

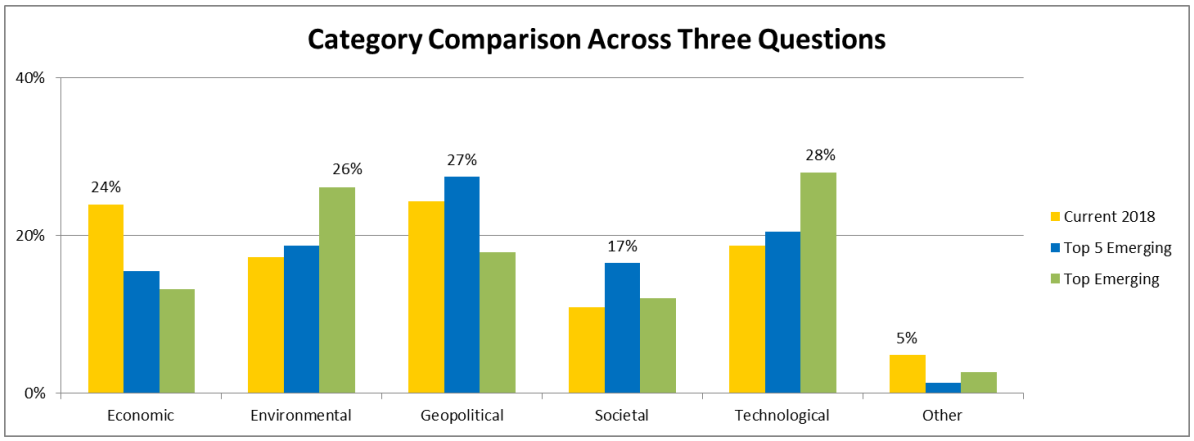
% of Responses to Given Question



An interesting comparison is to look at which of the three metrics—current risk with the greatest impact, top five emerging risks and top emerging risk—is highest for each risk category. The results of this comparison are shown in Figure 34. Risks were identified as current risks more frequently than as emerging risks in both the Economic and Other categories. Risks in the Geopolitical and Societal categories have the highest percentages as top-five risks. And in the Environmental and Technological categories, risks are identified as the top emerging risk more than as the most impactful current risk or a top-five emerging risk.

Figure 34: Risk Perception, by Risk Category and Question

% of Responses Selected From Category for Given Question



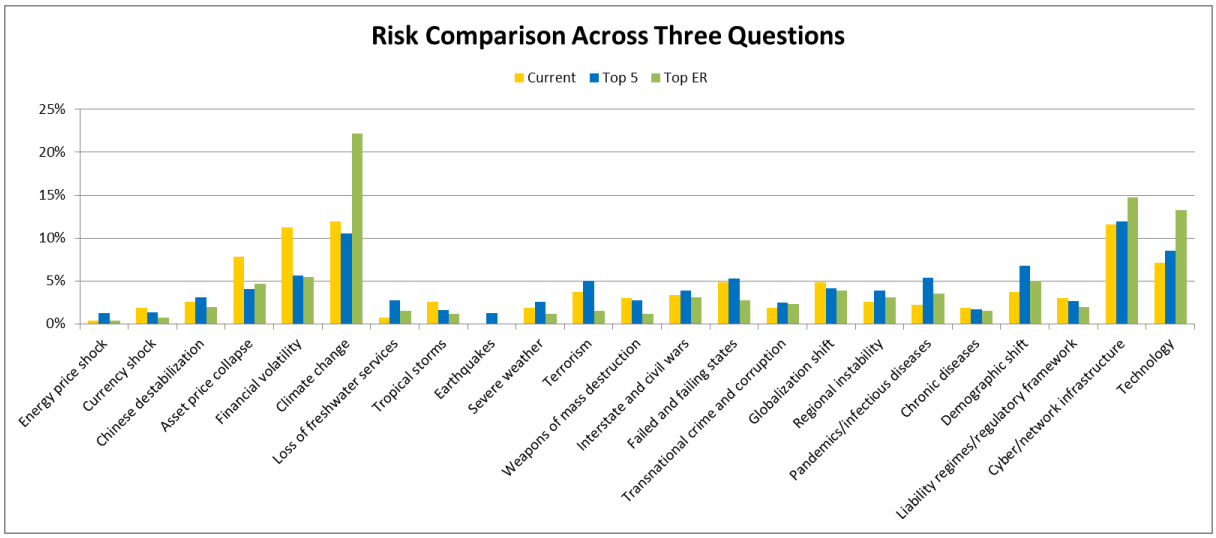
A comparison of the top current risk and top emerging risk suggests which risks are expected to be relatively more important in the future. The largest absolute negative differential (current less than top emerging risk) is *Climate change*, with 10%, followed by *Technology* and *Cyber/network infrastructure*. The largest absolute positive differentials, suggesting an expectation of lower risk in the future, are *Financial volatility* (6%) and *Asset price collapse* (3%).

While the top-five choices might be thought to come from a different distribution, we might compare those selections with top emerging risk scores as a gauge of concentration risk. Risks that have higher concentration risk have a top-five score materially lower than their top emerging risk scores. In this year's survey, those risks are *Climate change* and *Technology*.

Another interesting characteristic of a particular risk is to have the top-five response be the highest of the three measures of its perceived risk. This could reflect a risk that respondents are worried about but cannot quite get their heads around it being the most important risk. These could also be risks seen more in combination with others. As shown in Figure 35, this characteristic is seen with 12 risks: *Energy price shock*, *Chinese destabilization*, *Loss of freshwater services*, *Natural catastrophe: earthquakes*, *Natural catastrophe: severe weather*, *Terrorism*, *Interstate and civil wars*, *Failed and failing states*, *Transnational crime and corruption*, *Regional instability, Pandemics/infectious diseases* and *Demographic shift.*

Figure 35: Risk Perception, by Risk and Question

% of Responses to Given Question



4.5.3 Risk Combinations

Many companies manage their risks by identifying their most impactful risks and creating a plan to address them, but most do not consider clustering. Clustering occurs when multiple risks that are either independent or have low correlations occur at the same time. For example, an earthquake could occur during a pandemic or financial crisis. Other risks interact in ways that are not linear, with higher-order interactions not always apparent in advance. These tend to have unintended consequences. As the environment warms, for example, indirect impacts will be felt as resources like fresh water become scarcer. Concurrent emerging risks could exacerbate a scenario, as in 2011, when the Japanese earthquake and tsunami, followed immediately by the Fukushima Daiichi nuclear disaster, led to a scenario that continues to play out.

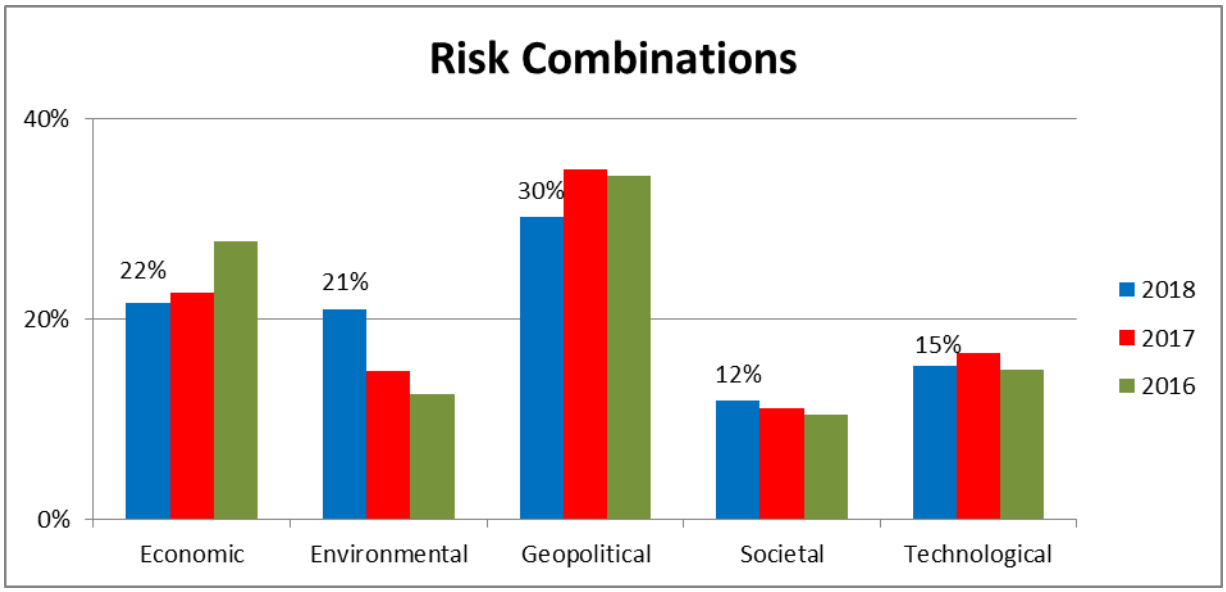
To explore this issue, the survey asked each respondent to choose up to three combinations of two risks they believe will have a large impact over the next few years, either concurrently or sequentially. Appendix II includes a grid showing all the combinations chosen.

Even though the question is about combinations of risks, it is helpful to look first at the distribution of categories from which the risks were chosen. The Geopolitical and Economic categories remain the most frequent response categories, with Economic risks falling for the sixth consecutive year. Figure 36 provides a graphical representation of the results that follow.

1. 30%/35%/34% Geopolitical (2018/2017/2016)
2. 22%/23%/28% Economic
3. 21%/15%/12% Environmental
4. 15%/17%/15% Technological
5. 12%/11%/10% Societal

Figure 36: Most Impactful Risk Combinations, by Risk Category

% of Responses Selected From Category in Given Year



The individual risks most often selected for combinations were *Climate change*, *Cyber/network infrastructure* and *Financial volatility*.

1. 11%/7%/5% *Climate change*
2. 9%/10%/10% *Cyber/network infrastructure*
3. 8%/8%/11% *Financial volatility*
4. 7%/7%/7% *Asset price collapse*
5. 7%/6%/5% *Technology*

The top risk combinations chosen continue to show a broad dispersion. The difference drops off quickly when combinations are ranked based on the percentage choosing them. The top-five combinations among the 697 responses were as follows:

1. 9%/7%/5%, No. 1 in previous survey
   Cyber/network infrastructure
   Technology

2. 6%/6%/4%, No. 2
   Asset price collapse
   Financial volatility

3. 4%/3%/2%, No. 5
   Climate change
   Natural catastrophe: severe weather

4. 4%, NR (not rated in top 10 in previous survey)
   Climate change
   Loss of freshwater services

5. 4%/3%/2%, No. 7

Climate change
Natural catastrophe: tropical storms

The major category combinations were as follows (with percentages from the current and prior survey):

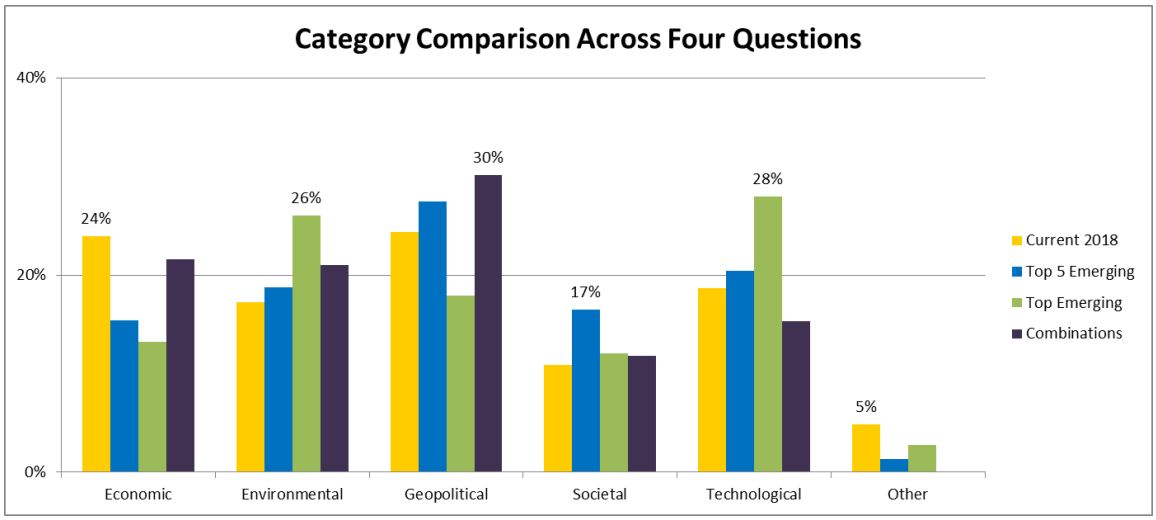
16%/20%	Geopolitical–Geopolitical
13%/9%	Environmental–Environmental
11%/13%	Economic–Economic
11%/10%	Economic–Geopolitical
9%/7%	Technological–Technological
7%/13%	Geopolitical–Technological
7%/4%	Environmental–Societal
4%/4%	Environmental–Geopolitical
4%/4%	Economic–Societal
3%/4%	Societal–Societal
3%/4%	Economic–Technological
5%/4%	Geopolitical–Societal
3%/2%	Economic–Environmental
2%/2%	Societal–Technological
1%/1%	Environmental–Technological

Geopolitical responses dropped off between 2017 and 2018, as they did for other questions, and the Environmental category moved up.

By category, frequency of responses generally does not vary by a large amount when viewed across the four major questions. As shown in Figure 37, exceptions occur for the Economic category (the frequency of including these risks in the top-five emerging risks is low), Geopolitical (frequency of selection for combinations is high), Societal (selection of top-five emerging risks is high) and Technological (selection of combinations is low).

Figure 37: Selection of Risks in Category, by Question

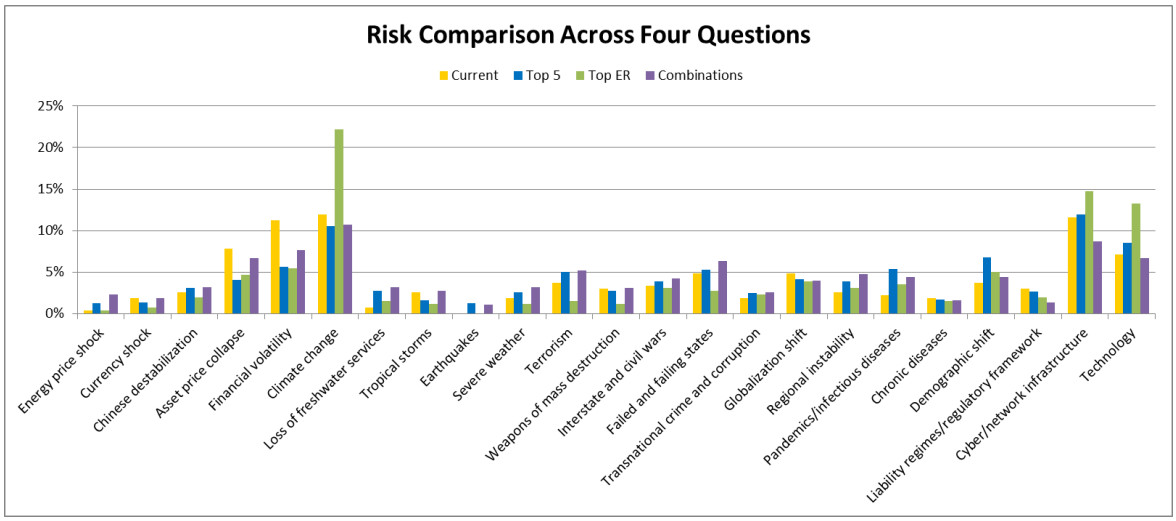
% of Responses Selected from Category for Given Question



Risk by risk, there is much more variation, as shown in Figure 38.

Figure 38: Selection of Risk, by Question

% of Responses to Given Question



The following risks were most often selected as the top current risk:

- *Currency shock*
- *Asset price collapse*
- *Financial volatility*
- *Globalization shift*
- *Chronic diseases*
- *Liability regimes/regulatory framework*

The following risks were most often selected as one of the top five emerging risks:

- *Natural catastrophe: earthquakes*
- *Pandemics/infectious diseases*
- *Demographic shift*

The following risks were most often selected as the top emerging risk:

- *Climate change*
- *Cyber/network infrastructure*
- *Technology*

The following risks were most often selected as part of a combination:

- *Energy price shock*
- *Chinese destabilization*
- *Loss of freshwater services*
- *Natural catastrophe: tropical storms*
- *Natural catastrophe: severe weather*
- *Terrorism*
- *Weapons of mass destruction*
- *Interstate and civil wars*
- *Failed and failing states*

- *Transnational crime and corruption*
- *Regional instability*

There are 253 possible risk combinations. Following the financial crisis in 2008–2009, results have moved toward reduced concentration. That trend continued during this survey for the leading 50 combinations, as shown in Figure 39.

Figure 39: Cumulative Distribution of Risk Combinations Selected

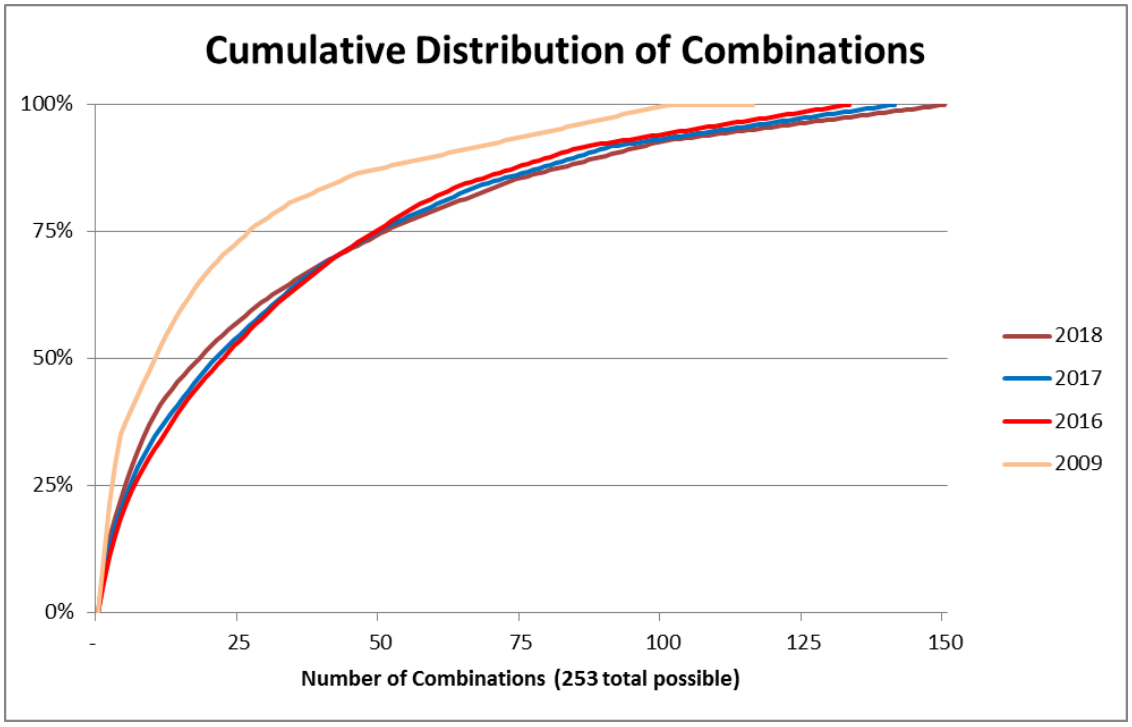
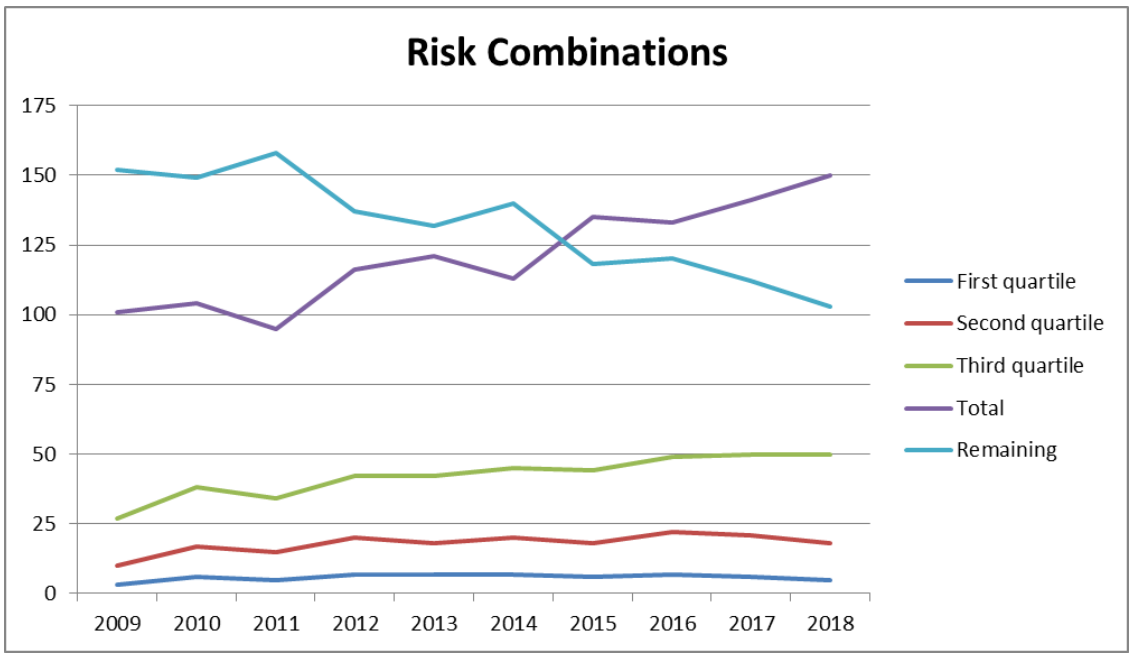


Figure 40 shows the number of combinations selected each year, with data listed cumulatively and the first quartile representing the most frequent responses. The past several surveys suggest a trend toward broader consideration of risks, especially in the third- and fourth-quartile results, which will continue to be monitored and analyzed. In 2018, more than half of the possible two-risk combinations were again selected.

Figure 40: Number of Risk Combinations Selected, by Year

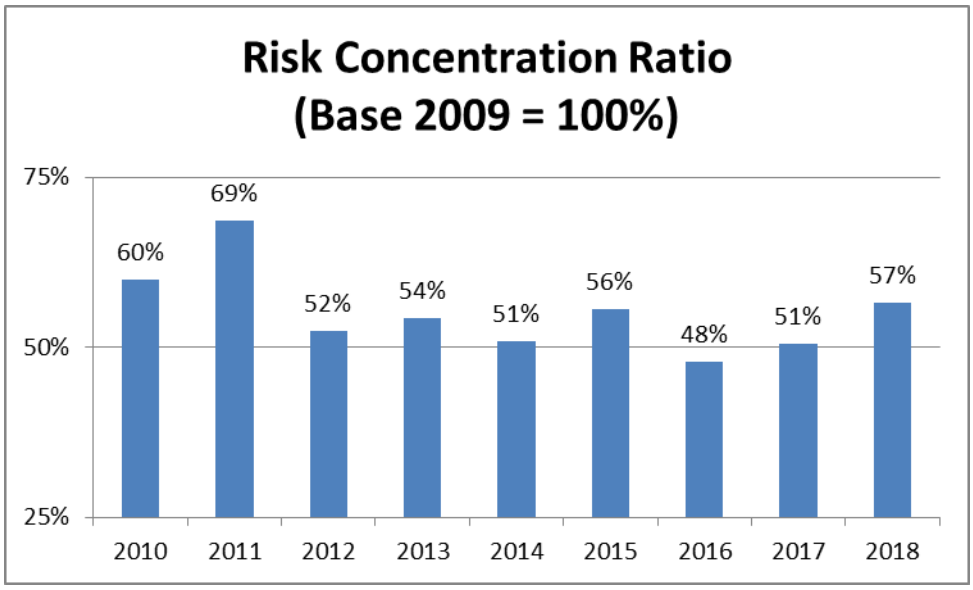


The broad representation may be an indicator of the current risk environment, with each quartile being considered against the extreme example of 2009. Shown in Figure 41, this year's risk concentration ratio of 57% is at the high end of a fairly stable range of results since 2012.[10]

[10] The risk concentration ratio is calculated by comparing the ratio at each of the three quartiles (2009 result divided by current year result) and averaging them.

Figure 41: Risk Concentration Ratio

Base 2009 = 100%



4.5.4 Famine-Related Risks

This survey includes a rotating question allowing a choice of up to three risks that fit specified criteria. In this survey, respondents were asked, "What emerging risks do you think would have the greatest role in creating a global famine?" Figures 42 through 44 show the results from this question by category, by risk, and as a comparison with the question about top-five emerging risks. It is not surprising that Environmental risks, led by *Climate change* (24%) and *Loss of freshwater services* (20%), were the top two individual risk responses. None of the other individual risks topped 10%.

Figure 42: Risk Categories Associated With Global Famine

% of Responses Selected From Category

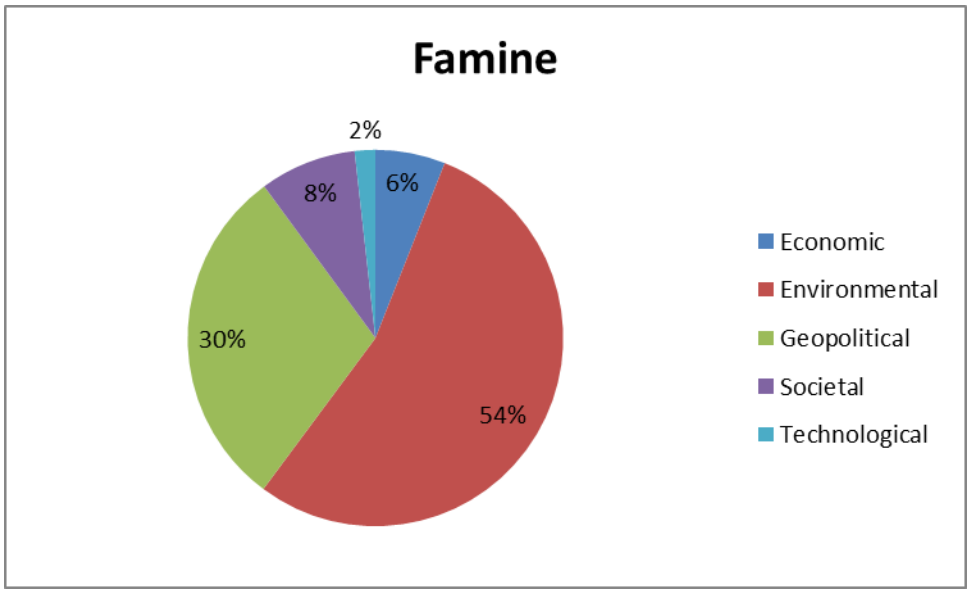
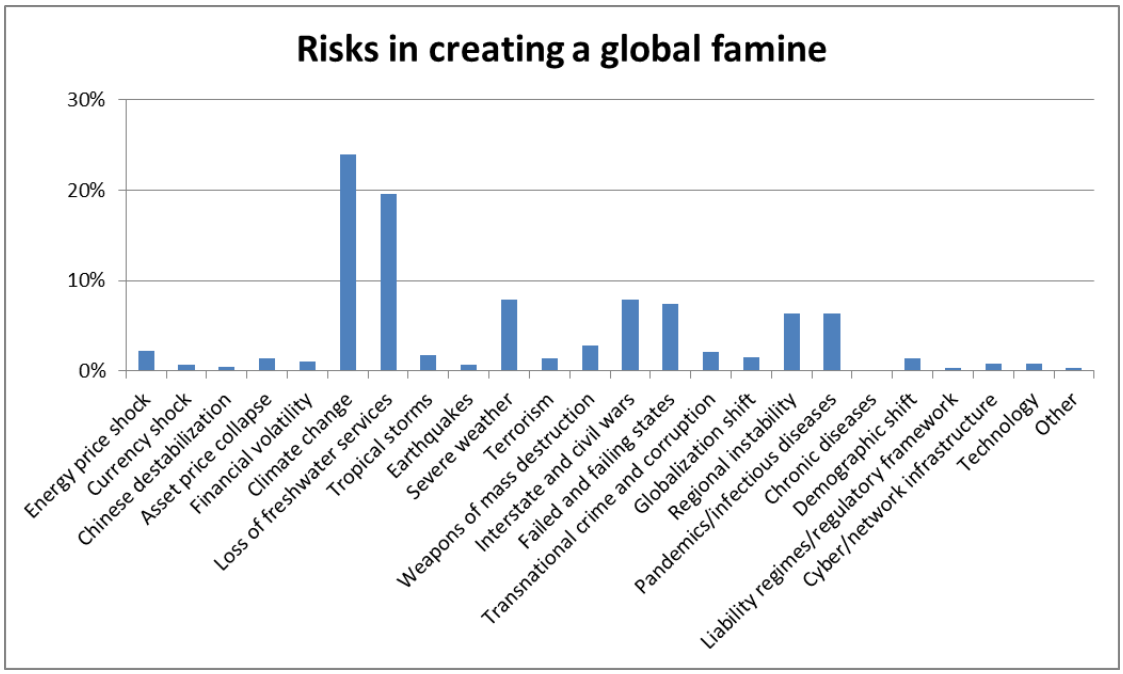


Figure 43: Risks Associated With Global Famine

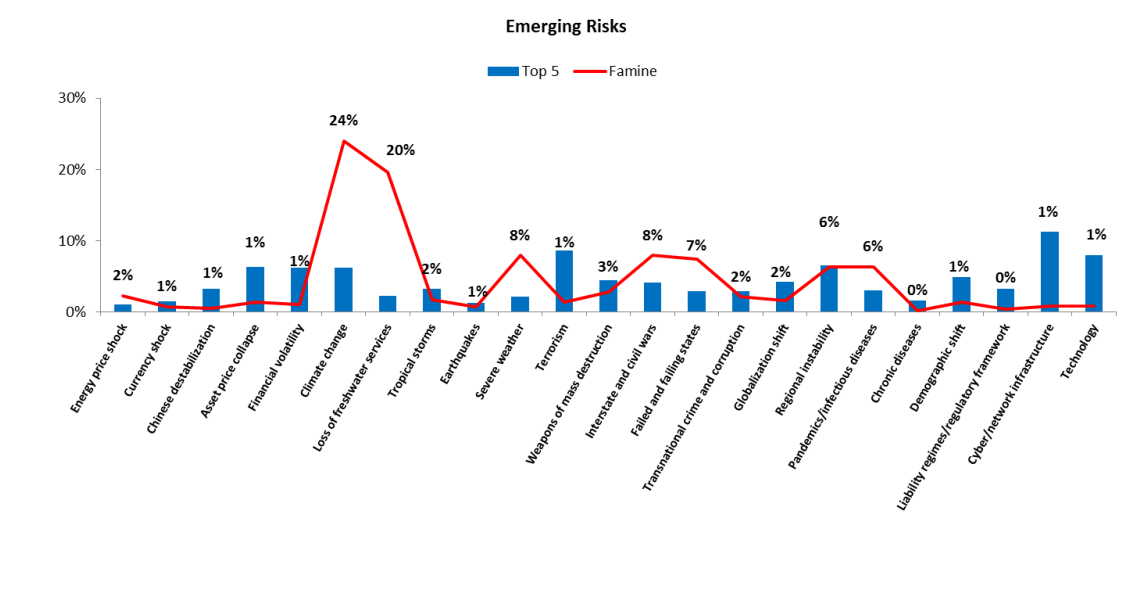
% of Responses



When compared with responses to the question about the top five emerging risks, risks identified as being associated with famine tended to be more frequently in the Environmental category and less often in the Technological and Economic categories.

Figure 44: Risks Associated With Famine vs. Emerging Risks

% of Responses to Given Question



4.5.5 Additional Risks

A final question for this section asked for suggestions of risks that are not included in the current set of 23 (defined in Appendix I). Each respondent could suggest up to two additional risks. These responses are typically used to modify the risk definitions to incorporate risk nuances. Here are some of the typical suggestions: [11]

- *Lack of trust in financial institutions*
- *Increasing wealth/income inequality*
- *Opioid crisis*
- *Loss of ocean ecosystem*
- *Religious persecution*
- *Rapidly increasing human life expectancy*
- *Political uncertainty*
- *Environmental exposure to endocrine disruptors causing crash in fertility for humans and other mammals*
- *Uncontrollable health care costs*
- *Low-growth regime*

While responses like alien encounters or a comet strike may be something to think about qualitatively, many of the others on this list do cause one to pause and think about whether these 23 risks are complete. Several suggestions deal specifically with various morbidity risks, and some respondents have expressed

[11] Direct comments from respondents have been slightly edited throughout the paper.

concerns about mortality/longevity risk. These could be incorporated into *Demographic shift* and *Chronic diseases* in future iterations of the survey. Income and wealth inequality are cyclical and potentially linked to risks like populism so likely fit best with *Globalization shift.*

4.6 SECTION B: LEADING INDICATORS

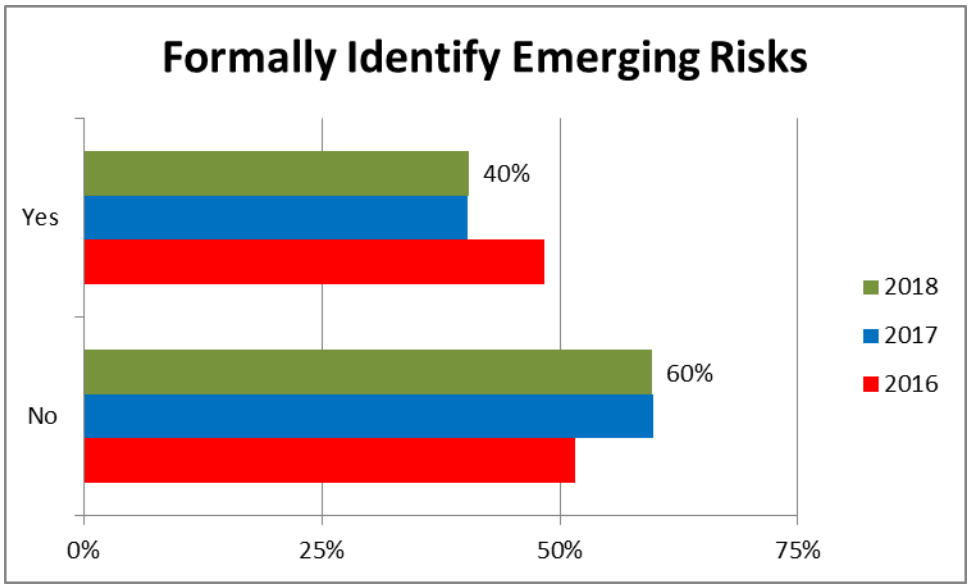
Key risk indicators (KRIs) provide information about a specific risk. They do not replace metrics that measure value in hindsight (lagging indicators, such as an income statement or number of employees hired) but attempt to identify drivers of future performance. Leading indicators of emerging risks are metrics or events (e.g., enactment of a new piece of legislation) indicating that an emerging risk is likely to materialize. This allows responsive actions to be taken earlier than they might be otherwise.

Trending indicators like gross domestic product (GDP) or consumer price index (CPI) can provide macroeconomic KRIs, as can revenue and expenses for a firm. These measure historical results. Leading indicators, by contrast, provide information earlier in the process. For example, a lower unemployment rate would drive expectations of higher collected taxes. A leading indicator could be an event that becomes a Boolean operator, acting as an on/off indicator. An example might be the signing of a star player by a major-league baseball team, with expectations of higher attendance and additional revenues from jersey sales. Almost as a secondary purpose, they expect to win more games.

The survey asked about the use of leading indicators that provide a firm with actionable information. As shown in Figure 45, 40% of respondents said they formally identify emerging risks, steady with the prior survey.

Figure 45: Whether Respondents Formally Identify Emerging Risks

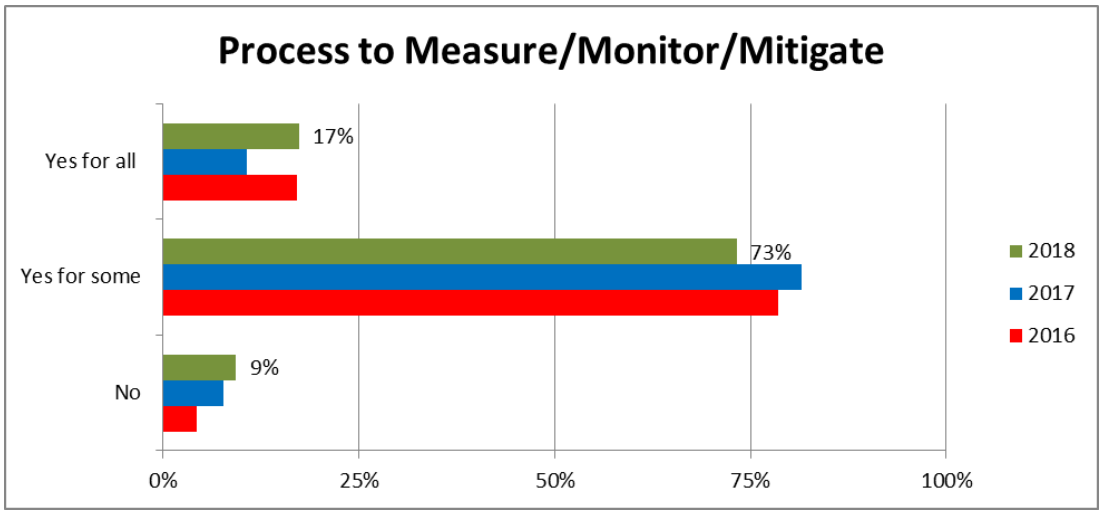
% of Responses in Given Year



For respondents who reported having a formal process (those without one moved directly to the next section), the survey asked about measuring, monitoring and mitigating an emerging risk once it has been identified. Figure 46 shows that nearly all respondents said they do this for some or all of their identified emerging risks. However, 9% reported having no process in place, continuing an upward trend.

Figure 46: Whether Respondents Have a Process to Measure, Monitor, Mitigate Emerging Risks

% of Responses in Given Year



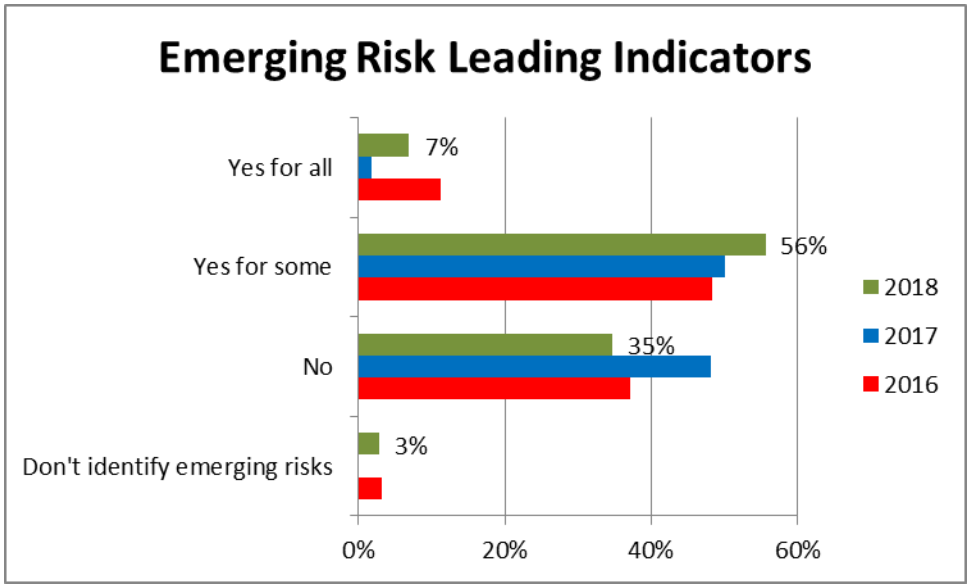
Most of the comments about actual processes used talked about respondents' activities to measure, monitor and mitigate the risk. This shows that progress is being made, as more leading indicators are listed and proactive steps taken as a result. Here are a few of the metrics followed and how the information is shared:

- *US sanctions on Chinese nuclear companies*
- *Ballot initiatives or elections which will significantly affect key customers*
- *Chemical and pharmaceutical litigation and accumulations*
- *Risks are categorized and then ranked by likelihood of onset and potential impact*
- *State Department STEP rating of travel risks*
- *Rising currency hedge cost*
- *Active participation on industry groups that monitor regulatory developments*
- *Cyber—moving from emerging to managed*
- *Climate change scenarios on various asset classes*

A follow-up question asked, "Once an emerging risk is identified, do you select leading indicators to measure changing likelihoods?" As shown in Figure 47, 63% of respondents noted that they had leading indicators for some of or all identified emerging risks, an increase over the prior survey. These results show risk managers are aware of the need for leading indicators, and the examples provided show they have a good understanding of what is required.

Figure 47: Whether Respondents Have Leading Indicators for Emerging Risks

% of Responses in Given Year



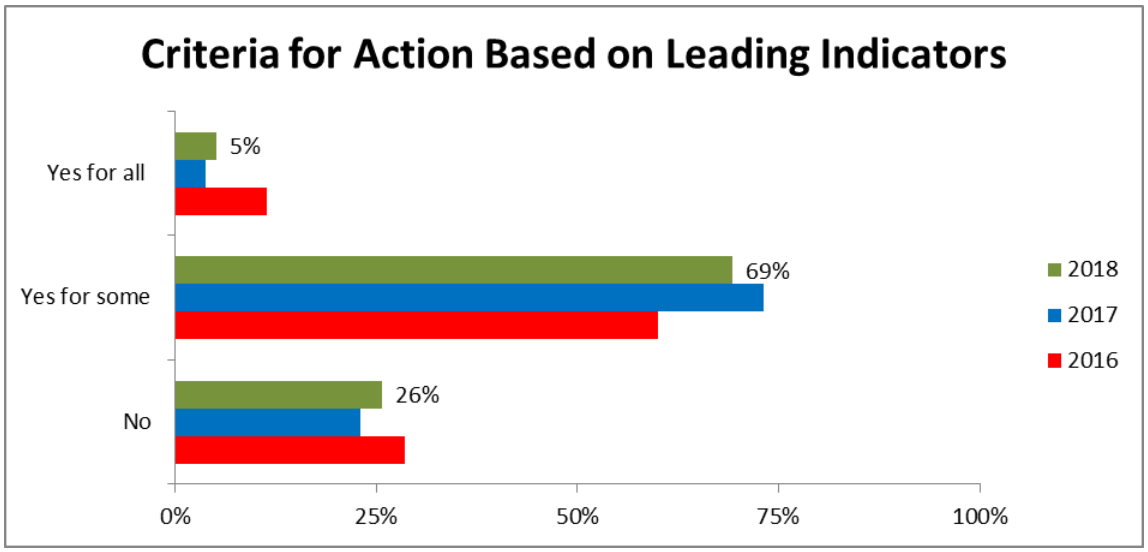
The specific examples shared about leading indicators being collected and monitored are interesting. The broader group of respondents allows the survey to include additional practices (e.g., only recently has the survey been sent to health and pension practitioners). Here are a few of the responses:

- *Civil and social unrest are tracked.*
- *Poll numbers, subject matter experts, customer feedback.*
- *Justified complaints as percentage of premium in line of business.*
- *Construction of a "Risk Wall." We periodically report about our greatest risks concerns, taking specific actions when thresholds are reached.*
- *Corruption risk is reflected by number of citations in the news.*
- *Number of reported hacks.*
- *Ebola cases.*

The survey asked whether these leading indicators include criteria that would lead to an action to mitigate or accept the risk. Almost three-quarters (74%) stated that criteria exist for some or all of their emerging risks, as shown in Figure 48. This is an evolving practice, but the high percentage is encouraging.

Figure 48: Whether Leading Indicators Include Criteria for Action

% of Responses in Given Year



When respondents were asked for examples, they shared some specific actions and triggers. Some good examples are as follows:

- *Increase/decrease the hedge position.*
- *Action is taken when the 5% probability scenario crosses the risk appetite.*
- *We evaluate risks in terms of impact to surplus and earnings, and have established criteria where we will take corrective action—including exiting certain products or markets—if those criteria are triggered.*

Emerging risk analysis will have varying levels of sophistication as the process matures, often starting with qualitative analysis and moving toward quantifying the risks. Velocity is joining severity and frequency as a key factor in this type of analysis. It describes how fast a risk can move from benign to critical. For example, seismic activity can happen quickly, allowing little time to plan, whereas a demographic shift may occur slowly over many years.

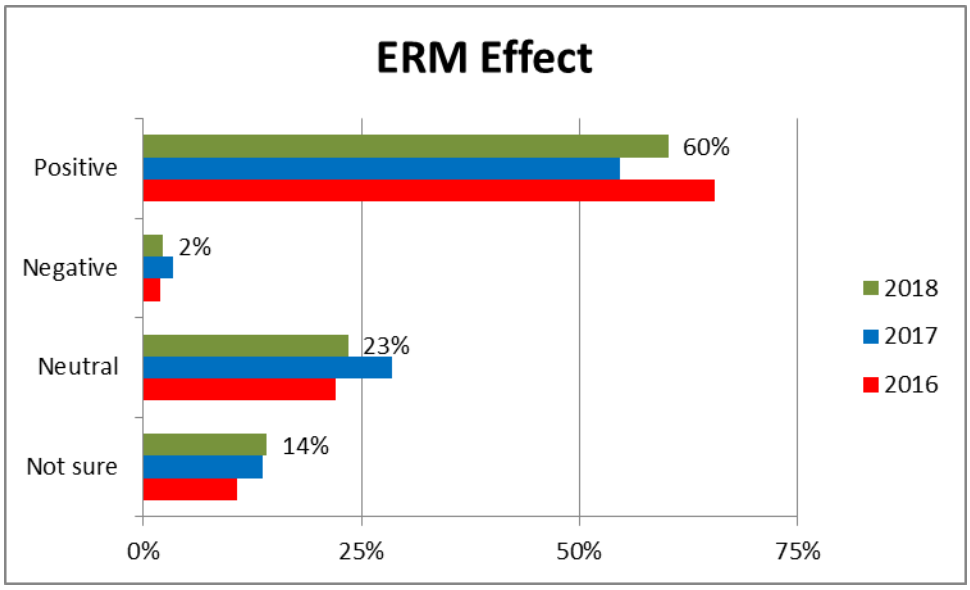
4.7 SECTION C: METHODOLOGY

This section solicits input on the overall health of ERM. The open-ended questions complement the emerging-risk trends asked about in Section A. Each risk management program is at a unique point on a maturity scale. The reader's experience will differ from that of the researcher, so each will pick out and interpret comments in unique ways. The reader is encouraged to scan the complete comments found in Appendix II. They suggest possible future development paths of an ERM process for those at various maturity levels.

The first question in this section asked respondents whether "enterprise risk management [has] had a positive, negative or neutral effect in your company/industry." As Figure 49 shows, very few (2%) said it has had a negative effect, and a majority (60%, up from 55% in 2017) responded that the effect has been positive. The high number of *Neutral* or *Not sure* responses also is telling, as ERM continues to evolve toward company-specific levels consistent with unique governance goals.

Figure 49: Effect of ERM in Respondents' Company/Industry

% of responses in Given Year



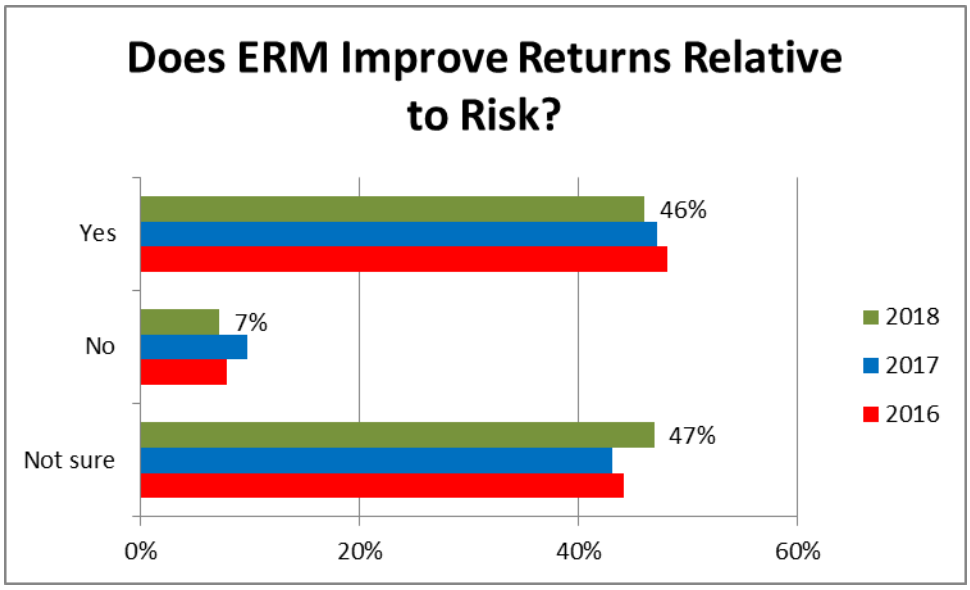
An open-ended question asked respondents to share an example from the past year where another company used ERM in a positive way. Most of the comments considered the ERM process. The comments included the following:

- *The presence of strong ERM leaders is a constant reminder to management to be risk cognizant in their decisions. So the impact is more second order rather than a specific example where ERM has saved the day.*
- *Air Canada's entrance into the annuity market to manage DB pension plan risk.*
- *ERM works with Corporate Audit to ensure that the audit plan is aligned with near term risks.*
- *A company I work with reviewed their investment process and intermingled it more with the liabilities to improve ALM and liquidity.*

It is important for decision makers to strive toward achieving the desired balance between risk and return. The survey asked, "Does implementing ERM improve company returns relative to the amount of risk?" Results as shown in Figure 50 are similar to those in the previous survey, with *Not sure* responses (47%) continuing to take votes from both *Yes* and *No* responses. This is interesting to trend. Splitting the comments out by how the question was answered provides additional clarification.

Figure 50: Whether ERM Improves Returns Relative to Risk

% of Responses in Given Year



Among those stating that ERM does improve returns relative to risk, comments included improved transparency and better methods of decision making and allocating capital:

- *More data-driven decision making*
- *It reduces the risk of catastrophic failures within the company that can undermine the company value. Most companies are probably slightly overvalued due to lack of accounting for this risk. When the risks begin to materialize, the losses may compound as the public and stakeholders will lose all trust in company.*
- *Creates transparency.*
- *Helps reject/select among alternative courses of action.*

Respondents concerned about the health industry and poor incentives drove the comments of those who said ERM does not improve returns relative to risk. Comments included the following:

- *To repeat, have seen no ERM work in the health industry. There is no "emerging" risk. The risk is already here.*
- *Misalignment of incentives. Failure to accurately assess risks and their impact on return.*

Some of the most thoughtful comments came from those who were not sure if ERM has added value. The comments included:

- *I don't think it does directly. The benefits are indirect: helping you identify what risks you want to take—and ideally avoid those you don't—and in helping develop preparedness/plans for certain risks.*
- *Seems like the regulatory emphasis and buzz of ERM creates a need for companies to do something formal to satisfy having an "ERM" function, but the efficiency and effectiveness of having such a function is not always clear. Sometimes seems like a way for senior management to sound like they are fulfilling best practices.*
- *There are formidable complications in measurement.*
- *Over time I think it adds value, but early on could be viewed as a distraction.*

- *Yes, it improves returns, but not necessarily net of the ERM costs.*

Two new questions were added for this iteration of the survey. In the first, respondents were asked which term—frequency, probability or likelihood—they preferred to use to describe how often an event occurs. As shown in Figures 51 and 52, frequency was preferred by 43%, but results varied by practice area.

Figure 51: Preferred Term for How Often Event Occurs

% of Responses

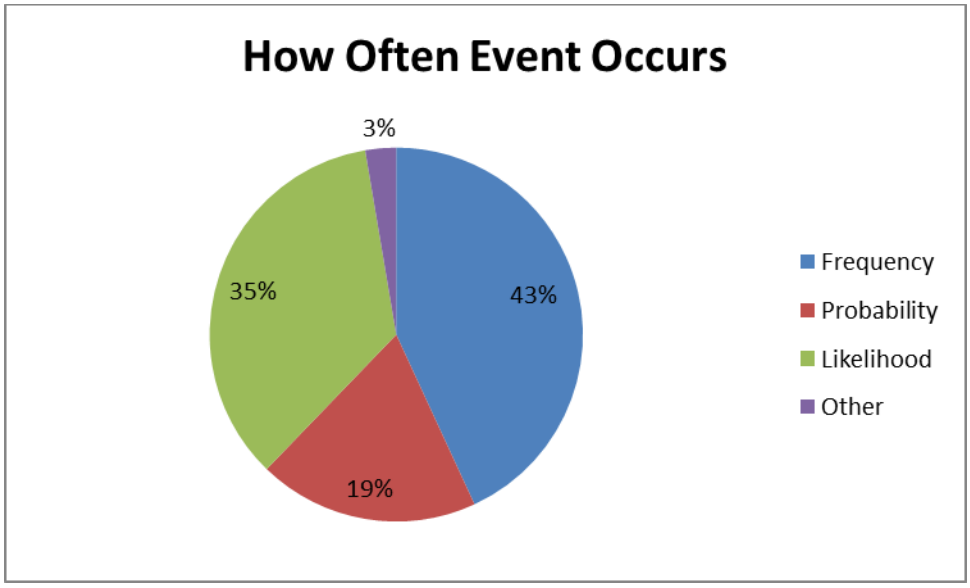
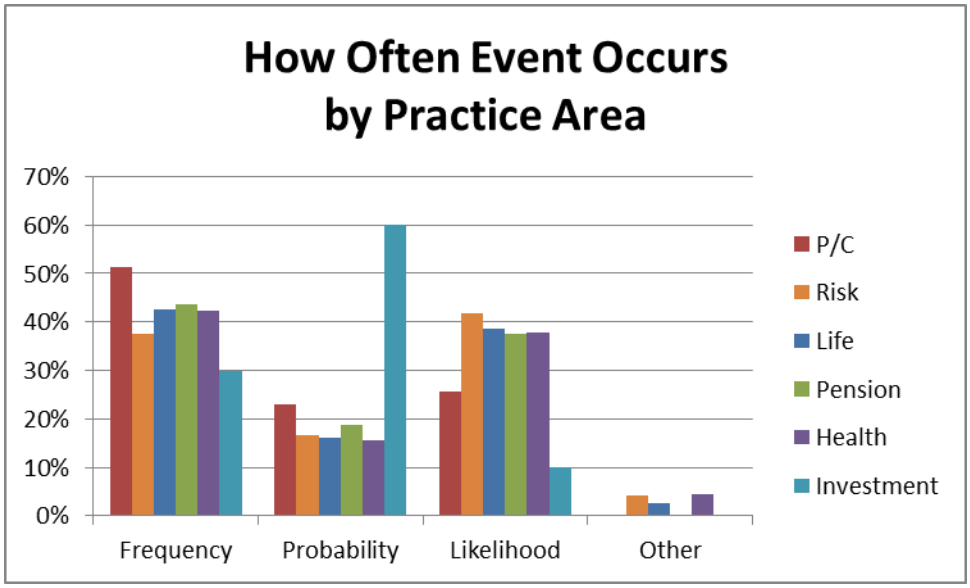


Figure 52: Preferred Term for How Often Event Occurs, by Practice Area

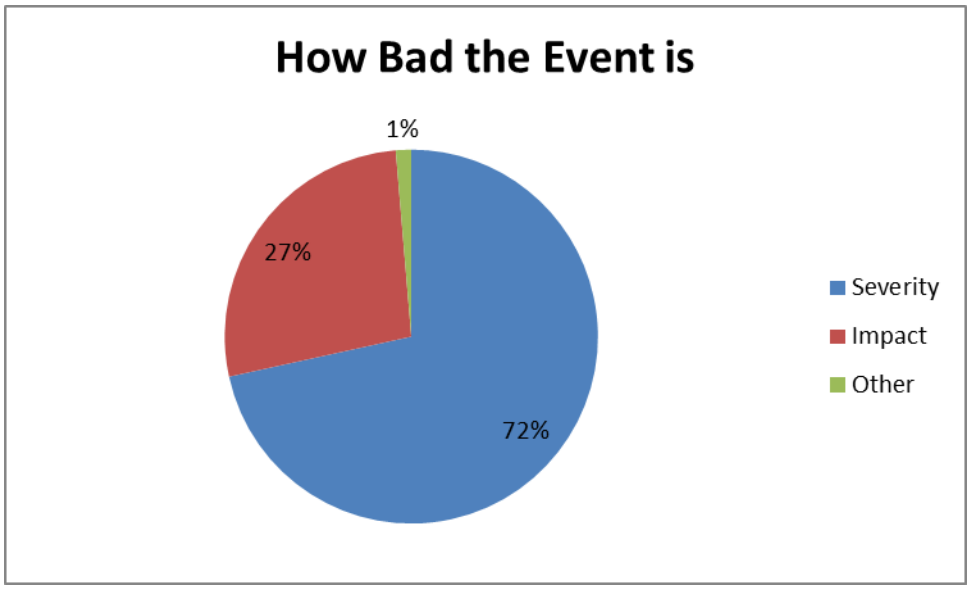
% of Responses



A similar question was asked about terminology for describing how bad an event is. Here, the options included severity and impact. As shown in Figure 53, severity received 72% of the responses. In this case, responses were consistent across practice areas.

Figure 53: Preferred Term for How Bad Event Is

% of Responses

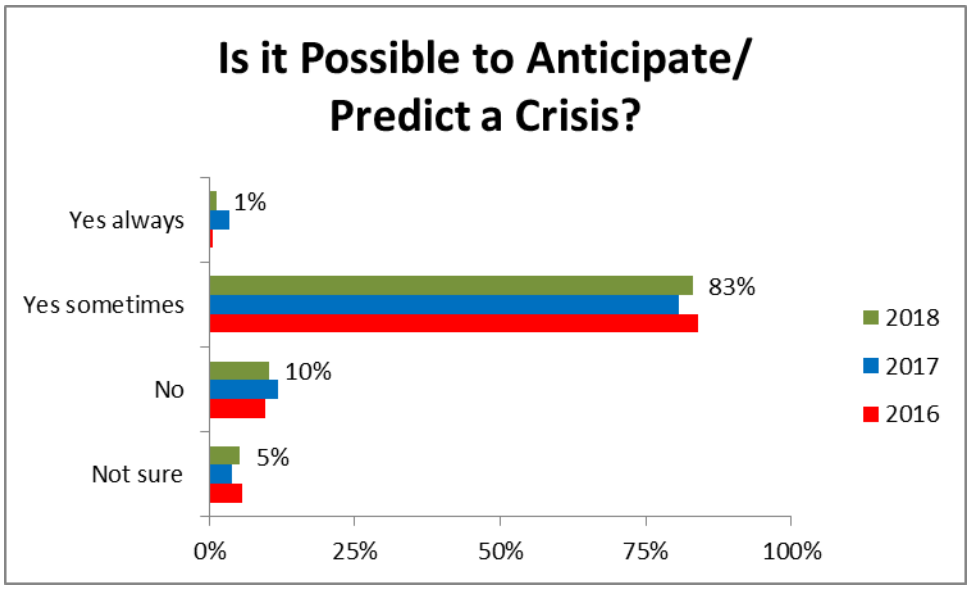


4.8 SECTION D: PREDICTIONS

Risk managers are becoming increasingly involved with tactical and strategic planning, and a part of that is developing scenarios. Consistent with past surveys, developing a range of outcomes is more important than predicting an accurate scenario. As risk managers become more aware of cognitive biases, they become more aware of potential bubbles and underpriced cash flow streams. When asked whether it is possible to anticipate/predict a crisis, most respondents (84%) stated that it is possible at least sometimes, as seen in Figure 54.

Figure 54: Whether It Is Possible to Anticipate/Predict a Crisis

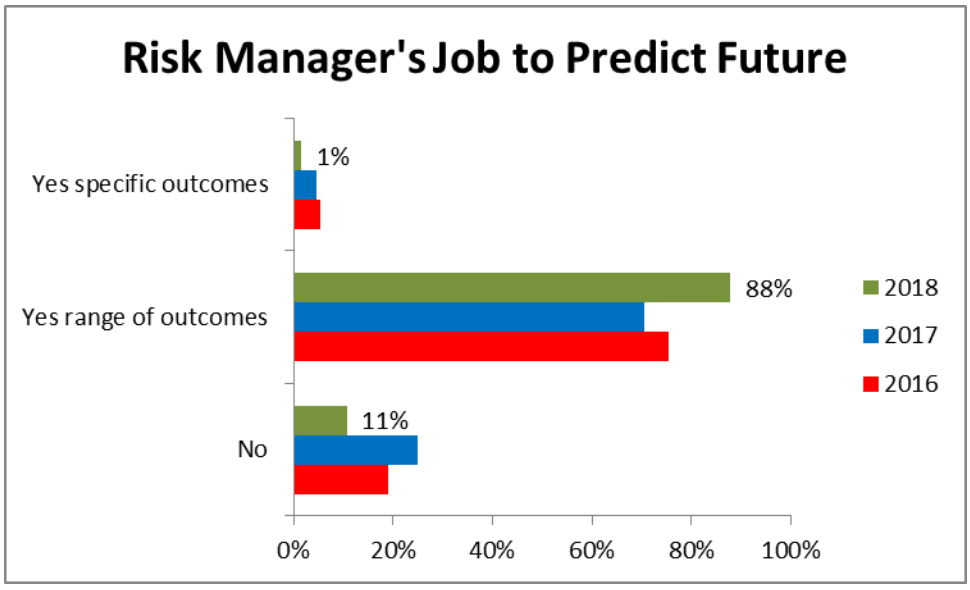
% of Responses



As shown in Figure 55, a majority (88%) said it was part of their job to predict a range of outcomes, up from 70% in the prior survey. This allows the risk manager to choose events that are plausibly adverse or deep in the tail depending on the desired level of risk being considered.

Figure 55: Whether It Is Risk Manager's Job to Predict Future

% of Responses



4.9 SECTION E: CURRENT TOPICS

More than a decade after the event, the 12th survey in this series continues to reflect on the period since the global crisis. The Current Topics section reflects this, showing changing expectations.

Asked their expectations about the global economy in 2019, respondents were a bit less positive than respondents the previous year, with 61% having a moderate and 30% a good outlook, as shown in Figure 56. Only 6% (up from 4%) had poor expectations. As can be seen in Figure 57, although the combined good and strong expectations slipped in 2018, they have been trending higher since 2009.

Figure 56: Expectations for the Global Economy

% of Responses in Given Year

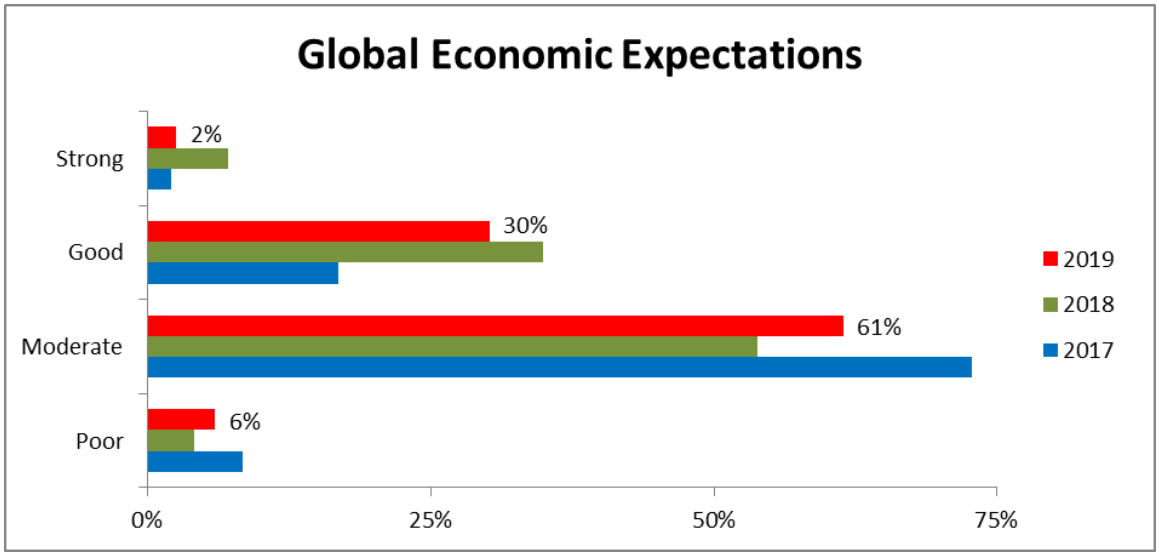
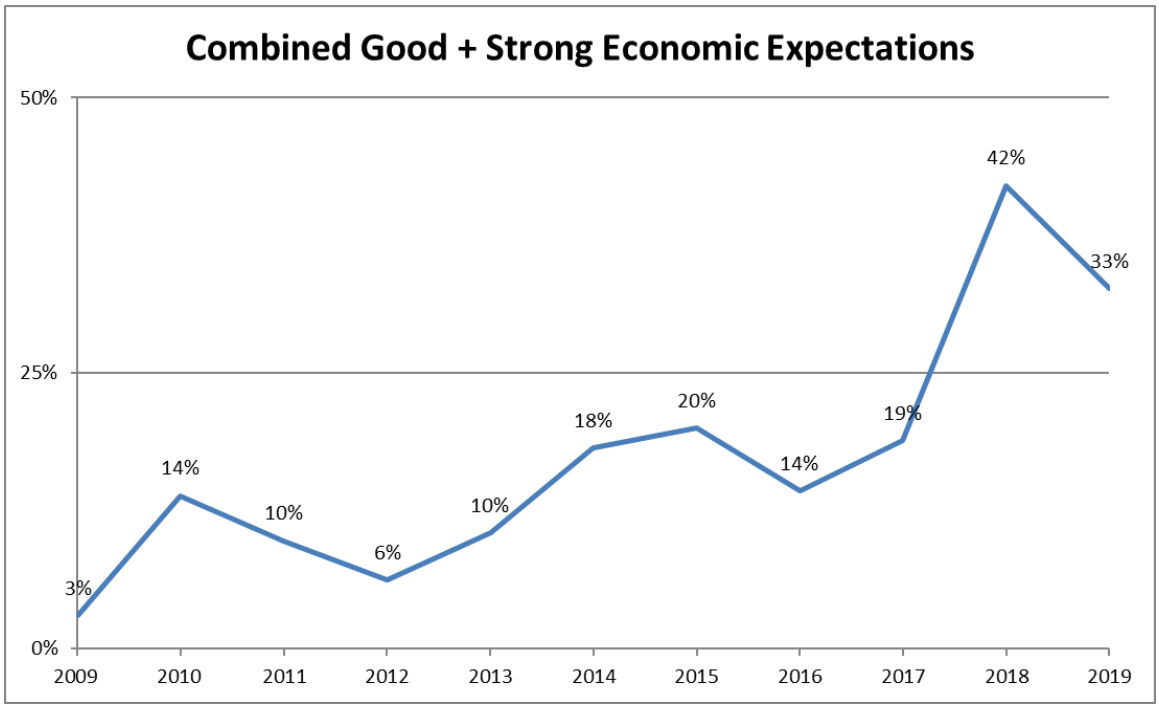


Figure 57: Combined Good and Strong Economic Expectations, 2009–2019

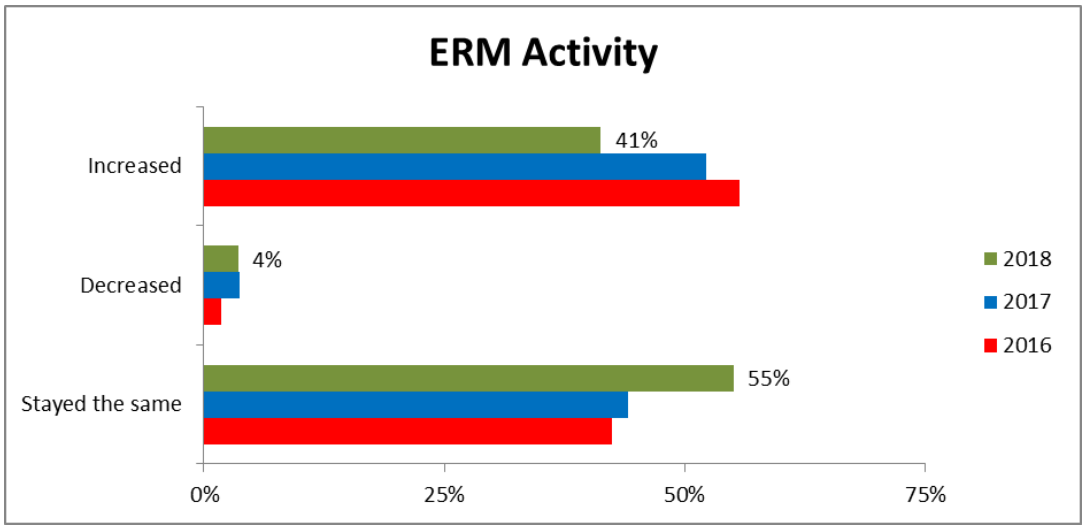
% of Responses in Given Year



Concerning the level of ERM activity, risk managers generally (55%) saw it stay the same in 2018, as shown in Figure 58.

Figure 58: Perceived Level of ERM Activity

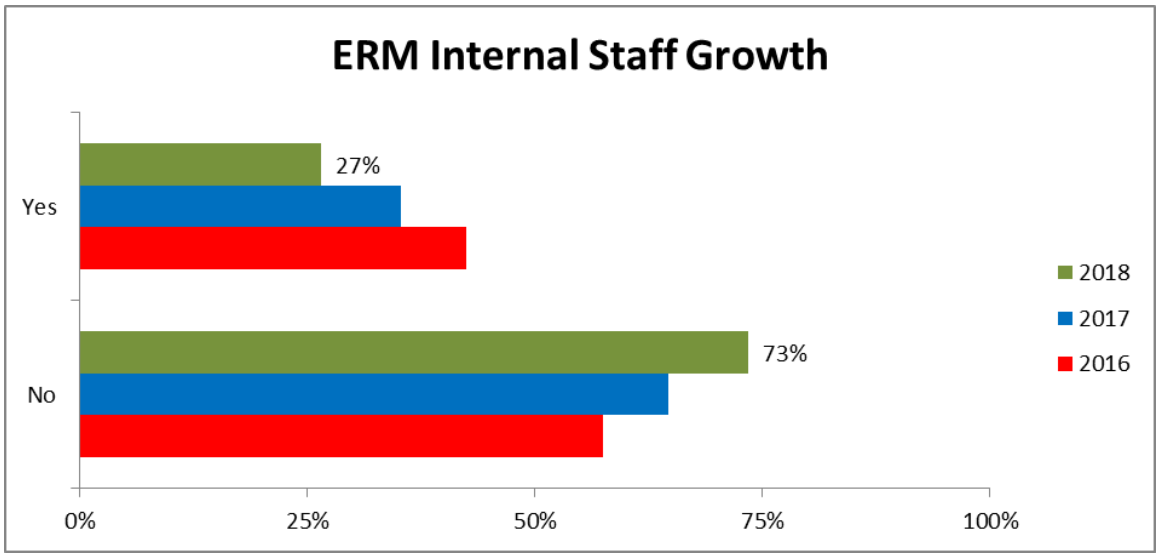
% of Responses in Given Year



Higher ERM activity led to internal staff growth for only 27% of the respondents in 2018, as shown in Figure 59. We seem to be entering an era where ERM is considered a cost center with a goal to reduce its size, at least until the next crisis.

Figure 59: ERM Internal Staff Growth

% of Responses in Given Year



In an effort to determine what types of *Cyber/networking infrastructure* activities were being added, the survey asked just that question. It's clear that there is limited standardization to date, but lots of effort is going into the process. Some of the interesting comments included the following:

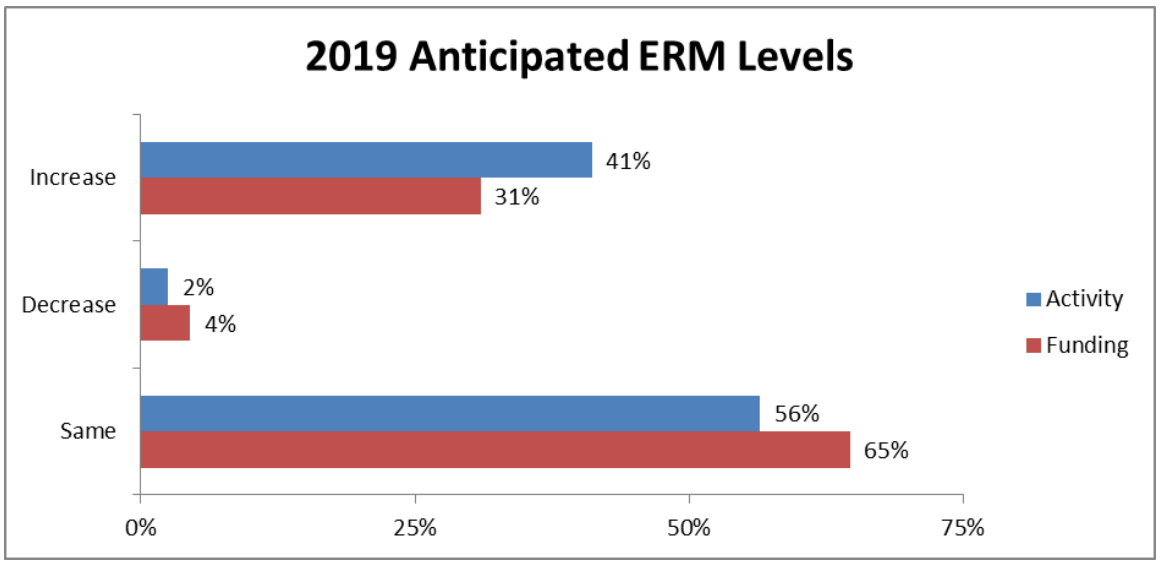
- *Phishing, denial of service*
- *Transactional fraud, hacker damaging systems, theft of client data*

- *Health insurer data breaches have had a lot of information. Severity (cost per record) is much more manageable and realistic than experts (e.g., Ponemon Institute).*
- *Rogue software (not an attack, but unintended consequences, or a bug)*
- *Cyberterrorism attack on energy or chemical facilities, attack on cloud service provider, malicious code attack, cyberstrike against state, major software flaws, etc.*
- *Most scenarios are focused on understanding point of entry weaknesses, potential cost of an event, and the company's ability to quickly react and contain.*
- *Internal threats and external bad actors*
- *Worm/virus attack*
- *Data breach/disruption/manipulation*
- *Medium to very large events, internally and externally sourced, and a wide range of reputation outcomes*
- *Attacks, loss of data or of integrity, or violation of privacy*
- *Theft of client data, unavailability of systems*

Respondents indicated whether they expected any change (increase or decrease) in activity and funding for ERM in 2019. Figure 60 combines the activity and funding responses for the upcoming year.

Figure 60: Anticipated Levels of ERM Activity and Funding in 2019

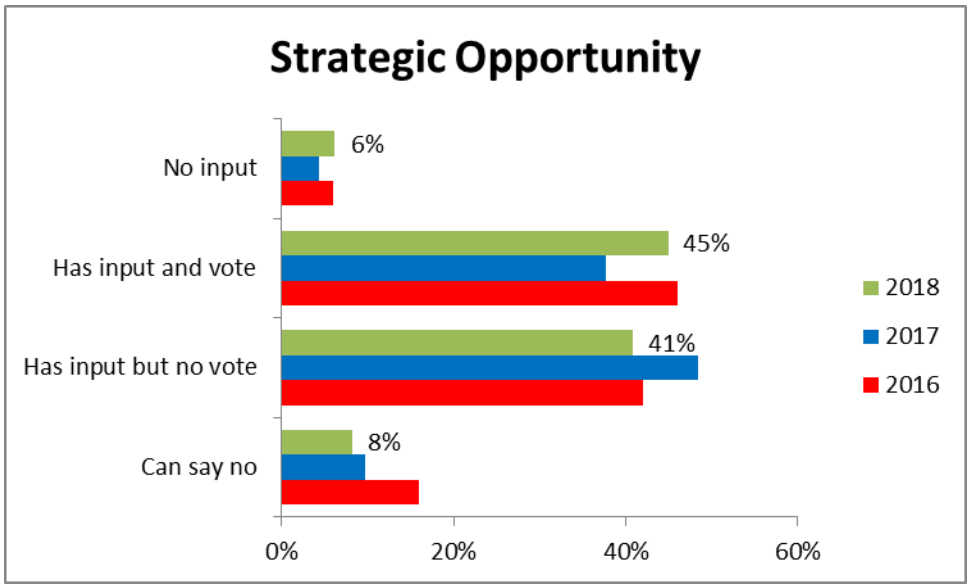
% of Responses to Given Question



The survey asked how the ERM team is used when a strategic opportunity is presented to a firm. As illustrated in Figure 61, while 94% of respondents said they can either say no to a strategic opportunity and/or have input, some still have no input. Companies are still trying to figure out the proper role of the risk manager, and it will likely vary based on the manager's skill set and the firm's risk culture and risk profile. Best practice incorporates the risk manager in decision making, as part of the senior team.

Figure 61: Use of ERM Team for a Strategic Opportunity

% of Respondents in Given Year



Respondents were asked to share examples of the ERM department being recognized following a risk event, either in a positive or negative way. Most of the examples showed proactive mitigation, while a few expressed concern that their attempts at risk mitigation were perceived as meddlesome by the business units.

- *During the significant property catastrophe activity of 2017, our ERM team received credit from management for having directed the purchase of additional reinsurance, given our assessment that the pricing made sense relative to our risk levels.*
- *ERM analyzed the enterprise risks of a specific large project independent of project development and presented to the risk committee. The risk committee decided that the project involved too much risk to continue and was canceled.*
- *We have developed a set of sensitivity tests that we run quarterly. Having these readily available helps address questions quickly when financial markets move. It has also allowed us to be more proactive in managing the business. This is recognized positively by senior management and the board.*
- *A shift deliberately toward introduction of recurring premium products to mitigate interest volatility was recognized positively.*
- *Resiliency funding strategy (that is, sources of liquidity in a stress scenario)*
- *Our ERM team performed a reputation risk assessment related to affiliating with external individual.*

Many risk managers view risk as two-sided, with opportunities drawn from the same tools and data sets used for risk mitigation. Identifying trends and leading indicators earlier than your competitors can provide an advantage. The survey asked which emerging "opportunities" are being monitored. In this survey, responses evolved beyond seeking out asset class opportunities to include natural hedges and cyber insurance. Here are some specific examples:

- *Swaps market to hedge future interest rate risk*
- *Natural hedges, inappropriate capital frameworks*

- *Reinsurance. We look to see if we can retain, or shed, risk as the prices dictate.*
- *Technology disruption*
- *Overreaction and mean reversion*
- *This is how we started writing cyber insurance—we felt the market was mispricing.*
- *Technology upside risk, major project upside*

Respondents were asked if they had identified bubbles. In the past some indicated that they believe there is no such thing as a bubble, but in this iteration of the survey many around the world chose their local housing market as a candidate. Debt of various kinds, including government, car, student, and collateralized assets, were suggested.

- *Real estate prices in Bay Area and Los Angeles are a bubble.*
- *Global debt levels, government debt, public pension underfunding, technology company valuations*
- *CLOs*
- *The "underwriting" cycle in health reinsurance still exists. This can be taken advantage of as a purchaser of reinsurance.*
- *College tuition. It is way too expensive for the benefits it provides students.*
- *On the ceded side, many classes of P/C reinsurance are still underpriced, so we are buying more than our competitors.*
- *Government-supported energy*
- *The Belt and Road Initiative that China is working on*
- *Housing in Colombia*
- *Car finance credit bubble*
- *Canadian housing market*
- *The Fed is trying to unwind a subsidized economy without bubbles bursting—unlikely to happen, bonds, equities with high levels of debt, highly levered countries, companies, individuals in general.*

Respondents were also asked to share an unknown known, where there is historical data but it is not predictive, along with how it is managed. Several referred to capital market issues during a severe downturn.

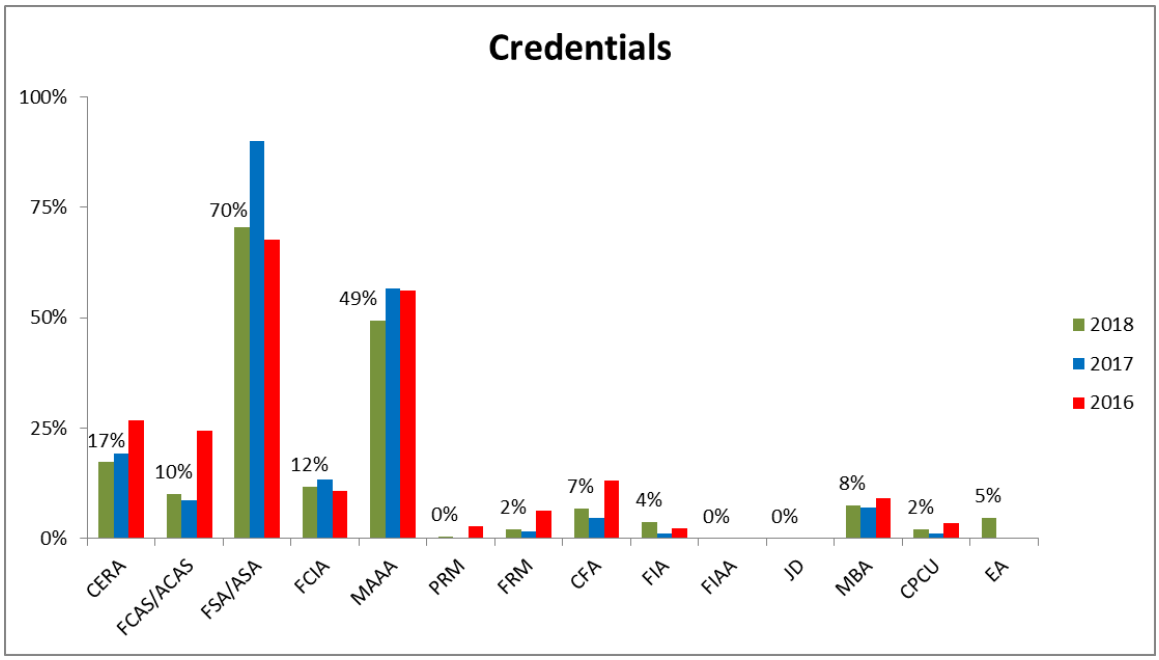
- *The availability and readiness of auction participants for liquidation purposes in a systemic risk event*
- *Most strategic risks are of this nature. Do scenario testing.*
- *Policyholder behavior—healthy lapsation, dynamic lapse*
- *Policyholder reaction to a severe economic event. Margins are held based on policyholders reacting in a way that negatively impacts the company, and scenario testing is completed to monitor the size and trend of this exposure.*
- *Monetary policy regime shifts—by various nations*
- *Mortality trends—how relevant is historical data to future? Rely on a mix of historical data, internal expertise, and conservatism.*
- *The possibility that the capital markets are temporarily interrupted or not functioning well over an extended period, mitigated by monitoring, war-gaming, asset/liability management, and established lines of credit.*
- *New riders on some products where there is no historic data. Manage through conservative pricing and monitoring of leading/lagging indicators.*
- *Morbidity improvement in LTC insurance*
- *Longevity improvements. Potential for significant change, likely longer. Unlikely to be as predicted by mortality improvement scales. Model for disruptive changes, such as doubling of life expectancy within a generation.*
- *Time horizon—climate change will force a review of insurance products with more than a five-year life.*

4.10 SECTION F: DEMOGRAPHICS

Each year, the *Survey of Emerging Risks* is distributed using targeted emails and social media. As noted elsewhere, pension and health practitioners were targeted in this survey only recently. For this survey, 38% reported filling out the survey in the past. The sponsor, the JRMS, was well represented in the survey, with 70% of respondents holding a credential from the SOA, 10% from the CAS and 12% from the CIA (see Figure 62). Other groups strongly represented were CFA charter holders (7%) and those with a master's degree in business administration (8%). Many respondents held multiple credentials.

Figure 62: Credentials Held by Respondents

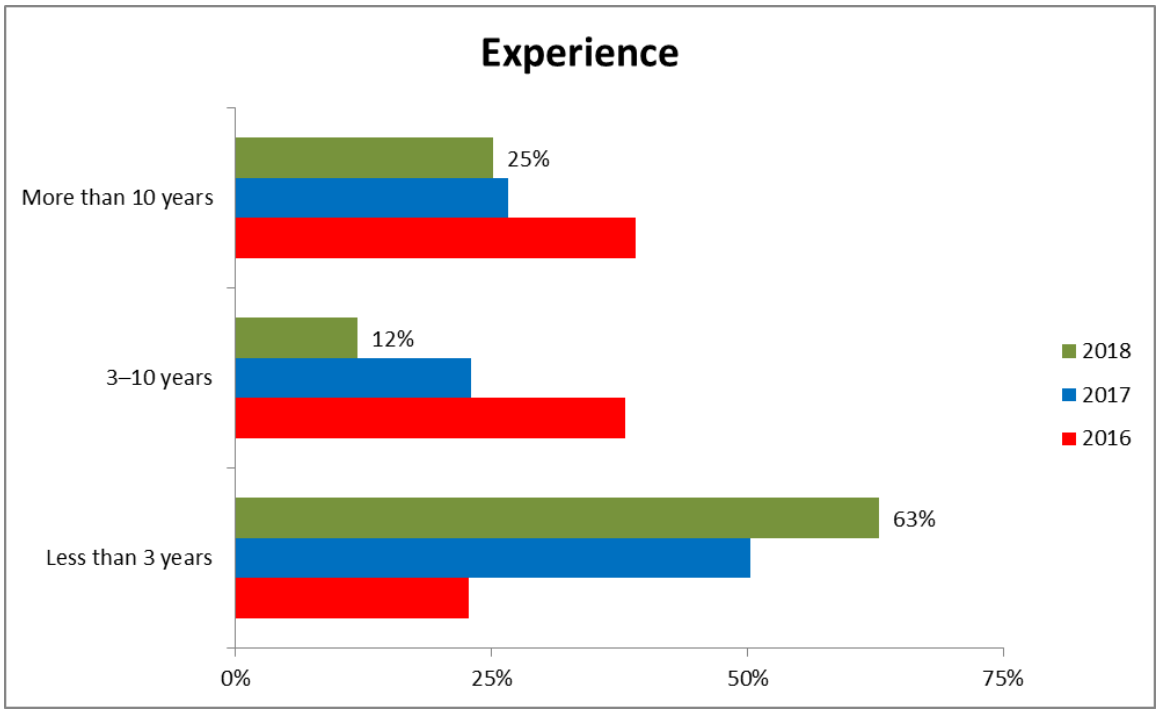
% of Responses in Given Year



This year's survey was completed by fewer experienced practitioners, with only 25% having more than 10 years of experience as risk managers (see Figure 63). The researcher is again indebted to respondents who share their experiences. Most respondents work at an insurer/reinsurer (49%) or consulting firm (23%).

Figure 63: Respondents' Risk Management Experience

% of Responses in Given Year



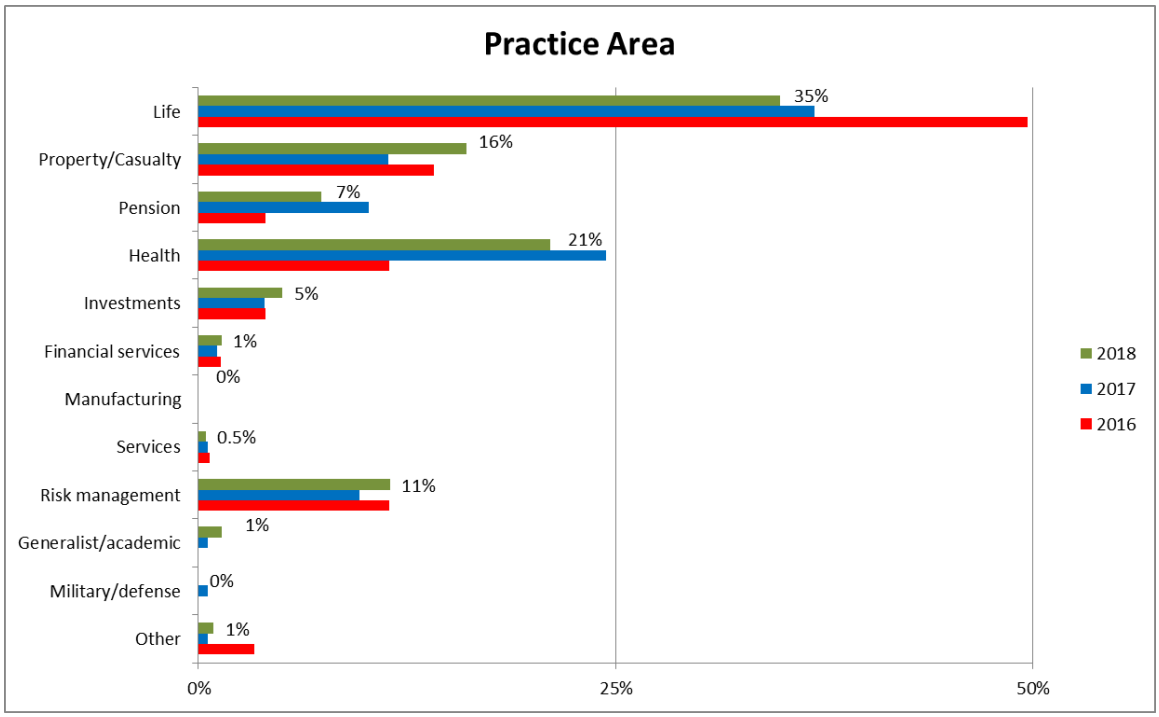
The survey was sent directly to all JRMS and INARM members, some targeted social media groups on LinkedIn and Twitter, and to the members of several SOA sections.

The survey continued to be dominated by North Americans (87%), with a significant minority coming from Europe (5%) and Asia (4%). This year, surveys were also completed by risk managers in the Middle Eastern, South American, Caribbean/Bermuda, and African regions.

As illustrated in Figure 64, the primary areas of practice this year were more spread out than in prior years, with life insurance (35%) and health (21%) having the highest percentages.

Figure 64: Respondents' Practice Areas

% of Responses in Given Year



A final survey question asked for sources respondents use to scan for emerging risks. While you are encouraged to read all of the responses for personal interest, many respondents shared newspapers, magazines (e.g., *The Economist, New England Journal of Medicine, The Actuary, National Geographic*), reinsurer and consultant publications, rating-agency reports, seminars, blogs, government agencies, professional actuarial organizations (e.g., the CAS, SOA and CIA) and the Risk Management Society. Some of the most interesting comments referred to the Berkshire Hathaway annual meeting and al Jazeera. This survey was referenced as a good source, meeting the hopes of the researcher.

4.11 WEF GLOBAL RISKS REPORT 2019

Consulting firms are among the many groups publishing risk surveys. One of the longest running is *The Global Risks Report 2019*, now in its 14th edition.[12] Its respondents are typically European business economists, and there is more analysis by the authors based on a separate workshop that they facilitate. It is a nice companion piece to this survey. Published in January, the survey portion is completed early in the prior year. It is a thought-provoking survey, providing potential solutions and scenarios, but does not trend results.

The WEF survey is presented in four sections; a description of the survey; a consideration of challenges where risks are evolving, along with a series of "Future Shocks" that discuss potential scenarios; a look back

[12] World Economic Forum, *The Global Risks Report 2019*, 14th ed., 2019. https://www.weforum.org/reports/the-global-risks-report-2019.

at risks written up previously, covering food system security, governance/civil society and infrastructure; and guest articles about balancing risks and the need for contrarian thought and diversity.

While not always the primary concepts discussed, what follows are some interesting one-off takeaways:

- The pace of biodiversity loss is accelerating; species abundance is down 60% since 1970.
- WEF survey looks only at downside risks.
- Women are more highly affected by risks: violence, discrimination, poverty, being primary providers (of child care, food, fuel, so they walk farther and have less ability to escape after natural disaster), jobs displaced by automation.
- Higher levels of carbon dioxide affect nutritional composition of staples (reduced zinc, protein, iron).
- Mental-health issues, especially for teenagers (more so for American girls), have increased since 1990.
- Latin America accounts for 8% of global population but 33% of its murders.
- Infectious diseases (Ebola, MERS, SARS, Zika, yellow fever, influenza, Nipah virus, malaria, dengue fever) require increased vigilance, but near-miss catastrophes are lulling us into complacency. A war game assumed stocks would be down 90% in a pandemic scenario.
- Synthetic biology using machine learning could help identify deadly mutations but must balance transparency with abilities of hostile actors.
- In many coastal locations, land subsidence (dropping) is occurring, as well as sea level rise.
- Sea-level rise costs as a percentage of GDP will vary widely—high in Kuwait, Bahrain, United Arab Emirates, Vietnam.
- Worst-case scenario of Gulf Coast hurricane and Brazilian rains could cut off half of global soybean supply.

Section 5: Future Recommendations

This survey should continue to use open-ended questions to learn from practitioners. Using the experience of the Project Oversight Group (POG) has worked well to develop questions and should continue. The survey should seek to expand distribution beyond North America and outside the insurance industry. The International Actuarial Association publicized the survey for the first time, and hopefully this partnership can continue and lead to other cross-networking opportunities. Here are specific suggestions made by the researcher, POG and respondents:

For 2019

- Change *Technology* to *Disruptive technology.*
- Add reference to insects (reduced biodiversity) in *Climate change* definition.
- Share examples of chronic diseases.
- Biodiversity
- Globalization shift/political uncertainty
- *Can we make it so all of the 23 risks appear on one screen? Can we show a progress bar?*
- *Review Section 1 Question 9 for medical costs and medical advances, tying in mortality and morbidity.*
- *Risks to consider: race, inequality, low interest rates*
- Rotating question: As a follow-up from the 2050 question, ask a multiple-choice question like “For your top long-term risk, would you expect to start acting in 5, 10, 15, 20, 25 years?”
- Review *Chronic diseases* definition to include morbidity and health care more broadly.
- *Climate change* definition should include pollution and ecosystem/biodiversity impact.
- *Interstate and civil war* can be broad (global) war.
- Take out Section D.
- Experience—add option “Not a risk manager.”
- For Figure 40 consider using a Stacked Area Chart, so it's easier to understand Total in relation to the components. Also, think about dropping the Remaining line, because (a) it goes to say that as more combinations are selected, combinations remaining is falling at the inverse rate, and (b) having the top lines cross rather than a 100% scale being filled is visually confusing.
- Consider question asking about systemic risk to their practice area
- change "have either" to "either have," so it says, "risks either have ... or have not ..." in the opening section of the survey
- Combinations table in Appendix II should be larger, perhaps rotated to a full page

Appendix I: Glossary of Risks

Initially, 23 core risks were defined by the World Economic Forum in *Global Risks 2007: A Global Risk Network Report*. An active link for the report can be found at https://www.mccombs.utexas.edu/~/media/Files/MSB/Centers/CRMI/GlobalRisks2007.pdf. What follows is an updated version for the *Survey of Emerging Risks* with a description of the current 23 risks.

Economic Risks

- Energy price shock—Energy prices change abruptly.
- Currency shock—Material disruptions to currency equilibrium.
- Chinese destabilization—China's economic growth slows, potentially as a result of protectionism, internal political or economic difficulties.
- Asset price collapse—The value of assets such as housing and equities collapses.
- Financial volatility—Price instability and extremes of sectors, including commodities, equities or interest rates.

Environmental Risks

- Climate change—Change in climate patterns generates both extreme events and gradual changes, impacting infrastructure, agricultural yields and human lives. (Drivers include, but are not limited to, space weather and human influence.)
- Loss of freshwater services—Water shortages impact agriculture, businesses and human lives.
- Natural catastrophe: tropical storms—Hurricanes and typhoons lead to disruption, catastrophic economic losses, and/or high human loss of life.
- Natural catastrophe: earthquakes—Strong seismic/volcanic activity leads to disruption, catastrophic economic losses and/or high human loss of life.
- Natural catastrophe: severe weather (except tropical storms)—Meteorological phenomena lead to disruption, catastrophic economic losses, and/or high human loss of life. Includes inland flooding, tornados, thunderstorms, drought, wildfires, high winds, snowstorms and dust storms.

Geopolitical Risks

- Terrorism—Attacks lead to disruption, catastrophic economic losses and/or high human loss of life.
- Weapons of mass destruction—Nuclear, biological, radiological or chemical technologies are held by unstable groups, leading to disruption, catastrophic economic losses and/or high human loss of life.
- Interstate and civil wars—Major interstate or civil wars erupt.
- Failed and failing states—The trend of a widening gap between order and disorder.
- Transnational crime and corruption—Corruption continues to be endemic, and non-state entities successfully penetrate the global economy.
- Globalization shift—Preference changes to imports and immigration. Countries retrench and become more nationalistic and protectionist, or open up their economies to outsiders. Inequality challenges the concept of fairness and egalitarianism.
- Regional instability—Certain unstable areas may cause widespread political and other crises.

Societal Risks

- Pandemics/infectious diseases—A pandemic emerges with high mortality/incidence of diseases such as HIV/AIDS, Ebola or influenza. Antimicrobial resistance becomes common.
- Chronic diseases—Diseases such as obesity, diabetes and cardiovascular become widespread.

- Demographic shift—Evolving populations (e.g., age, size, race, migration trends) drive changes in economic growth and levels of government intervention.
- Liability regimes/regulatory framework—Costs increase faster than GDP, with the spread of litigiousness and speed of regulatory revisions.

Technological Risks

- Cyber/network infrastructure—A major disruption of the availability, reliability and resilience of critical information infrastructure caused by cyber risks, terrorist attack or technical failure. Results are felt in major infrastructure: power distribution, water supply, transportation, telecommunication, emergency services and finance.
- Technology—Unintended consequences of technology lead to disruption and/or catastrophic economic losses (e.g., drones, self-driving cars, additive manufacturing, the internet of things, nanoparticles).

Evolution of Risks

The survey has attempted to maintain consistent risks as much as possible.

Spring 2008—23 risks generated by the WEF's *Global Risks 2007*

Fall 2008—No change to risks, minor changes to definition wording

2009—No changes

2010—Some definitional changes

- Changed *Oil price shock/energy supply interruptions* to *Oil price shock*
- Changed *US current account deficit/fall in US dollar* to *Fall in value of US$*
- Changed *Blow up in asset prices/excessive indebtedness* to *Blow up in asset prices*
- Changed *Middle East instability—The Israel–Palestine conflict and Iraqi civil war continue* to *Regional instability* (A variety of hot spots are prevalent around the world. These include the Middle East and the Korean Peninsula.)
- Changed *Infectious diseases in the developing world* to *Infectious diseases*
- Changed *Chronic disease in the developed world* to *Chronic disease*
- Changed *Emergence of risks associated with nanotechnology* to *Nanotechnology*

2011—More substantive changes, but with an attempt to maintain trends and simplify

- Moved *Fiscal crises caused by demographic shift* from Economic to Societal category and renamed it *Demographic shift*; updated trend data to make consistent going forward
- Added *Financial volatility—price instability of core products such as commodities, energy or currency* to Economic category
- Combined *Pandemic* and *Infectious diseases* to make *Pandemics/infectious diseases* (A pandemic emerges with high mortality/incidence of diseases such as HIV/AIDS spreads geographically.)

- Changed *Breakdown of critical information infrastructure (CII)* to *Cybersecurity/interconnectedness of infrastructure*
- Changed *Nanotechnology* (Studies indicate health impairment due to unregulated exposure to a class of commonly used nanoparticles—used in paint, nanocoated clothing, cosmetics or health care—exhibiting unexpected, novel properties and easily entering the human body.) to *Technology/space weather* (Health is impaired due to exposure to nanoparticles, unintended consequences of technology or disruptions caused by geomagnetic storms, meteorites and other phenomena originating from beyond the earth.)
- Changed definition of *International terrorism* from "Attacks disrupt economic activity, causing major human and economic losses. Indirectly, attacks aid retrenchment from globalization" to "Attacks disrupt economic activity, causing major human and economic losses."
- Changed the definition of *Regional instability* from "A variety of hot spots are prevalent around the world. These include the Middle East and the Korean peninsula" to "Certain unstable areas may cause widespread political and other crises. These include, but are not limited to, the Middle East and the Korean peninsula."
- Changed definition of *Liability regimes* from "U.S. liability costs rise by multiples of GDP growth, with litigiousness spreading to Europe and Asia" to "Liability costs rise by multiples of GDP growth, with the spread of litigiousness."

2012—No changes

2013—Changes to two definitions

- Changed *Natural catastrophe: inland flooding* to *Natural catastrophe: severe weather (except tropical storms)* and the definition to "Meteorological phenomena with the potential to cause significant economic losses, fatalities and disruption. Includes inland flooding from all causes, tornados, thunderstorms, drought, wildfires, high winds, snowstorms and dust storms."
- Changed *Liability regimes* to *Liability regime and regulatory framework*, and the definition to "Costs rise by multiples of GDP growth, with the spread of litigiousness and regulatory revisions."

2014—Changes to the names of two risks

- Changed *Fall in value of US$* to *Currency trend*
- Changed *Blow up in asset prices* to *Asset price collapse*

2015—Changes to the names of four risks

- Changed *Currency trend* to *Currency shock*
- Changed *Climate change* to *Climate change (includes space weather)*
- Changed *International terrorism* to *Terrorism*
- Changed *Technology/space weather* to *Technology* to reflect that space weather is a cause of cyclical climatic variations

2016—Changes to the names of two risks and updates to the definitions of eight risks, mainly to adopt a consistent method of describing the negative results of a risk. Definition changes were meant to add clarity. Specifically, *Demographic shift* added migration as a specific factor

- Changed definition of *Natural catastrophe: tropical storms* from "A hurricane or typhoon passes over heavily populated areas, leading to catastrophic economic losses and/or high human death tolls" to "A hurricane or typhoon leads to disruption, catastrophic economic losses, and/or high human loss of life."
- Changed *Natural catastrophe: earthquakes* from "Strong earthquake(s) occurs in heavily populated areas" to "Strong earthquake(s)/volcanic eruptions lead to disruption, catastrophic economic losses and/or high human loss of life."
- Changed *Natural catastrophe: severe weather (except tropical storms)* from "Meteorological phenomena with the potential to cause significant economic losses, fatalities and disruption. Includes inland flooding from all causes, tornados, thunderstorms, drought, wildfires, high winds, snowstorms and dust storms" to "Meteorological phenomena lead to disruption, catastrophic economic losses, and/or high human loss of life. Includes inland flooding, tornados, thunderstorms, drought, wildfires, high winds, snowstorms and dust storms."
- Changed *Terrorism* from "Attacks disrupt economic activity, causing major human and economic losses" to "Attacks lead to disruption, catastrophic economic losses, and/or high human loss of life."
- Changed both name and definition—from *Proliferation of weapons of mass destruction (WMD)*—"Treaty on the Nonproliferation of Nuclear Weapons is no longer effective, leading to the spread of nuclear technologies" to *Weapons of mass destruction*—"Nuclear, biological, radiological and chemical technologies are held by unstable groups, leading to disruption, catastrophic economic losses, and/or high human loss of life."
- Changed *Demographic shift* from "Aging populations in developed economies drive economic stagnation by forcing governments to raise taxes or borrow" to "Evolving populations (e.g., age, size, migration trends) drive economic stagnation and government interventions."
- Changed both name and definition from *Cybersecurity/interconnectedness of infrastructure*—"A major disruption of the availability, reliability and resilience of a critical information infrastructure caused by cybercrime, terrorist attack or technical failure. Results are felt in the major infrastructure: power distribution, water supply, transportation, telecommunication, emergency services and finance" to *Cyber/interconnectedness of infrastructure*—"A major disruption of the availability, reliability and resilience of critical information infrastructure caused by cyber risks, terrorist attack or technical failure. Results are felt in major infrastructure: power distribution, water supply, transportation, telecommunication, emergency services, and finance." Previous surveys had noted that cybersecurity did not cover all cyber risks.
- Changed *Technology* from "Health is impaired due to exposure to nanoparticles or unintended consequences of technology" to "Includes drones, self-driving cars, additive manufacturing (3-D printing), the internet of things, exposure to nanoparticles, or other unintended consequences of technology that lead to disruption and/or catastrophic economic losses."

2017—Changes to the names of two risks and update to the definitions of seven risks, partly to show risk as two-sided

- Changed both name and definition from *Climate change (includes space weather)*—"Climate change generates both extreme events and gradual changes, impacting infrastructure, agricultural yields and human lives. (Drivers are unspecified; examples include space weather and human influence.)" to *Climate change*—"Change in climate patterns generates both extreme events and gradual changes, impacting infrastructure, agricultural yields and human lives. (Drivers include, but are not limited to, space weather and human influence.)"
- Changed the definition of *Natural catastrophe: tropical storms* from "A hurricane or typhoon leads to disruption, catastrophic economic losses, and/or high human loss of life" to "Hurricanes and typhoons lead to disruption, catastrophic economic losses, and/or high human loss of life."
- Changed the definition of *Natural catastrophe: earthquakes* from "Strong earthquake(s)/volcanic eruptions lead to disruption, catastrophic economic losses, and/or high human loss of life" to

"Strong earthquake(s)/seismic activity lead to disruption, catastrophic economic losses, and/or high human loss of life."

- Changed the definition of *Weapons of mass destruction* from "Nuclear, biological, radiological and chemical technologies are held by unstable groups, leading to disruption, catastrophic economic losses, and/or high human loss of life" to "Nuclear, biological, radiological or chemical technologies are held by unstable groups, leading to disruption, catastrophic economic losses, and/or high human loss of life."
- Changed both the name and definition from "*Retrenchment from globalization*—Rising concerns about cheap imports and immigration sharpen protectionism in developed countries. Countries become more nationalistic and state-oriented" to "*Globalization shift*—Preference changes to imports and immigration. Countries retrench and become more nationalistic and protectionist, or open up their economies to outsiders."
- Changed the definition of *Demographic shift* from "Evolving populations (e.g., age, size, migration trends) drive economic stagnation and government interventions" to "Evolving populations (e.g., age, size, migration trends) drive changes in economic growth and levels of government intervention."
- Changed the definition of *Technology* from "Includes drones, self-driving cars, additive manufacturing (3-D printing), the internet of things, exposure to nanoparticles, or other unintended consequences of technology that lead to disruption and/or catastrophic economic losses" to "Unintended consequences of technology leads to disruption and/or catastrophic economic losses (e.g., drones, self-driving cars, additive manufacturing, the internet of things, exposure to nanoparticles)."

2018—Changes to the names of two risks and update to the definitions of six risks

- Changed definition for *Natural catastrophe: earthquakes* to reflect seismic/volcanic activity rather than earthquake/seismic to clarify that volcanic activity should be included with this risk
- Changed name from *Chinese economic hard landing* to *Chinese destabilization*.
- Changed definition of *Transnational crime and corruption* to refer to non-state entities rather than organized crime
- Definition of *Globalization shift* adds Inequality challenges the concept of fairness and egalitarianism.
- Definition of *Pandemics/infectious diseases* expanded to include Antimicrobial resistance becomes common.
- Definition of *Demographic shift* adds race as an example of an evolving population.
- Changed name of *Cyber/interconnectedness of infrastructure* to *Cyber/network infrastructure*.
- Changed definition of *Technology* to list nanoparticles rather than exposure to nanoparticles.

Appendix II: 12th Survey Results (Compiled Fall 2018)

This appendix includes the survey as well as the responses. There were 267 respondents. Not all of the respondents answered every question. The percentages reflect the number of responses received divided by the number who answered the specific question. Some totals may not add to 100% due to rounding. All tables of response percentages include the most recent results, starting with the current survey and working backward through the given number of surveys.

Responses to open-ended questions have been lightly edited, but original intent is unchanged. Occasionally a comment is highlighted using boldface type to reflect those the researcher found particularly thought-provoking. Comments are identified using *italics.*

The following text introduced the survey to recipients via email. The survey as seen by the respondents is highlighted in green.

The Joint Risk Management Section, sponsored by the Casualty Actuarial Society, the Canadian Institute of Actuaries and the Society of Actuaries, is conducting an online survey to help understand individual risk managers' perspectives on emerging risks. We value your insights and invite you to participate in this annual survey.

Please complete this survey by Nov. 19. It should take about 15 minutes to complete. We hope you will share your thoughts and experiences in comment boxes. Responses from more than one risk manager within the same company are encouraged. All responses are anonymous.

If you have questions about the survey, please contact Jan Schuh at jschuh@soa.org.

Thank you for your participation.

Once inside the survey, the respondent is greeted with the following.

Emerging risks have either not previously occurred or have not occurred for so long that they are not considered possible. The lack of credible historical data creates a formidable challenge for risk managers. While completing the survey, please consider a time horizon that extends beyond a business plan time frame (often 3–5 years).

This survey is sponsored by the Joint Risk Management Section (Canadian Institute of Actuaries, Casualty Actuarial Society, and Society of Actuaries). The complete results will be available at www.soa.org.

Responses are anonymous and multiple responses from an organization are encouraged.

As you complete the six sections of the survey, keep in mind that you cannot use the "back" button in your browser to review prior answers. Use the "Previous" button at the bottom of each page to navigate back to already answered questions. Upon completion of the survey, you will be provided a printable report of your survey responses. If you are having challenges entering information in the survey, please clear the browsing history as it may resolve the issue. Also, make sure that the open text boxes are your responses when answering.

Please respond no later than **Nov. 19, 2018**.

A glossary of terms is available for reference: Glossary of risks 2018. [This is Appendix I.]

Thanks for participating!

****

The following data is not presented to the respondents but is useful in the analysis since recency bias has been identified as a contributing factor to the results.

Macroeconomic Trends

Survey Date	S&P 500	Oil price ($ per barrel)	EUR/USD
Spring 2008	1,385.59	113.70	1.56
Fall 2008	968.75	68.10	1.27
Fall 2009	1,106.41	77.04	1.48
Fall 2010	1,176.19	84.49	1.40
Fall 2011	1,131.42	78.93	1.34
Fall 2012	1,440.67	92.18	1.29
Fall 2013	1,681.55	102.36	1.35
Fall 2014	1,972.29	91.17	1.26
Fall 2015	2,079.36	46.60	1.10
Fall 2016	2,126.15	46.83	1.10
Fall 2017	2,575.26	54.36	1.16
Fall 2018	2,711.74	65.31	1.14

Sources:
S&P 500 https://fred.stlouisfed.org/series/SP500
Oil price ($ per barrel) http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D
EUR/USD http://www.federalreserve.gov/releases/h10/Hist/dat00_eu.htm

The initial survey was completed in April 2008, soon after Bear Stearns lost its independence. At that time, the S&P 500 stood at 1,385.59, the price of a barrel of oil was $113.70, and one euro cost $1.56. The price of oil was high, the stock markets were at then record levels, and the dollar was cheap relative to the euro. The table had been set for the financial crisis that was soon to follow. Today's survey reflects a doubling of the S&P 500 and much lower prices for oil and the dollar relative to the euro.

Default Question Block

Previous surveys have found that respondents tend to be anchored in the present with their responses. It is thought that knowledge of that tendency will help you understand and compensate for it, so we will start by asking you about today's risks. The following questions will ask you to identify current and emerging risks that you expect to have the greatest strategic impact currently and in the future.

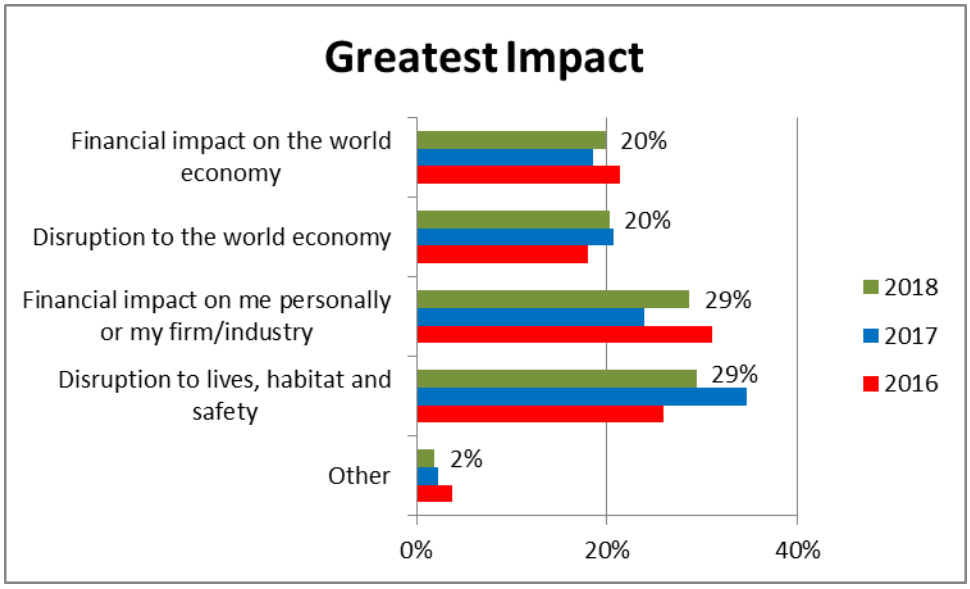
The original list of risks was developed by the World Economic Forum (WEF) for their inaugural Global Risks Survey. There is a balance required between keeping the list current and being able to show trends. The

WEF has aggressively updated its list of risks, despite a stated time horizon of 10 years, and the current report includes about 30 risks across the same five categories. The *Survey of Emerging Risks* has tried to maintain stability for trending purposes, although the list has evolved over time.

Question 1. Greatest strategic impact related to risk can have various meanings. How do you define it?

262 total responses

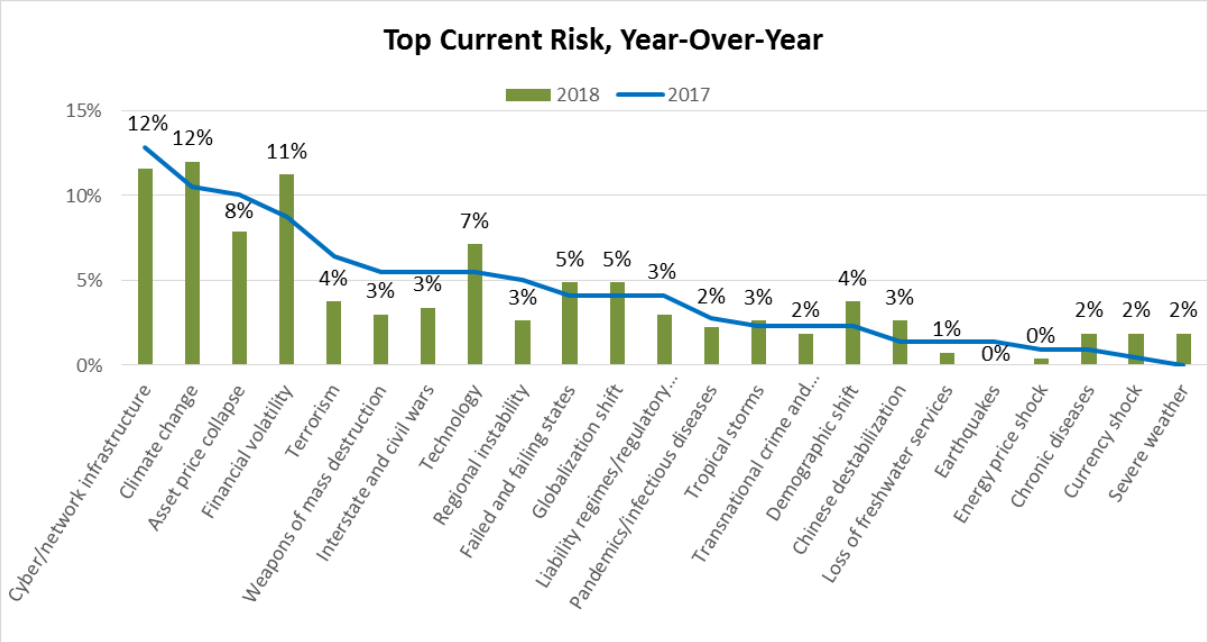
- 52 responses (20% in 2018 survey/18% in 2017 survey/21% in 2016 survey) Financial impact on the world economy
- 53 responses (20%/21%/18%) Disruption to the world economy
- 75 responses (29%/24%/31%) Financial impact on me personally or my firm/industry
- 77 responses (29%/35%/26%) Disruption to lives, habitat and safety
- 5 responses (2%/2%/4%) Other
    - *Financial impact on the US economy*
    - *Disruption to world society, of which the natural environment and the economy are two components*
    - *The fast moving of technology and "discruption" to the way people live, work, entertain and interaction with others*
    - *A risk that would change the strategy set for an entity*



Question 2. What is the risk that currently has the greatest impact? (Please select one.)

The 23 risks shown have been adapted from those developed by the World Economic Forum in 2007. (Ed. note: Detailed definitions of these risks can be found in Appendix I, along with how the definitions have evolved over time.)

In the following tables of responses, when previous results were above 2%, **boldface** is used to indicate a five percentage point increase or doubling, and *italics* indicate a five percentage point decrease or halving. The leading responses are numbered 1 through 5 to the left of the terms for those risks.



267 total responses

Economic—64 responses (24%/22%/27%/33%/39% in 2018/2017/2016/2015/2014)

• 1 response	(0%/1%/2%/4%/4%)		Energy price shock
• 5 responses	(2%/0%/0%/2%/1%)		Currency shock
• 7 responses	(3%/1%/2%/4%/4%)		Chinese destabilization
• 21 responses	(8%/10%/10%/10%/17%)	4	Asset price collapse
• 30 responses	(11%/9%/12%/12%/14%)	3	Financial volatility

Environmental—46 responses (17%/16%/13%/15%/10%)

• 32 responses	(12%/11%/10%/8%/6%)	1	Climate change
• 2 responses	(1%/1%/1%/2%/1%)		Loss of freshwater services
• 7 responses	(3%/2%/0%/1%/1%)		Natural catastrophe: tropical storms
• 0 responses	(0%/1%/0%/1%/1%)		Natural catastrophe: earthquakes
• 5 responses	(2%/0%/1%/3%/2%)		Natural catastrophe: severe weather

Geopolitical—65 responses (24%/33%/29%/19%/24%)

• 10 responses	(4%/6%/6%/6%/8%)	Terrorism
• *8 responses*	*(3%/6%/4%/2%/1%)*	*Weapons of mass destruction*
• *9 responses*	*(3%/6%/4%/4%/2%)*	*Interstate and civil wars*

• 13 responses	(5%/4%/5%/2%/5%)		Failed and failing states
• 5 responses	(2%/2%/1%/0%/0%)		Transnational crime and corruption
• 13 responses	(5%/4%/8%/1%/1%)		Globalization shift
• 7 responses	(3%/5%/0%/4%/7%)		Regional instability

Societal—29 responses (11%/10%/9%/12%/15%)

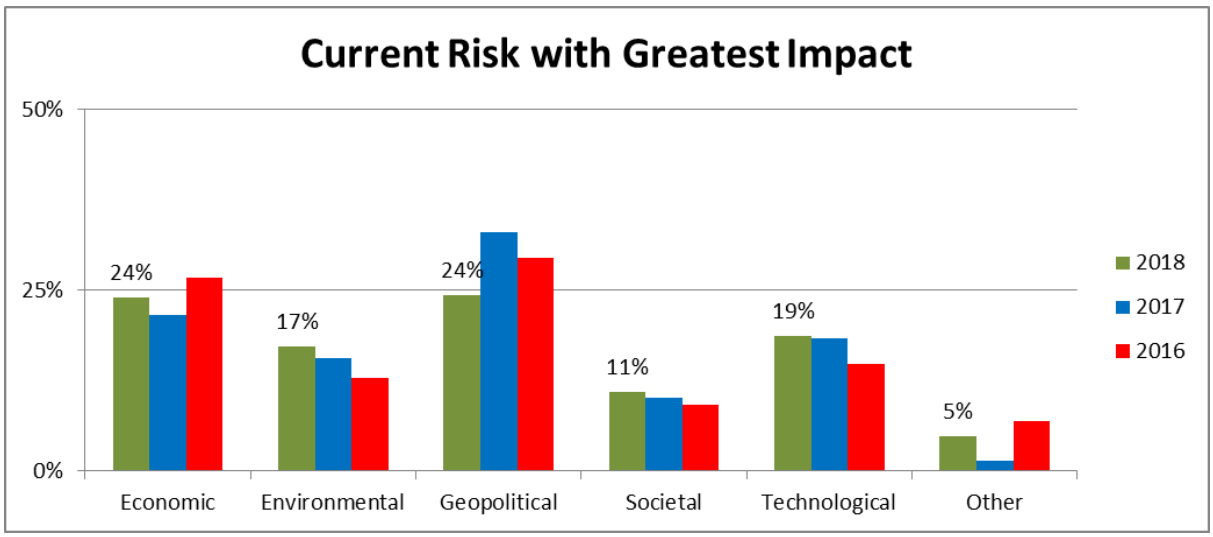
• 6 responses	(2%/3%/4%/3%/8%)		Pandemics/infectious diseases
• 5 responses	(2%/1%/0%/0%/0%)		Chronic diseases
• 10 responses	(4%/2%/2%/3%/2%)		Demographic shift
• 8 responses	(3%/4%/3%/5%/5%)		Liability regimes/regulatory framework

Technological—50 responses (19%/18%/15%/18%/6%)

• 31 responses	(12%/13%/11%/15%/6%)	2	Cyber/network infrastructure
• 19 responses	(7%/6%/4%/3%/0%)	5	Technology

Other—13 responses (5%/1%/7%/3%/6%)

- *Donald Trump*
- *Trump and the dissipation of U.S. leadership in the world*
- *Policyholder Behavior Risk*
- *Increasing political instability worldwide*
- *Political conflicts*
- *Political uncertainty*
- *Instability in the USA and other nations (e.g., Turkey, Philippines)*
- *Trumpism*
- *Natural catastrophes; catastrophic fires*
- *Two items: first, massive change and disruption in the U.S. health industry with actuaries tied to old business models; second, rising partisan politics/extremism fed by things like technology and fear*
- *Government policies*
- *Economic instability*
- *Socialism*



The categories of risks having the current greatest impact were:

- Economic 24%/22%/27%/33%/39% in 2018/2017/2016/2015/2014
- Environmental 17%/16%/13%/15%/10%
- Geopolitical 24%/33%/29%/19%/24%
- Societal 11%/10%/9%/12%/15%
- Technological 19%/18%/15%/18%/6%
- Other 5%/1%/7%/3%/6%

Section A: Emerging Risks

Question 1. Please choose up to five (5) emerging risks that you feel will have the greatest strategic impact in the future.

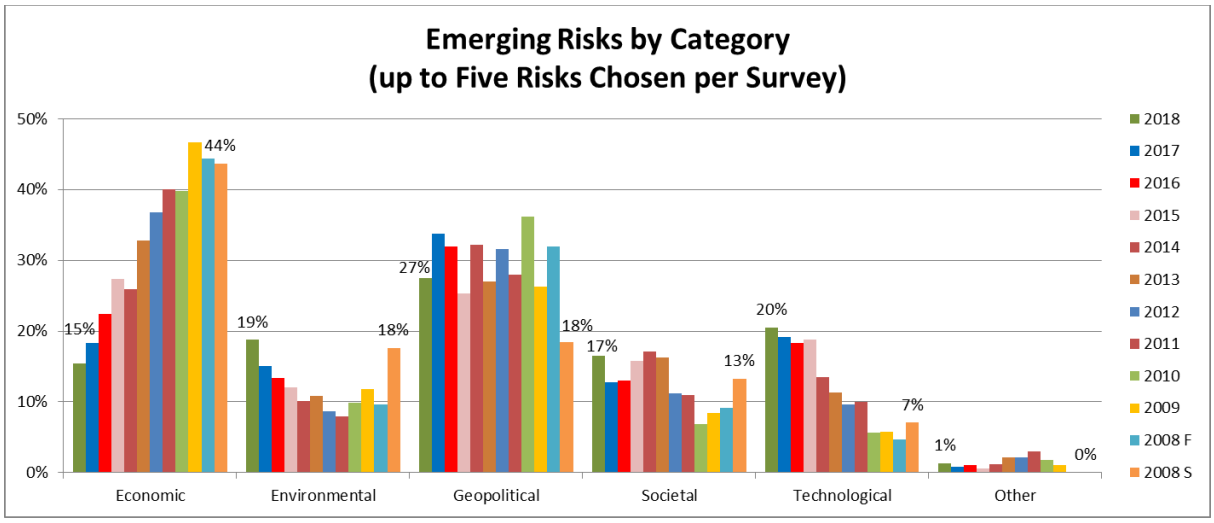
1,216 total responses from 260 surveys

Average of 4.68 risks selected per survey (4.73 in prior survey)

Divisor in percentages for major categories is 1,216; for individual risks, it is 260. Note that, due to multiple responses, the sum of all percentages will be materially greater than 100%.

Number of responses selected (maximum of 5):

- 1: 5 surveys (2%)
- 2: 2 surveys (1%)
- 3: 13 surveys (5%)
- 4: 32 surveys (12%)
- 5: 208 surveys (80%)



Economic—188 responses (15%/18%/22%/27%/26%/33%/37%/40%/40%/47%/44%/44% in November 2018, November 2017, November 2016, November 2015, October 2014, October 2013, October 2012, October 2011, October 2010, December 2009, November 2008, April 2008, usually listed as 2018/2017/2016/2015/2014/2013/2012/2011/2010/2009/F2008/S2008)

• 15 responses	(6%/5%/10%/14%/13%/7%/31%/32%/40%/45%)		Energy price shock
• 17 responses	(7%/7%/10%/14%/7%/27%/26%/25%/49%/66%)		Currency shock
• 38 responses	(15%/16%/17%/25%/27%/28%/31%/32%/41%/33%)		Chinese destabilization
• *49 responses*	*(19%/30%/26%/31%/31%/30%/24%/22%/31%/49%)*		*Asset price collapse*
• 69 responses	(27%/29%/43%/45%/44%/59%/62%/68%)	5	Financial volatility

Environmental—228 responses (19%/15%/13%/12%/10%/11%/9%/8%/10%/12%/10%/18%)

• 128 responses	**(49%/29%/28%/26%/19%/16%/20%/14%/25%/27%)**	**2**	**Climate change**
• 34 responses	(13%/11%/9%/8%/8%/9%/11%/6%/9%/10%)		Loss of freshwater services
• *20 responses*	*(8%/16%/8%/6%/5%/8%/6%/5%/4%/8%)*		*Natural catastrophe: tropical storms*
• 15 responses	(6%/6%/9%/7%/5%/6%/2%/6%/5%/7%)		Natural catastrophe: earthquakes
• 31 responses	(12%/10%/9%/10%/11%/11%/1%/4%/2%/5%)		Natural catastrophe: severe weather

Geopolitical—334 responses (27%/34%/32%/25%/32%/27%/32%/28%/36%/26%/32%/18%)

• *61 responses*	*(23%/41%/39%/37%/41%/27%/28%/20%/43%/30%)*	*Terrorism*
• *34 responses*	*(13%/21%/9%/8%/9%/5%/14%/9%/18%/14%)*	*Weapons of mass destruction*

• 47 responses	(18%/19%/16%/19%/19%/13%/14%/10%/10%/9%)		Interstate and civil wars
• 64 responses	**(25%/14%/21%/18%/28%/29%/33%/42%/38%/18%)**		**Failed and failing states**
• 30 responses	(12%/14%/10%/5%/10%/8%/5%/3%/12%/7%)		Transnational crime and corruption
• 51 responses	(20%/20%/30%/6%/8%/13%/13%/11%/25%/18%)		Globalization shift
• 47 responses	*(18%/31%/26%/26%/37%/29%/42%/32%/25%/28%)*		*Regional instability*

Societal—201 responses (17%/13%/13%/16%/17%/16%/11%/11%/7%/8%/9%/13%)

• 65 responses	**(25%/14%/16%/17%/30%/19%/12%/13%/22%/30%)**		**Pandemics /infectious diseases**
• 21 responses	(8%/8%/6%/8%/5%/3%/3%/2%/4%/4%)		Chronic diseases
• 83 responses	**(32%/23%/24%/26%/23%/30%/30%/30%/26%/27%)**	**4**	**Demographic shift**
• 32 responses	(12%/16%/15%/24%/22%/23%/8%/7%/6%/6%)		Liability regimes/regulatory framework

Technological—198 responses (20%/19%/18%/19%/14%/11%/10%/10%/6%/6%/5%/7%)

• 145 responses	(56%/53%/53%/65%/58%/47%/40%/38%/23%/21%)	1	Cyber/network infrastructure
• 104 responses	(40%/38%/34%/24%/5%/5%/6%/5%/4%/7%)	3	Technology

Other—16 responses (6%/1%/1%/1%/1%/2%/2%/3%/2%/1%/4%/4%)

- *Donald Trump*
- *Increasing wealth inequality*
- *Trump*
- *Threats to the power grid*
- *Political uncertainty*
- *Human population size & President Trump of USA*
- *Insufficient source of energy*
- *Global war*
- *Human behavioral changes*
- *Not sure how this is different from previous. So, massive change in U.S. health system, partisan politics/extremism. Plus various illnesses that are different for each country (you should not have listed chronic as an issue—chronic diseases (in U.S. definition) have enough attention and mostly already under way (I assume AIDS in Africa is not chronic, nor is drinking and related illnesses in Russia)*
- *Fundamentalism in religions*
- *Stupid country leaders (e.g., Trump)*
- *Ability to find qualified workforce*
- *Growth of nationalism*
- *Economic instability*
- *Socialism*

Another way to review this data is as a percentage of the total responses. For example, *Climate change* had 128 responses in this survey. In the previous analysis just shared, 128/260 = 49%. In the following tables, we will look at 128/1,216 = 11% and compare the results with the average across all of the surveys and against other questions in the current survey. **Bold** signifies higher than the average in the current survey, and *italics* signifies lower than the average.[13]

Results are presented with the average across all 12 surveys first, then listing each result starting with the most recent survey.

Economic (33% average—15%/18%/22%/27%/26%/33%/37%/40%/40%/47%/43%/42%)

- *5%—1%/1%/2%/3%/3%/2%/6%/7%/9%/10%/8%/13%* — *Energy price shock*
- *6%—1%/1%/2%/3%/1%/6%/5%/6%/10%/14%/10%/9%* — *Currency shock*
- *6%—3%/3%/4%/5%/6%/6%/7%/7%/9%/7%/6%/9%* — *Chinese destabilization*
- *7%—4%/6%/5%/6%/7%/7%/5%/5%/6%/10%/14%/5%* — *Asset price collapse*
- *10%—6%/6%/9%/9%/9%/13%/13%/15%* — *Financial volatility*

Environmental (12%—19%/15%/13%/12%/10%/11%/9%/8%/10%/12%/9%/17%)

- **6%—11%/6%/6%/6%/4%/4%/4%/3%/5%/6%/5%/9%** — **Climate change**
- **2%—3%/2%/2%/2%/2%/2%/2%/1%/2%/2%/2%/3%** — **Loss of freshwater services**
- 2%—2%/3%/2%/1%/1%/2%/1%/1%/1%/2%/1%/2% — Natural catastrophe: tropical storms
- 1%—1%/1%/2%/1%/1%/1%/0%/1%/1%/1%/1%/2% — Natural catastrophe: earthquakes
- **1%—3%/2%/2%/2%/2%/2%/0%/1%/0%/1%/0%/1%** — **Natural catastrophe: severe weather**

Geopolitical (29%—27%/34%/32%/25%/32%/27%/32%/28%/36%/26%/31%/18%)

- *7%—5%/9%/8%/8%/9%/6%/6%/4%/9%/6%/6%/4%* — *Terrorism*
- 3%—3%/4%/2%/2%/2%/1%/3%/2%/4%/3%/3%/4% — Weapons of mass destruction
- **3%—4%/4%/3%/4%/4%/3%/3%/2%/2%/2%/2%/3%** — **Interstate and civil wars**
- 5%—5%/3%/4%/4%/6%/6%/7%/9%/8%/4%/6%/2% — Failed and failing states
- 2%—2%/3%/2%/1%/2%/2%/1%/1%/3%/2%/2%/2% — Transnational crime and corruption
- 4%—4%/4%/6%/1%/2%/3%/3%/2%/5%/4%/5%/2% — Globalization shift
- *6%—4%/7%/5%/6%/8%/6%/9%/7%/5%/6%/7%/1%* — *Regional instability*

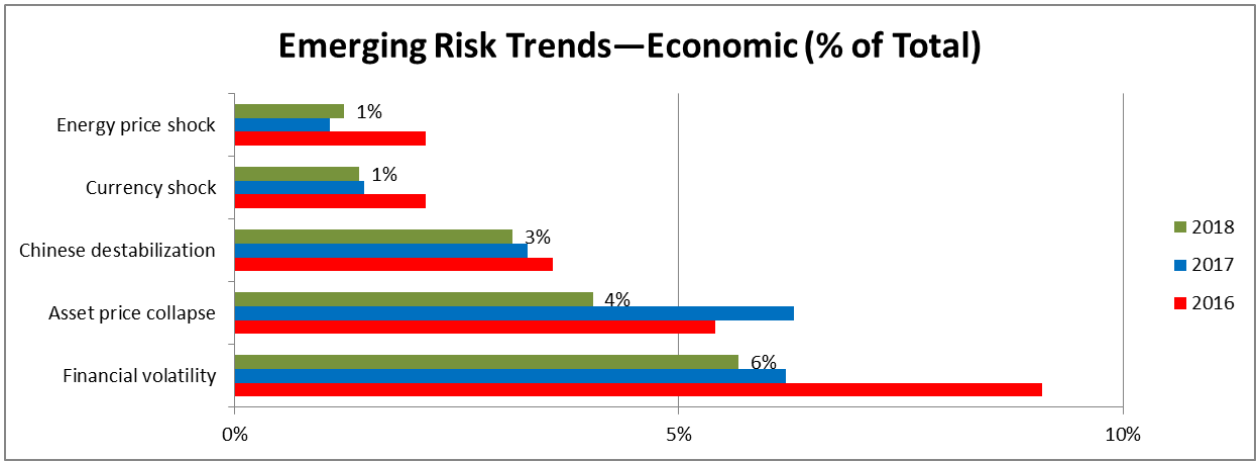
[13] Note that charts show actual results, while labels are rounded to the near percentage point. In some instances the bar in the graph has positive length but the label says 0%.

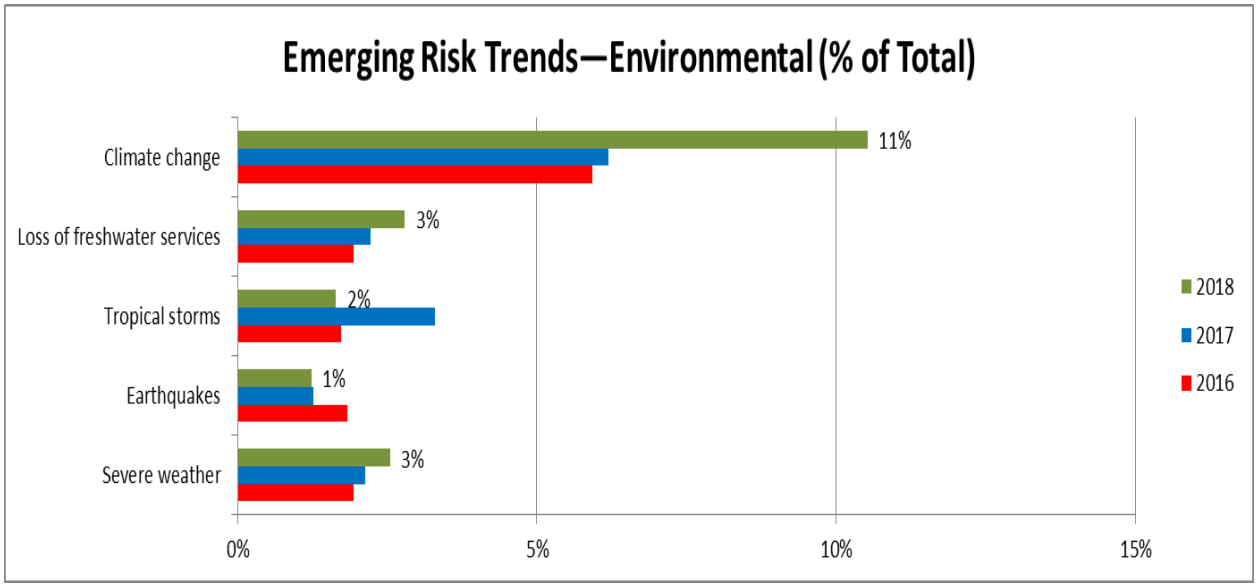
Societal (13%—17%/13%/13%/16%/17%/16%/11%/11%/7%/8%/9%/12%)

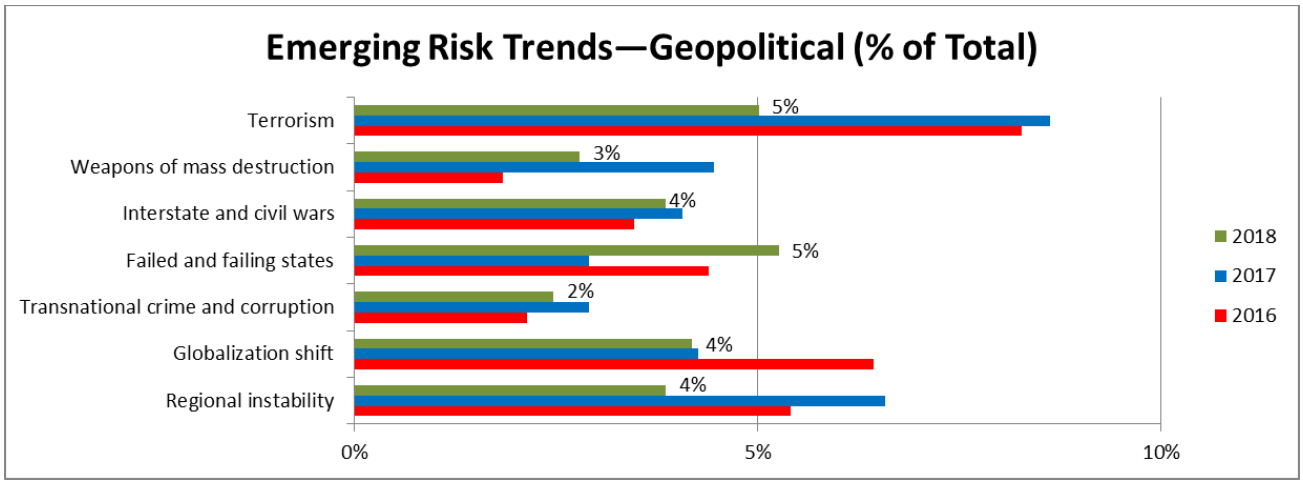
- 5%—5%/3%/3%/4%/6%/4%/3%/3%/5%/6%/7%/8% Pandemics/infectious diseases
- **1%—2%/2%/1%/2%/1%/1%/1%/2%/1%/1%/1%/2%** **Chronic diseases**
- **6%—7%/5%/5%/6%/5%/6%/6%/7%/6%/6%/5%/6%** **Demographic shift**
- 3%—3%/3%/3%/5%/5%/5%/2%/2%/1%/1%/1%/2% Liability regimes/regulatory framework

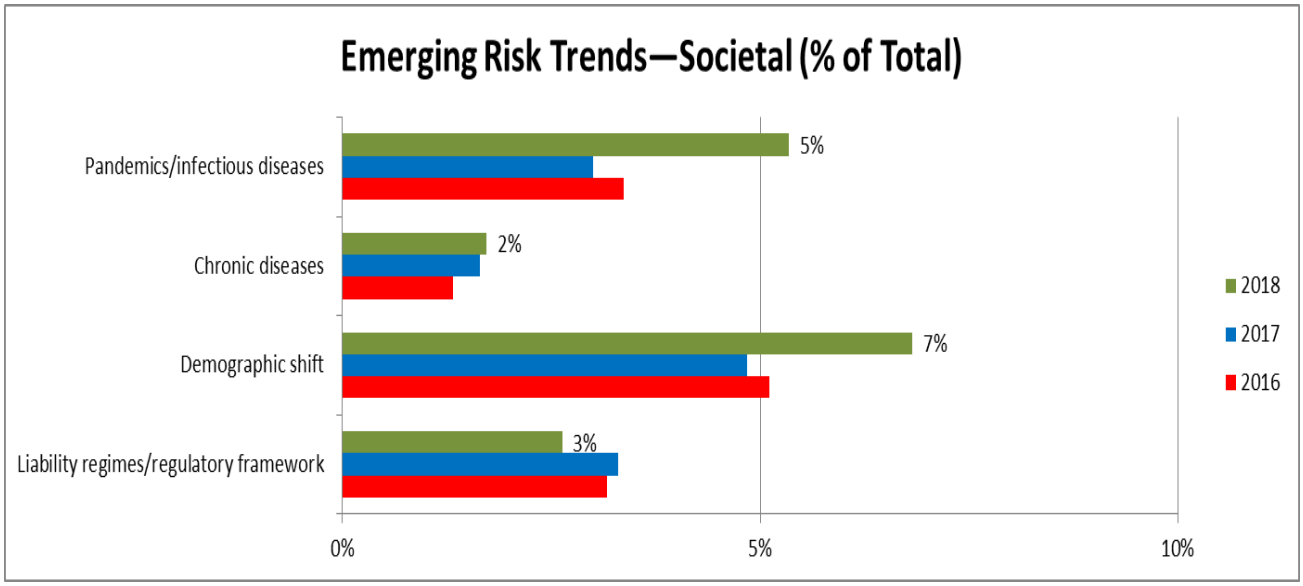
Technological (12%—20%/19%/18%/19%/3%/11%/10%/10%/6%/5%/4%/7%)

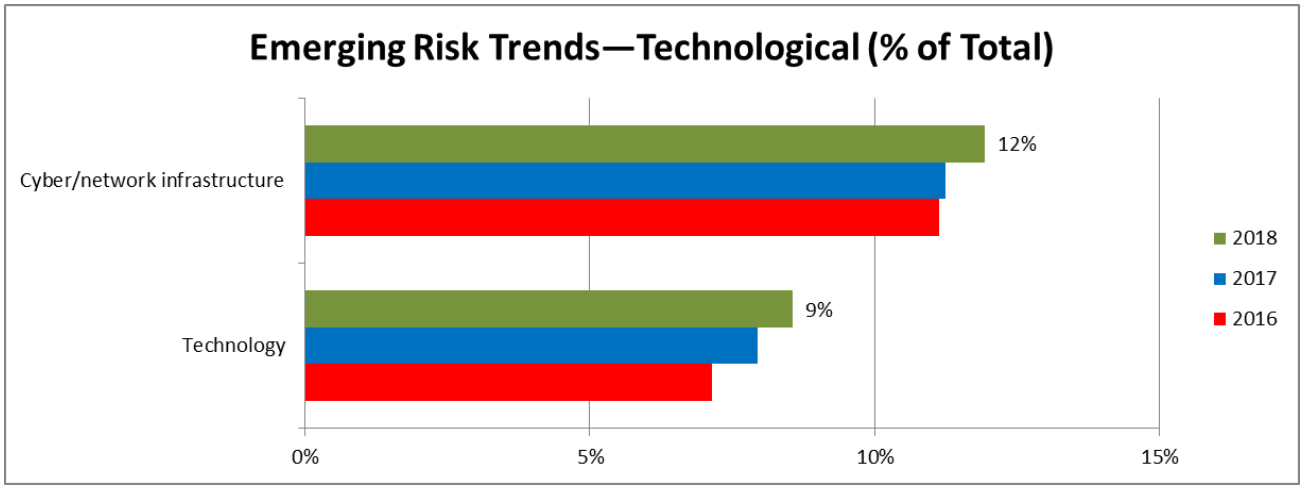
- **9%—12%/11%/11%/14%/12%/10%/8%/8%/5%/4%/3%/5%** **Cyber/network infrastructure**
- **3%—9%/8%/7%/5%/1%/1%/1%/1%/1%/1%/1%/2%** **Technology**



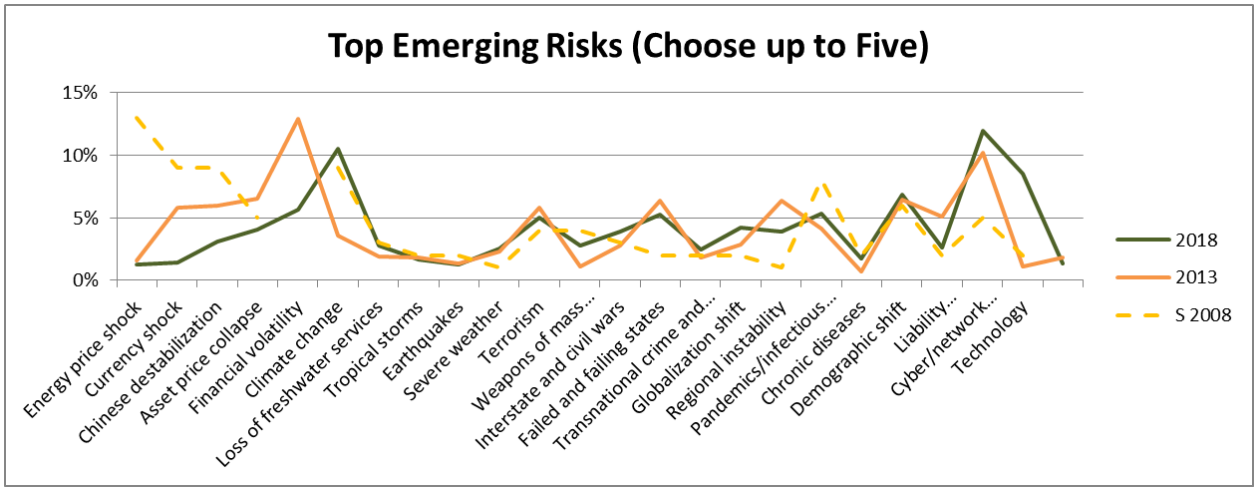




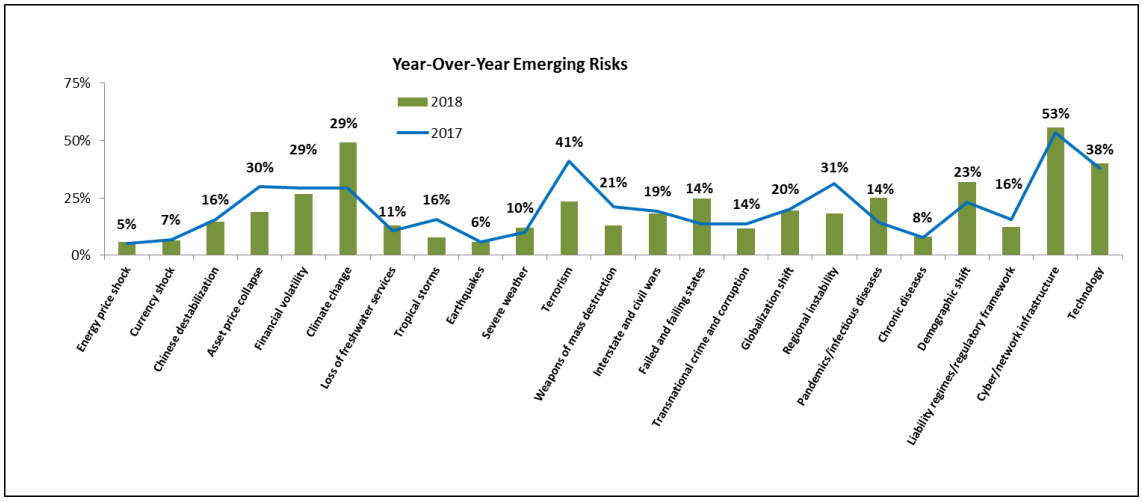


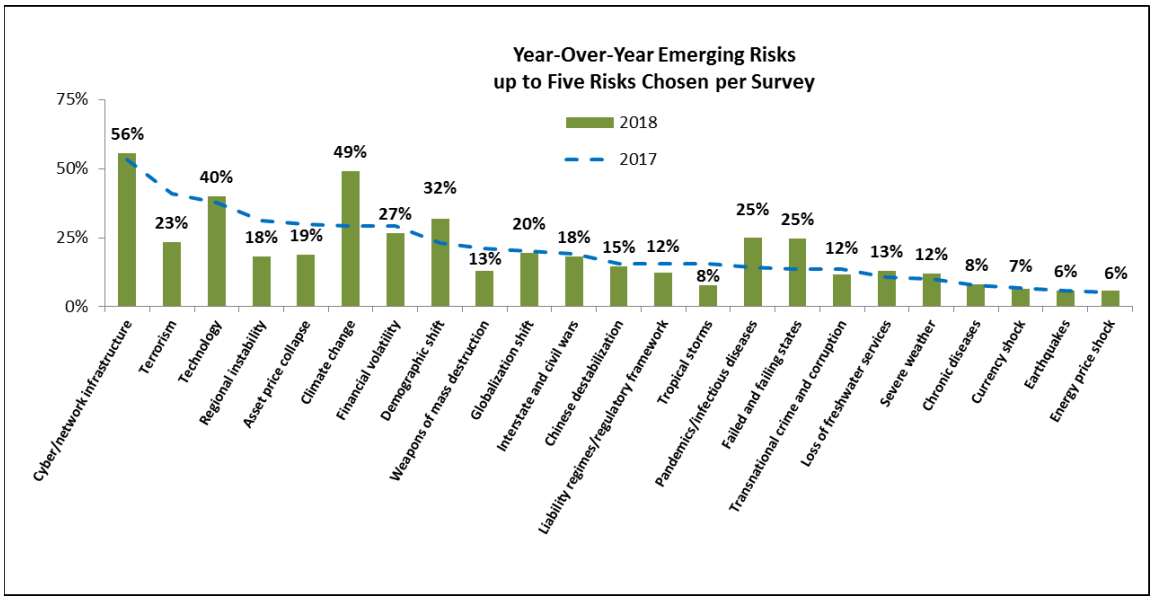


Top Five Emerging Risks as percentage of total (not by number of surveys)														
		2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	F 2008	S 2008	Average
1	Energy price shock	1%	1%	2%	3%	3%	2%	6%	7%	9%	10%	8%	13%	5%
2	Currency shock	1%	1%	2%	3%	1%	6%	5%	6%	10%	14%	10%	9%	6%
3	Chinese destabilization	3%	3%	4%	5%	6%	6%	7%	7%	9%	7%	6%	9%	6%
4	Asset price collapse	4%	6%	5%	6%	7%	7%	5%	5%	6%	10%	14%	5%	7%
5	Financial volatility	6%	6%	9%	9%	9%	13%	13%	15%					10%
6	Climate change	11%	6%	6%	6%	4%	4%	4%	3%	5%	6%	5%	9%	6%
7	Loss of freshwater services	3%	2%	2%	2%	2%	2%	2%	1%	2%	2%	2%	3%	2%
8	Tropical storms	2%	3%	2%	1%	1%	2%	1%	1%	1%	2%	1%	2%	2%
9	Earthquakes	1%	1%	2%	1%	1%	1%	0%	1%	1%	1%	1%	2%	1%
10	Severe weather	3%	2%	2%	2%	2%	2%	0%	1%	0%	1%	0%	1%	1%
11	Terrorism	5%	9%	8%	8%	9%	6%	6%	4%	9%	6%	6%	4%	7%
12	Weapons of mass destruction	3%	4%	2%	2%	2%	1%	3%	2%	4%	3%	3%	4%	3%
13	Interstate and civil wars	4%	4%	3%	4%	4%	3%	3%	2%	2%	2%	2%	3%	3%
14	Failed and failing states	5%	3%	4%	4%	6%	6%	7%	9%	8%	4%	6%	2%	5%
15	Transnational crime and corruption	2%	3%	2%	1%	2%	2%	1%	1%	3%	2%	2%	2%	2%
16	Globalization shift	4%	4%	6%	1%	2%	3%	3%	2%	5%	4%	5%	2%	4%
17	Regional instability	4%	7%	5%	6%	8%	6%	9%	7%	5%	6%	7%	1%	6%
18	Pandemics/infectious diseases	5%	3%	3%	4%	6%	4%	3%	3%	5%	6%	7%	8%	5%
19	Chronic diseases	2%	2%	1%	2%	1%	1%	1%	2%	1%	1%	1%	2%	1%
20	Demographic shift	7%	5%	5%	6%	5%	6%	6%	7%	6%	6%	5%	6%	6%
21	Liability regimes/regulatory framework	3%	3%	3%	5%	5%	5%	2%	2%	1%	1%	1%	2%	3%
22	Cyber/network infrastructure	12%	11%	11%	14%	12%	10%	8%	8%	5%	4%	3%	5%	9%
23	Technology	9%	8%	7%	5%	1%	1%	1%	1%	1%	1%	1%	2%	3%
24	Other	1%	1%	1%	1%	1%	2%	2%	3%	2%	1%	4%	4%	2%



What follows are two versions of the same chart, with the second one sorted based on the prior survey's results. The data labels in the first chart reflect 2017 results.





Question 2. Out of these five, what one emerging risk would you rank number one as having the greatest impact?

257 total responses

Answers in **boldface** are up at least three percentage points; those in *italics* are down at least three percentage points. Top responses are numbered 1 through 5.

Economic—34 responses (13%/20%/27%/30%/31%/44%/54%/56%/48%/63%/65%)

• 1 response	(0%/0%/1%/3%/2%/1%/5%)		Energy price shock
• 2 responses	(1%/0%/0%/2%/1%/5%/7%)		Currency shock
• 5 responses	(2%/2%/2%/7%/5%/6%/5%)		Chinese destabilization
• *12 responses*	*(5%/12%/11%/5%/10%/8%/9%)*		*Asset price collapse*
• 14 responses	(5%/6%/13%/13%/14%/24%/28%)	4	Financial volatility

Environmental—67 responses (26%/9%/8%/8%/5%/6%/6%/4%/7%/12%/4%)

• 57 responses	**(22%/7%/6%/6%/3%/4%/5%)**	**1**	**Climate change**
• 4 responses	(2%/0%/0%/0%/0%/0%/0%)		Loss of freshwater services
• 3 responses	(1%/0%/0%/0%/1%/0%/1%)		Natural catastrophe: tropical storms
• 0 responses	(0%/0%/0%/0%/0%/0%/0%)		Natural catastrophe: earthquakes
• 3 responses	(1%/0%/1%/1%/1%/0%)		Natural catastrophe: severe weather

Geopolitical—46 responses (18%/32%/29%/22%/31%/17%/23%/22%/28%/14%/18%)

• *4 responses*	*(2%/9%/3%/6%/8%/4%/1%)*		*Terrorism*
• 3 responses	(1%/2%/3%/2%/2%/1%/1%)		Weapons of mass destruction
• 8 responses	(3%/4%/4%/4%/3%/2%/3%)		Interstate and civil wars
• 7 responses	(3%/4%/4%/3%/8%/4%/8%)		Failed and failing states
• 6 responses	(2%/1%/1%/0%/0%/1%/0%)		Transnational crime and corruption
• 10 responses	(4%/4%/10%/0%/2%/1%/3%)		Globalization shift
• *8 responses*	*(3%/7%/3%/6%/8%/4%/7%)*		*Regional instability*

Societal—31 responses (12%/11%/8%/10%/16%/13%/6%/5%/4%/2%/2%)

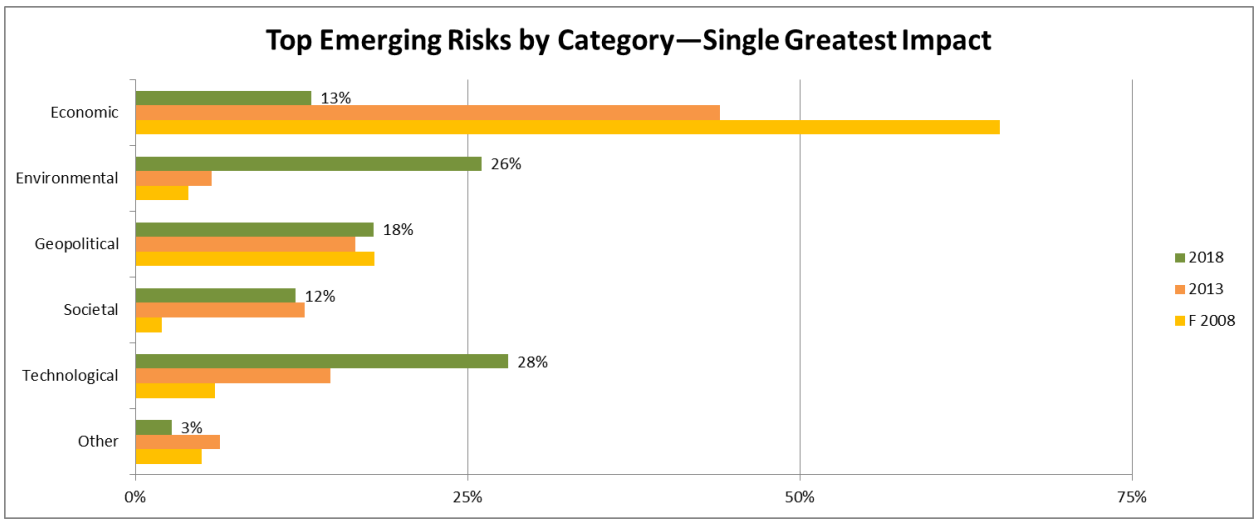
• 9 responses	**(4%/0%/2%/1%/3%/1%/1%)**		**Pandemics/infectious diseases**
• 4 responses	(2%/1%/0%/0%/0%/0%/1%)		Chronic diseases
• 13 responses	(5%/3%/3%/1%/4%/3%/2%)	5	Demographic shift
• *5 responses*	*(2%/6%/3%/7%/9%/10%/2%)*		*Liability regimes/regulatory framework*

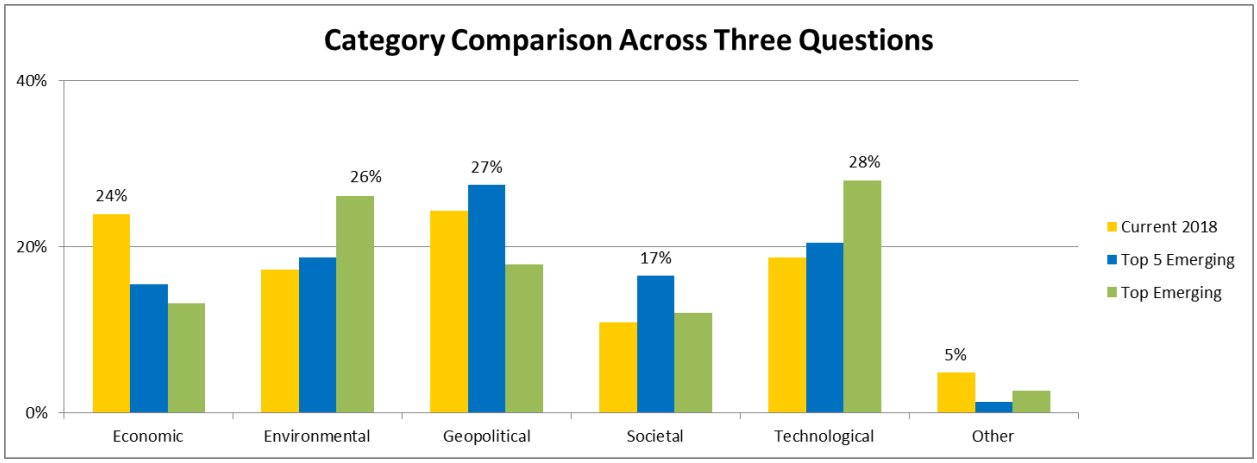
Technological—72 responses (28%/26%/24%/28%/15%/15%/8%/8%/9%/6%/6%)

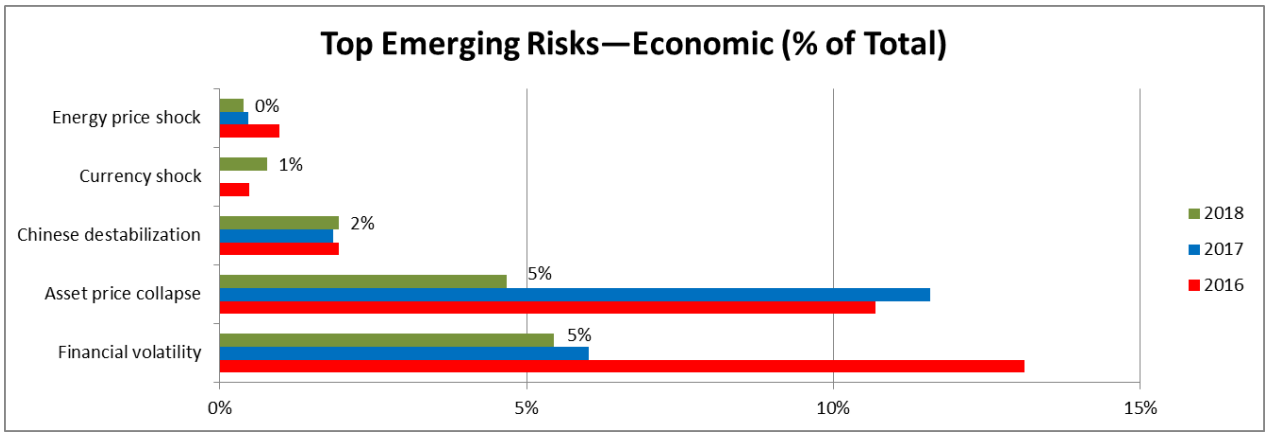
• 38 responses	(15%/16%/17%/23%/14%/14%/7%)	2	Cyber/network infrastructure
• 34 responses	**(13%/10%/7%/5%/1%/1%/1%)**	**3**	**Technology**

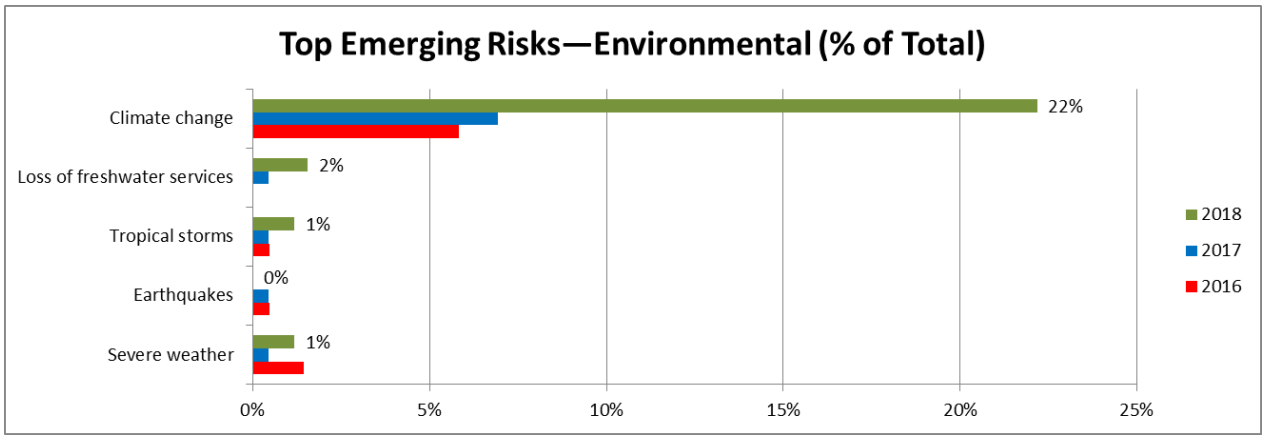
Other—7 responses (3%/2%/3%/1%/2%/6%/4%/5%/3%/3%/3%)

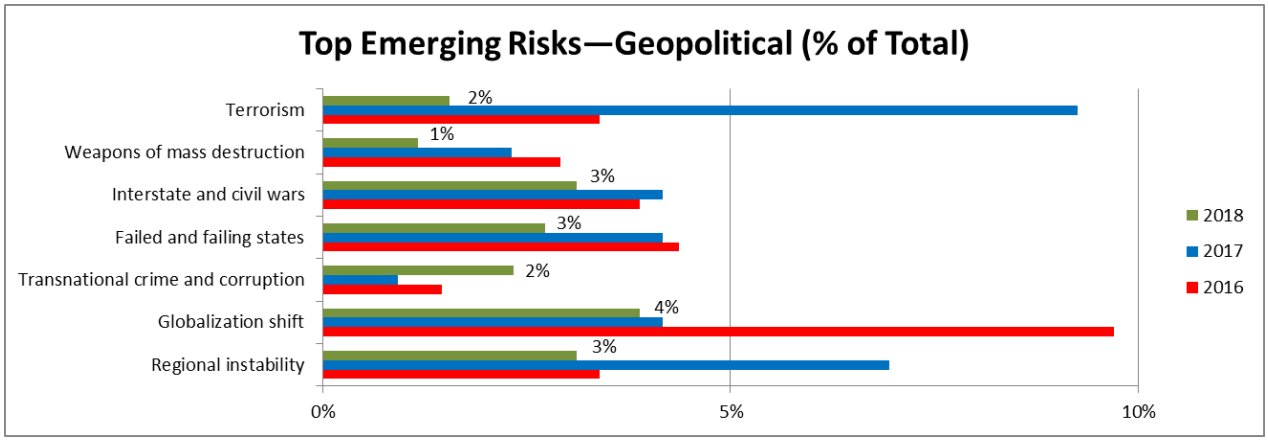
- *Donald Trump*
- *Increasing wealth inequality*
- *Trump*
- *Global war*
- *Not sure how this is different from previous. So, massive change in U.S. health system, partisan politics/extremism. Plus various illnesses that are different for each country (you should not have listed chronic as an issue—chronic diseases (in U.S. definition) have enough attention and mostly already underway (I assume AIDS in Africa is not chronic, nor is drinking and related illnesses in Russia).*
- *Ability to find qualified workforce*
- *Socialism*

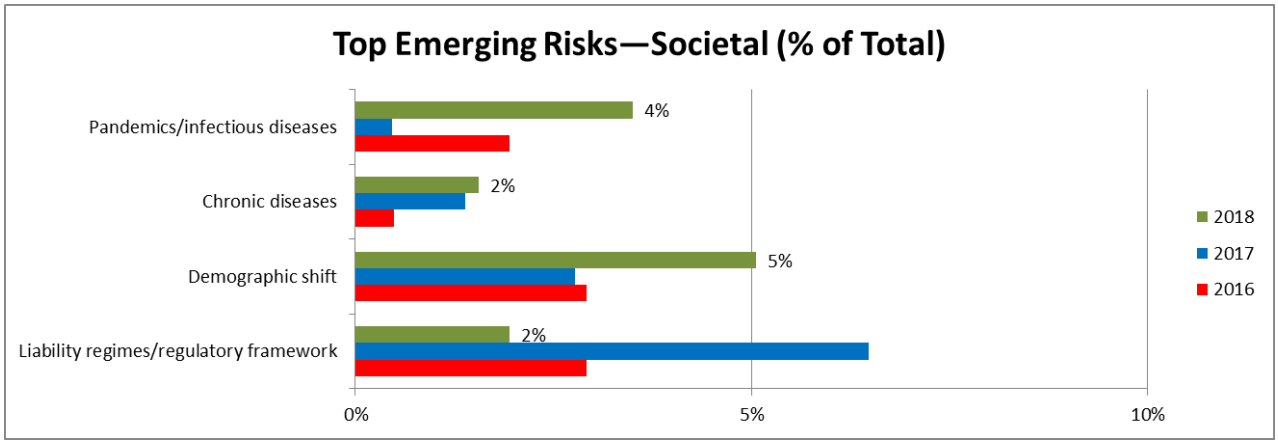


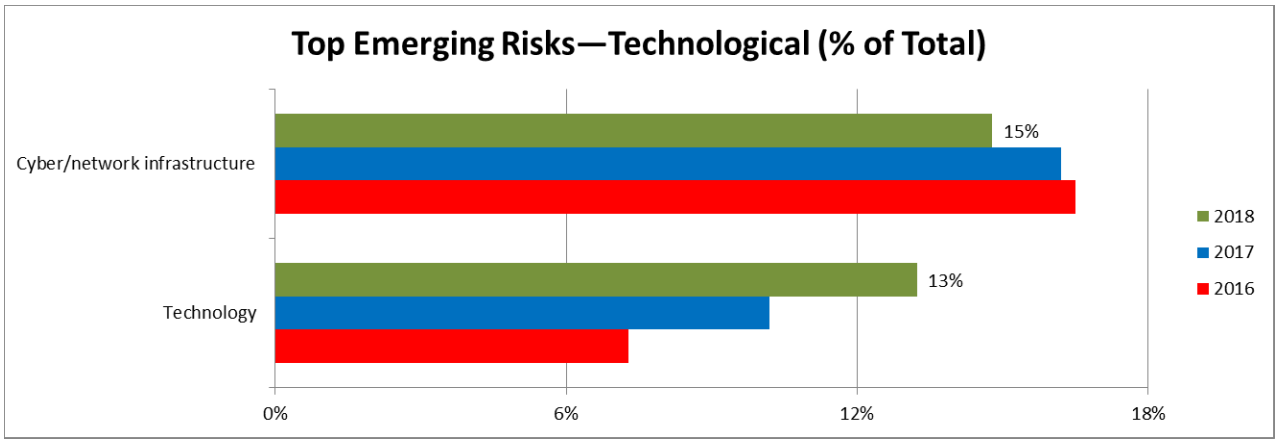


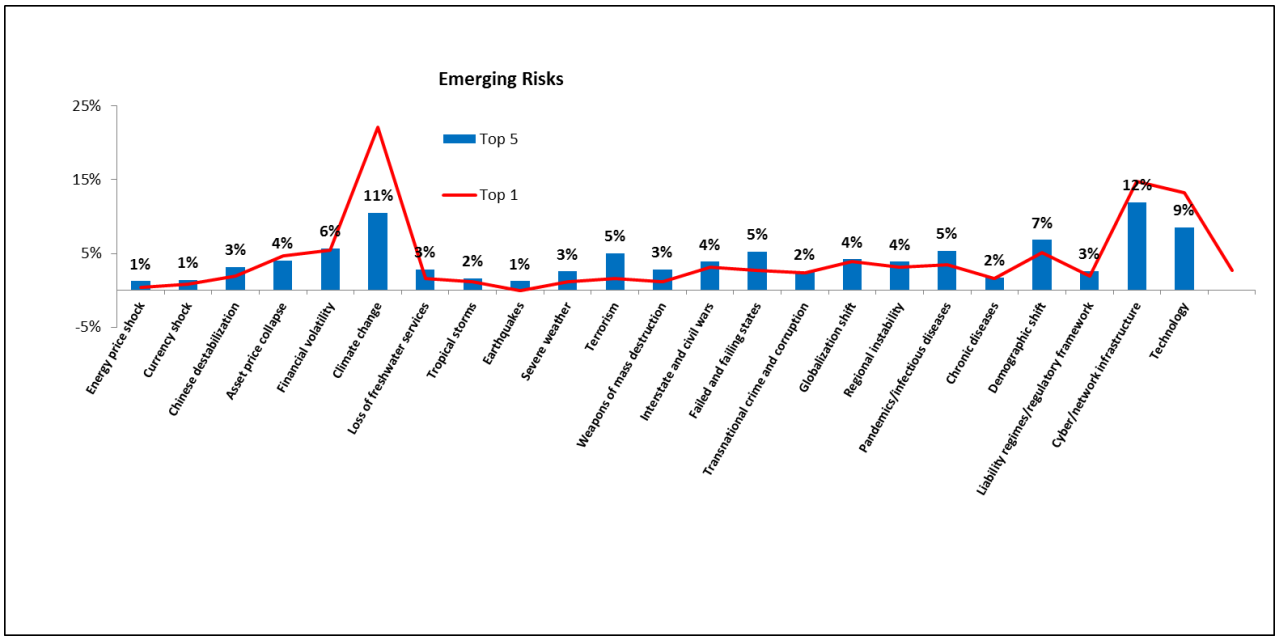


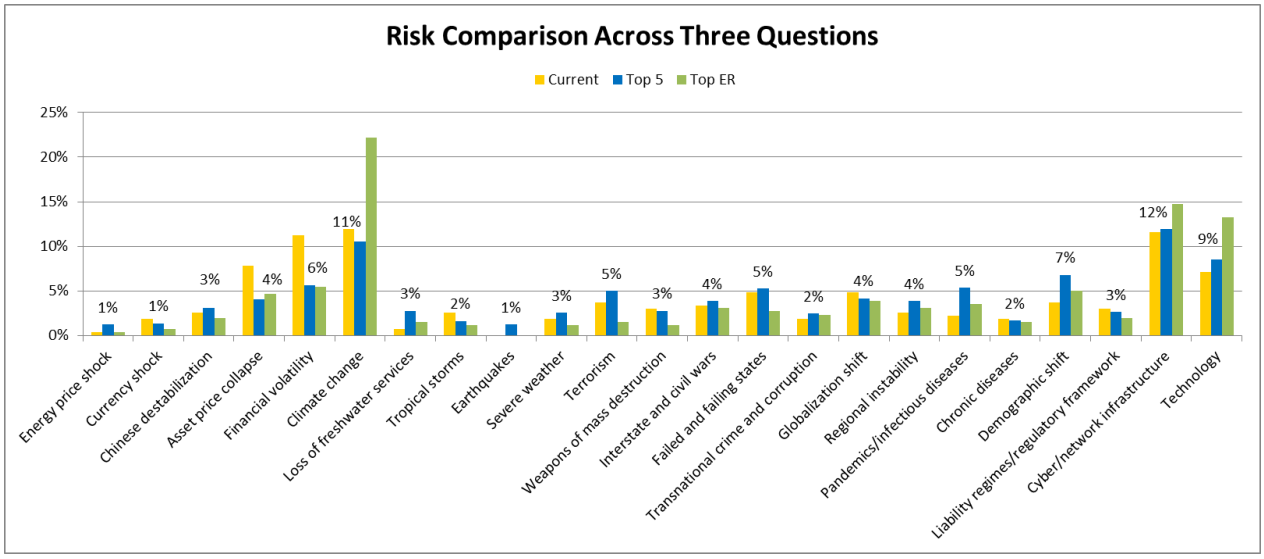












Questions 3, 4 and 5. Questions 3, 4 and 5 should be considered at the same time. Of the 23 emerging risks, are there combinations that you believe will have a large impact over the next few years? These could occur at the same time (concurrent) or follow each other (sequential). Please select a combination of TWO risks for each response. The first combination listed should be the one you think will have the largest impact.

Two-risk combinations—**697 total responses**

Economic (22%/23%/28%/33%/35%/40%/46%/48%/45%/53%/49%)

• (2%/2%/2%/4%/4%/3%/9%)		Energy price shock
• (2%/2%/3%/4%/2%/8%/6%)		Currency shock
• (3%/3%/4%/5%/5%/6%/7%)		Chinese destabilization
• (7%/7%/7%/8%/10%/7%/8%)	4T	Asset price collapse
• (8%/8%/11%/12%/13%/16%/15%)	3	Financial volatility

Environmental (21%/15%/12%/12%/10%/11%/9%/7%/11%/13%/9%)

• (11%/7%/5%/4%/4%/4%/4%)	**1**	**Climate change**
• (3%/2%/2%/2%/2%/2%/2%)		Loss of freshwater services
• (3%/3%/2%/2%/1%/2%/1%)		Natural catastrophe: tropical storms
• (1%/1%/1%/1%/0.4%/0.2%/1%)		Natural catastrophe: earthquakes
• (3%/3%/2%/2%/2%/3%/1%)		Natural catastrophe: severe weather

Geopolitical (30%/35%/34%/28%/35%/32%/32%/32%/35%/25%/32%)

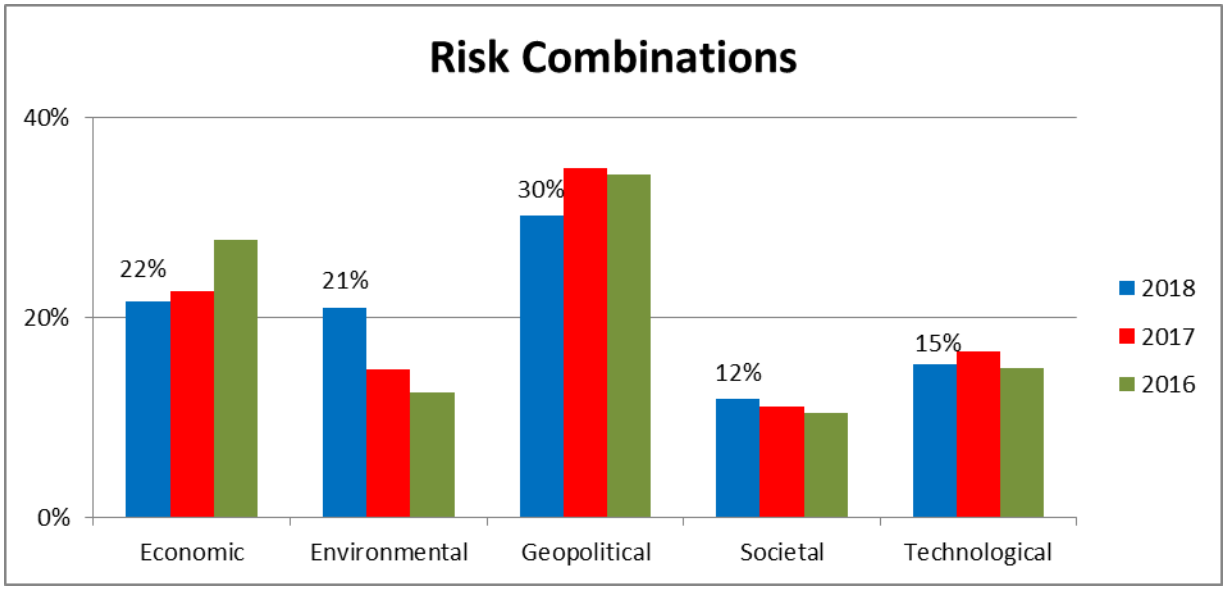
• *(5%/8%/9%/8%/9%/6%/6%)*	*Terrorism*
• (3%/4%/2%/2%/2%/4%/4%)	Weapons of mass destruction
• (4%/4%/4%/4%/4%/4%/4%)	Interstate and civil wars
• (6%/5%/5%/5%/7%/6%/8%)	Failed and failing states
• (3%/3%/3%/2%/2%/4%/1%)	Transnational crime and corruption
• (4%/5%/6%/1%/3%/3%/3%)	Globalization shift
• (5%/7%/6%/5%/7%/6%/7%)	Regional instability

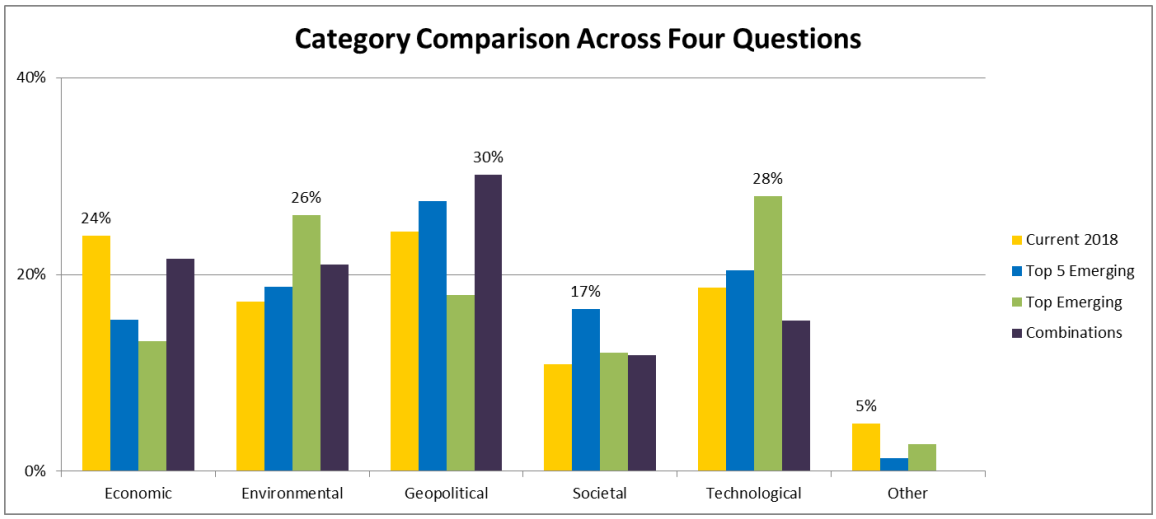
Societal (12%/11%/10%/10%/12%/9%/7%/6%/5%/5%/8%)

• (4%/3%/3%/3%/4%/2%/2%)	Pandemics/infectious diseases
• (2%/2%/1%/1%/1%/0.4%/1%)	Chronic disease
• (4%/3%/4%/3%/4%/3%/3%)	Demographic shift
• (1%/3%/2%/3%/3%4%/1%)	Liability regimes/regulatory framework

Technological (15%/17%/15%/17%/8%/9%/5%/7%/4%/3%/2%)

• (9%/10%/10%/12%/7%/7%/5%)	2	Cyber/network infrastructure
• (7%/6%/5%/5%/1%/1%/1%)	4T	Technology





Comparison across four questions			Current 2018	Top 5 2018	Top 2018	Combos 2018
Energy price shock			0.4%	1.2%	0.4%	2.3%
Currency shock			1.9%	1.4%	0.8%	1.9%
Chinese destabilization			2.6%	3.1%	1.9%	3.2%
Asset price collapse			7.9%	4.0%	4.7%	6.7%
Financial volatility			11.2%	5.7%	5.4%	7.7%
Climate change			12.0%	10.5%	22.2%	10.8%
Loss of freshwater services			0.7%	2.8%	1.6%	3.2%
Tropical storms			2.6%	1.6%	1.2%	2.8%
Earthquakes			0.0%	1.2%	0.0%	1.1%
Severe weather			1.9%	2.5%	1.2%	3.2%
Terrorism			3.7%	5.0%	1.6%	5.2%
Weapons of mass destruction			3.0%	2.8%	1.2%	3.1%
Interstate and civil wars			3.4%	3.9%	3.1%	4.2%
Failed and failing states			4.9%	5.3%	2.7%	6.3%
Transnational crime and corruption			1.9%	2.5%	2.3%	2.6%
Globalization shift			4.9%	4.2%	3.9%	3.9%
Regional instability			2.6%	3.9%	3.1%	4.8%
Pandemics/infectious diseases			2.2%	5.3%	3.5%	4.4%
Chronic diseases			1.9%	1.7%	1.6%	1.6%
Demographic shift			3.7%	6.8%	5.1%	4.4%
Liability regimes/regulatory framework			3.0%	2.6%	1.9%	1.4%
Cyber/interconnectedness			11.6%	11.9%	14.8%	8.7%
Technology			7.1%	8.6%	13.2%	6.7%
Other			4.9%	1.3%	2.7%	

Combinations

Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
1		0	1	3	6	10	0	0	1	0	1	0	3	3	0	1	2	1	0	0	0	0	0	1
2			8	9	1	0	0	0	1	0	0	0	1	4	0	0	1	0	0	1	1	0	0	2
3				4	3	0	0	0	0	0	2	1	3	4	3	8	5	0	0	2	0	1	0	3
4					41	2	0	1	1	2	2	0	3	2	0	2	3	4	0	6	0	5	3	4
5						5	0	1	0	0	4	1	1	4	3	8	5	2	2	3	7	6	4	5
6							25	25	1	28	0	0	5	5	1	3	8	19	1	7	0	3	2	6
7								0	1	1	1	0	0	0	0	0	1	14	1	0	0	0	0	7
8									4	3	0	0	0	2	0	0	1	0	0	1	0	1	0	8
9										2	1	0	0	0	0	0	0	1	1	0	0	1	0	9
10											1	0	0	1	0	0	1	6	0	0	0	0	0	10
11												21	3	4	2	0	2	2	0	2	0	20	5	11
12													4	6	1	0	1	0	0	2	0	2	3	12
13														17	2	5	3	1	0	2	0	5	0	13
14															10	2	14	1	0	4	1	3	0	14
15																2	1	0	1	1	4	4	1	15
16																	11	0	0	6	2	1	4	16
17																		2	0	3	2	0	1	17
18																			7	9	0	0	0	18
19																				1	0	0	1	19
20																					3	1	8	20
21																						3	0	21
22																							61	22
23																								23

Leading combinations were as follows (percentages shown for consecutive years in the top 10):

61 responses (9%/7%/5%/9%), No. 1 in previous survey

Cyber/network infrastructure

Technology

41 responses (6%/6%/4%/7%), No. 2

Asset price collapse

Financial volatility

28 responses (4%/3%/2%/2%), No. 5

Climate change

Natural catastrophe: severe weather

25 responses (4%), NR (not rated in top 10 in previous survey)

Climate change

Loss of freshwater services

25 responses (4%/3%/2%), No. 7

Climate change

Natural catastrophe: tropical storms

21 responses (3%/3%/2%), No.4

Terrorism

Regional instability

20 responses (3%/5%/6%/9%), No. 3

Terrorism

Cyber/network infrastructure

19 responses (3%), NR

Climate change

Pandemics/infectious diseases

17 responses (2%/3%/3%), No. 6

Terrorism

Weapons of mass destruction

14 responses (2%), NR

Interstate and civil wars

Failed and failing states

14 responses (2%), NR

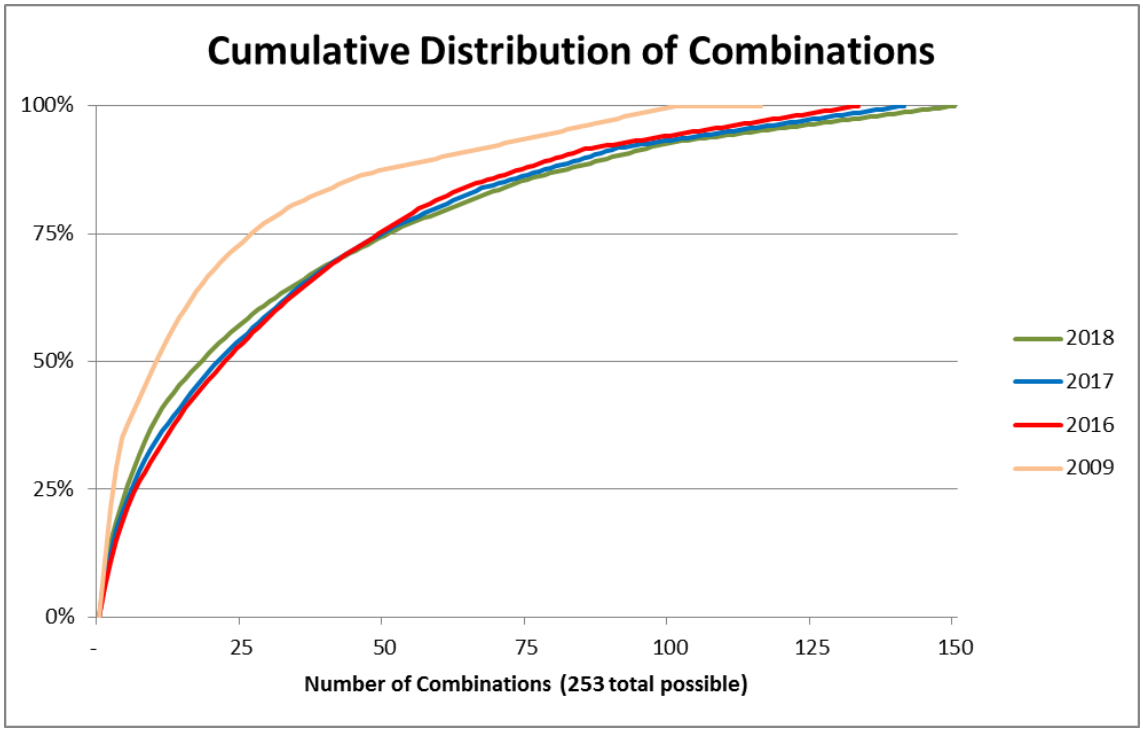
Failed and failing states

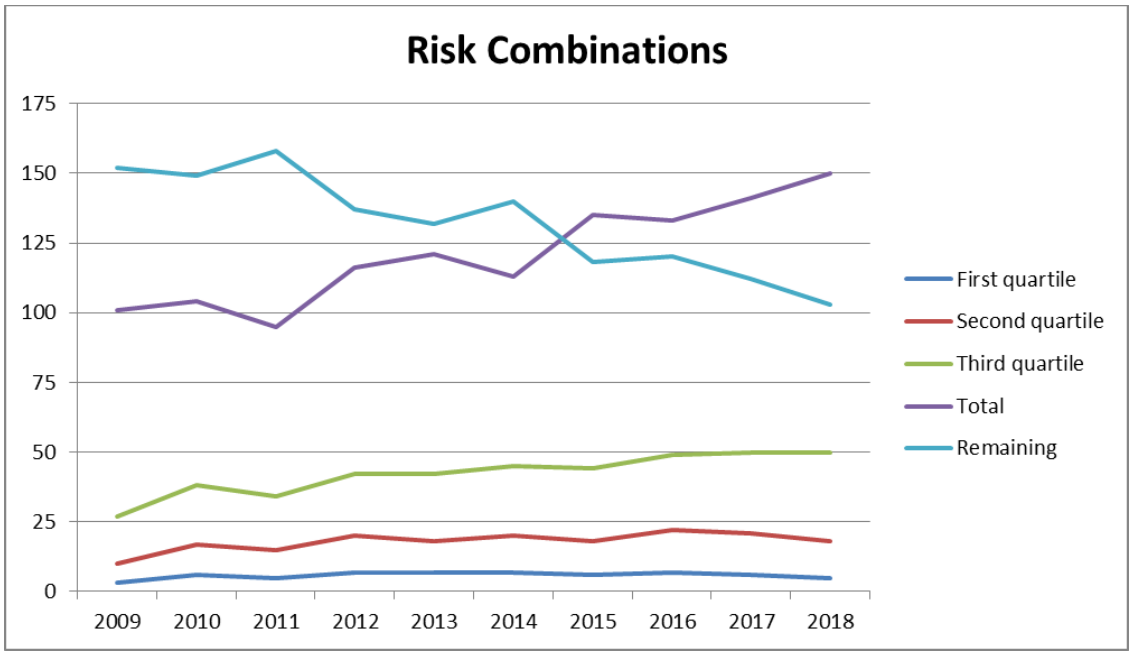
Regional instability

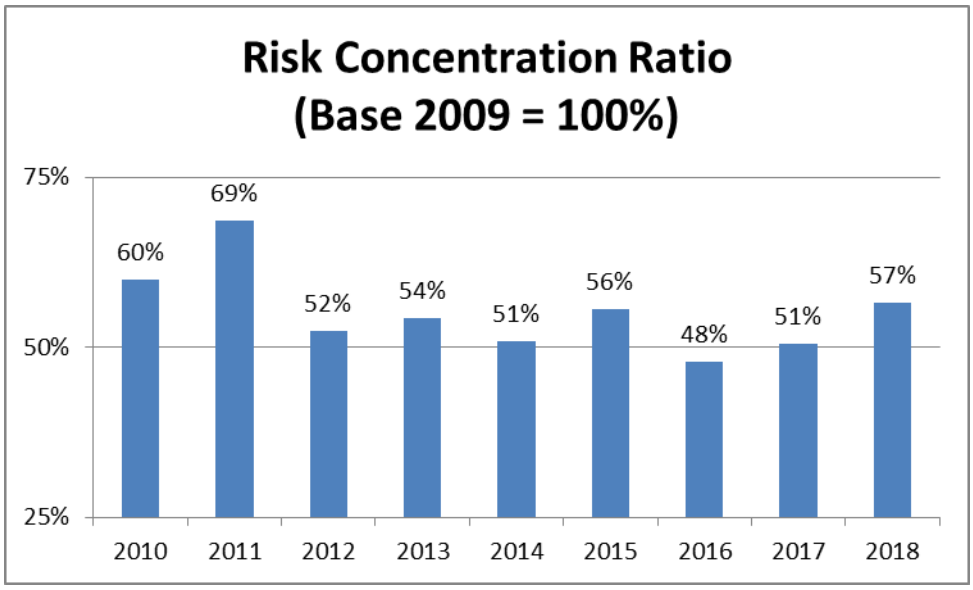
Combinations by Category		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Economic	Economic	34%	42%	29%	29%	29%	24%	19%	21%	14%	13%	11%
Economic	Environmental	2%	3%	5%	3%	3%	2%	2%	2%	2%	2%	3%
Economic	Geopolitical	22%	16%	21%	24%	21%	18%	15%	10%	15%	10%	11%
Economic	Societal	2%	3%	2%	6%	6%	7%	9%	7%	6%	4%	4%
Economic	Technological	1%	1%	3%	4%	3%	4%	4%	5%	4%	4%	3%
Environmental	Environmental	7%	9%	7%	4%	6%	7%	7%	8%	8%	9%	13%
Environmental	Geopolitical	2%	2%	3%	2%	2%	4%	2%	3%	3%	4%	4%
Environmental	Societal	5%	3%	2%	2%	1%	2%	1%	3%	4%	4%	7%
Environmental	Technological	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%
Geopolitical	Geopolitical	16%	14%	20%	14%	18%	15%	19%	15%	19%	20%	16%
Geopolitical	Societal	4%	2%	2%	1%	2%	4%	7%	2%	2%	4%	5%
Geopolitical	Technological	1%	2%	3%	7%	4%	9%	8%	12%	11%	13%	7%
Societal	Societal	2%	1%	2%	1%	2%	2%	2%	3%	3%	4%	3%
Societal	Technological	1%	0%	1%	0%	1%	1%	2%	3%	4%	2%	2%
Technological	Technological	0%	1%	0%	1%	1%	2%	1%	7%	5%	7%	9%

2018 Mix by Primary vs. Secondary Combination

Combination Splits by Category		Combo 1	Combo 2/3	Overall
Economic	Economic	11%	11%	11%
Economic	Environmental	3%	4%	3%
Economic	Geopolitical	9%	13%	11%
Economic	Societal	6%	3%	4%
Economic	Technological	3%	3%	3%
Environmental	Environmental	14%	12%	13%
Environmental	Geopolitical	7%	3%	4%
Environmental	Societal	5%	8%	7%
Environmental	Technological	1%	1%	1%
Geopolitical	Geopolitical	16%	16%	16%
Geopolitical	Societal	3%	7%	5%
Geopolitical	Technological	8%	7%	7%
Societal	Societal	4%	2%	3%
Societal	Technological	1%	2%	2%
Technological	Technological	11%	8%	9%







Each year a specialty question is asked. Traditionally the question has not been repeated in future surveys, but some may cycle through periodically.

Question 6. What emerging risks do you think would have the greatest role in creating a global famine? (Please select no more than three.)

234 respondents chose at least one risk, for a total of 567 responses (average of 2.42 risks selected per survey)

Economic—6%

- 2% Energy price shock

- 1% Currency shock
- 1% Chinese destabilization
- 1% Asset price collapse
- 1% Financial volatility

Environmental—54%

- 24% 1 Climate change
- 20% 2 Loss of freshwater services
- 2% Natural catastrophe: tropical storms
- 1% Natural catastrophe: earthquakes
- 8% 3T Natural catastrophe: severe weather

Geopolitical—30%

- 1% Terrorism
- 3% Weapons of mass destruction
- 8% 3T Interstate and civil wars
- 7% 5 Failed and failing states
- 2% Transnational crime and corruption
- 2% Globalization shift
- 6% Regional instability

Societal—8%

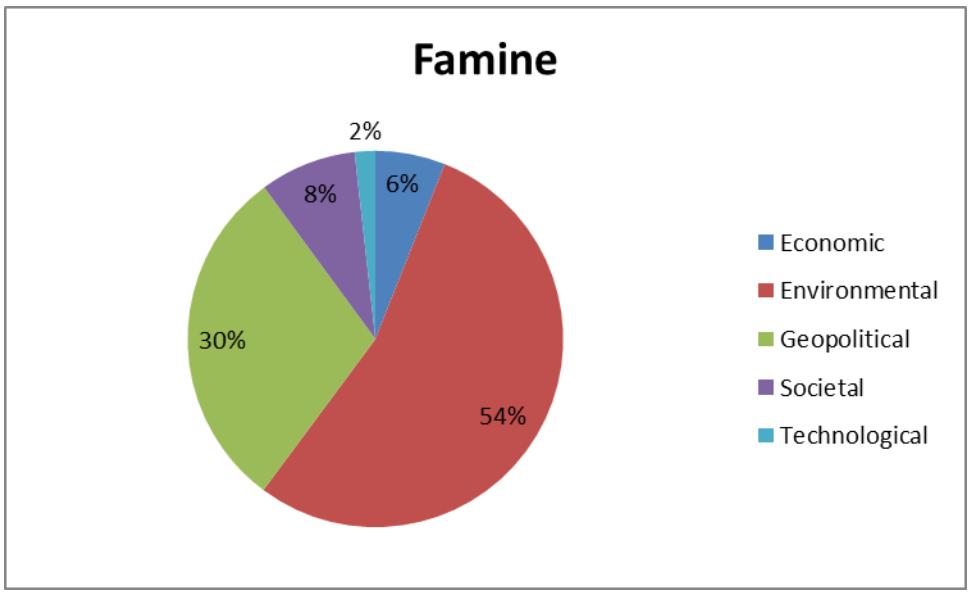
- 6% Pandemics/infectious diseases
- 0% Chronic diseases
- 1% Demographic shift
- 0% Liability regimes/regulatory framework

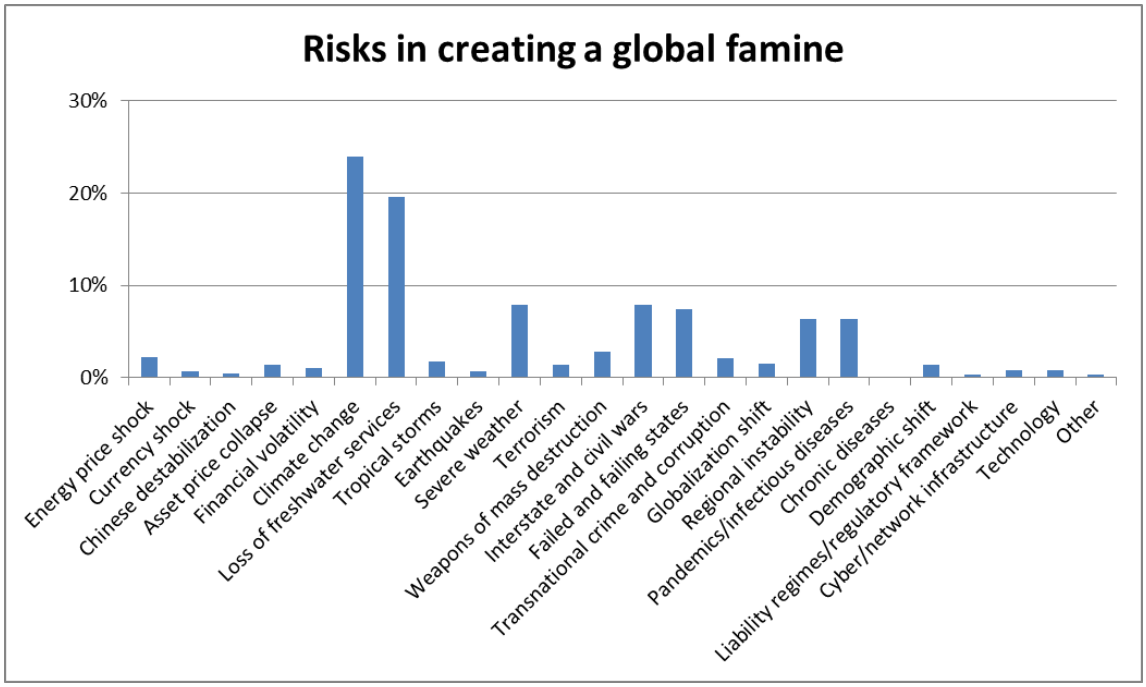
Technological—2%

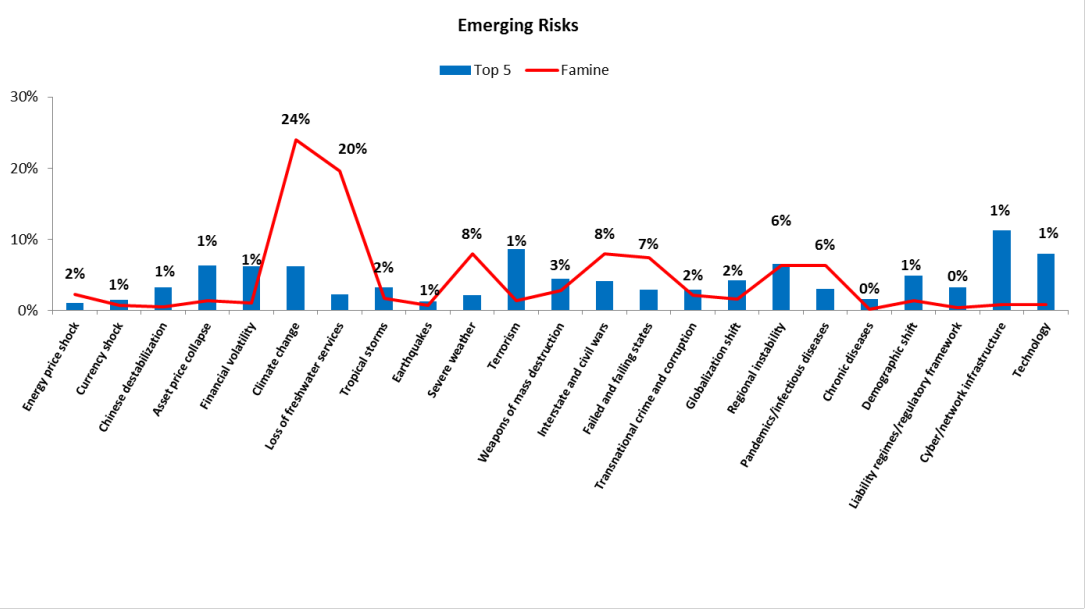
- 1% Cyber/network infrastructure
- 1% Technology

Other—0%

- *Political uncertainty*
- *Lack of genetic diversity, e.g., bees dying off*







Question 11. No list of risks is ever complete. Are there additional emerging risks you feel are significant that should be considered for future surveys?

As noted in the introductory paragraphs of this appendix, some responses are in **boldface** to signify that they are particularly thought-provoking to the researcher. Two entries were allowed for this question.

Option 1

- *The fact that Donald Trump could unfortunately remain in office for four more years.*
- *U.S. market collapse*
- *Donald Trump*
- *Lack of trust in financial institutions*
- *Turning from economic freedom/capitalism to socialism/communism*
- ***Increasing wealth inequality***
- *Overthrow of U.S.A.*
- *Destabilization of the United States*
- *Fascism*
- *Cloud computing/storage*
- *Political instability in U.S. or Europe*
- *Government default on debt obligations*
- *Opioid crisis*
- *Loss of ocean ecosystem*
- *Lack of civility*
- *Artificial intelligence*
- *National debt*
- *Failure of the energy grid*
- *U.S. political instability*
- *Rise of fascism*
- *Political conflicts*
- *Trade war*
- *Religious persecution*
- ***Rapidly increasing human life expectancy***
- *Widening human intellectual skill gap due to technology advancement*

- *Murder of heads of state*
- *Political uncertainty*
- *Socialism*
- *Rise of right-wing dictatorships*
- *Human population size*
- *I really worry about the rise of autocratic regimes across the world—Trump in the USA, Duterte in the Philippines, Erdogan in Turkey—to name just a few.*
- *IPCC malfeasance*
- *Environmental exposure to endocrine disruptors causing crash in fertility for humans and other mammals*
- *Lost hope, tendency toward Godlessness*
- *Economic divide*
- *Cyber risks against individuals*
- *China as the world-leading country in the world in the next few decades*
- *Income inequality*
- *Change fatigue in an organization*
- *Nationalism*
- *Regulatory sanctions*
- *Political/trade policies*
- *Alien invasion*
- *Change in Middle East "pecking" order*
- *Populism*
- *New sources of pollution (i.e., EMF exposure from 5G)*
- *Solar storm*
- *Data—with links to privacy, technology, cyber*
- *The rise of nationalism*
- *Default of a major world power*
- *Mental health pandemic*
- *Massive population migration*
- *Fragility of democratic regime*
- *Artificial intelligence*
- *Chinese hegemony*
- *Genetic engineering*
- *Generation X—change in career progression and educational methods*
- *Aging energy infrastructure*
- *AI risk (loss of labor demand)*
- *Hidden social structure*
- *Regionalism*
- *Insufficient sources of energy*
- *Political risk*
- *U.S. destabilization*
- *Lack of education worldwide*
- *Economic protectionism*
- *Opioid crisis*
- *Slow adaptation of company to changes in technology*
- *Reemergence of nationalism/fascism*
- *Human behavioral attitude changes—diet, euthanasia, racism, etc.*
- *Rise of populism*
- *Nationalism*
- *Disruptive competitors*

- *Rise of socialist-leaning governments*
- *Alt-Right resurgence*
- *Artificial intelligence gone awry*
- *From previous—rising extremism and radical politics supported by technology and fears such as terrorism*
- *U.S. political instability*
- *Fundamentalism in religions*
- *Protectionism and anti-immigration*
- *Widespread moral failure*
- *Mass rebellion/revolution*
- *High unemployment/job bubble*
- *Future of work*
- *Contact with outer-space civilization*
- *Government policies*
- *Sea level rise*
- *Nuclear war*
- *Civil and political unrest*
- *Political divide*
- *Nationalism*
- *Accounting changes IFRS17*
- *Inequality and social unrest*
- *Low investment yields*
- *Loss of affordable health care*
- *Nationalism*
- *Worldwide war*
- *Discrepancy between rich and poor*
- *Polluted and warming sea temps and possible impact to food chain*

Option 2

- *Extreme nationalism*
- *Increase of nationalization within the world*
- *Trump*
- *Genetic pharmacology*
- *International trade wars*
- *Uncontrollable health care costs*
- *Rogue nations*
- *Multiculturalism*
- *Low interest rate*
- *A society's lack of motivation to work (they just want free stuff)*
- *Aging population*
- *Communism*
- *Continued false news sources, including governments' propaganda*
- *President Trump*
- *Paper money*
- *U.S. destabilization*
- *Need for information versus need to privatize information*
- *Aging population*
- *Wealth divide*
- *Loss of human capital*

- *Infrastructure stability and spending*
- *Comet strike*
- *Nuclear capability for NK or Iran*
- *Nationalism*
- *Digital disruption*
- *Major world war*
- *AI in the workplace*
- *Lower birth rates that cannot support older people*
- *Mental health*
- *Nationalism and the threat to democratic systems*
- *Environmental degradation*
- *AI risk (loss of insurance demand)*
- *Fear of speaking out*
- *Transnational crime and corruption*
- *Societal divide—national, socioeconomic, urban/rural, education and economic status*
- *National debt*
- *World War III*
- *Rise of nationalism*
- *Misinformation/propaganda*
- *Nationalism*
- *Massive changes in U.S. health system with actuaries tightly connect to old models being discarded*
- *Implosion of NATO*
- *Low growth regime*
- *Social divisions*
- *Mega meteorite collision*
- *Political risks*
- *Extreme economic inequality*
- *Volcanic eruption*
- *Privacy regulations/fines*
- *Destruction of free media*
- *Religious fundamentalism*
- *Globalization*

Section B: Leading Indicators

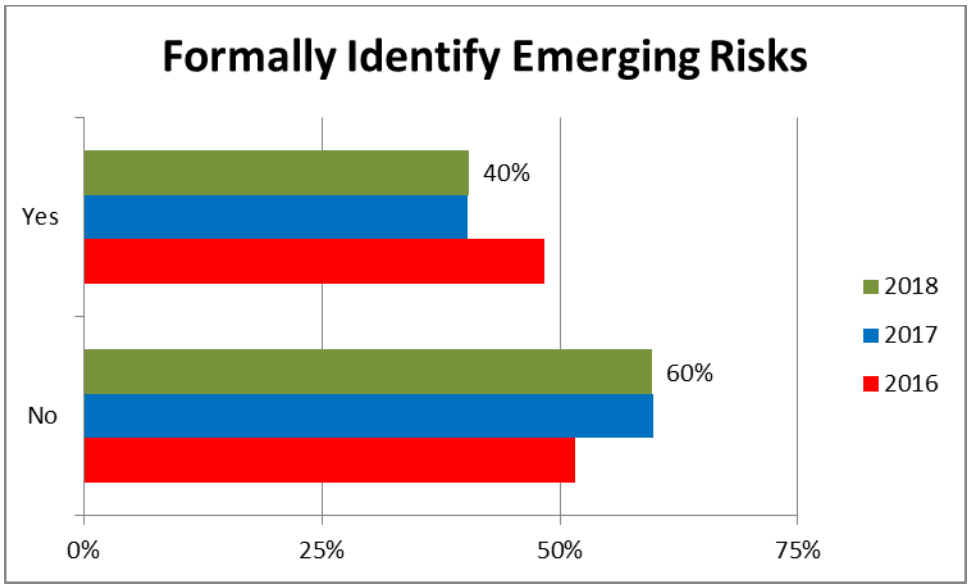
Some questions require an industry perspective. Please choose an industry where you are a risk expert and answer questions consistently throughout.

In this section, once a respondent answers a question "no" or "not applicable," the survey moves that respondent immediately to Section C.

Question 1. Do you formally identify emerging risks?

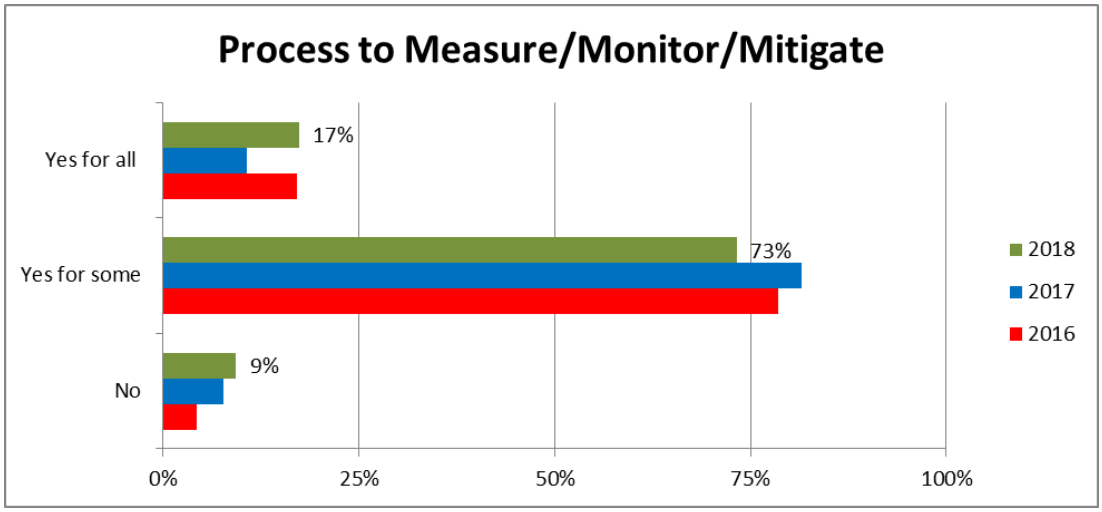
Percentages back out responses stating that the question is not applicable to the respondent.

- 40%/40%/48%/62% Yes
- 60%/60%/52%/38% No



Question 2. Once an emerging risk is identified, do you have a process to measure, monitor and/or mitigate the risk?

- 17%/11%/17%/17% Yes for all
- 73%/82%/79%/79% Yes for some
- 9%/8%/4%/4% No



Question 3. If yes, please provide examples.

From those who responded *Yes for all*:

- *We believe in risks, not emerging risks. We measure and monitor all material risks. For example. terrorism is always a risk. At any particular time the threat may be larger or smaller, but it is still just a risk.*
- *U.S. sanctions on Chinese nuclear companies (CGN); ballot initiatives or elections which will significantly affect key customers*

- *Once an emerging risk is deemed relevant, material and important, there is a rating system for likelihood and impact as well as a mitigation strategy attached. The emerging risks are regularly reviewed for relevancy.*
- *We track chemical and pharmaceutical litigation and accumulations. We monitor industry sources for news about emerging issues.*
- *Operational adjustments in response to disease or pandemics*
- *We have a top 25 risks, which are measured using our emerging risks framework.*
- *Risks are categorized and then ranked by likelihood of onset and potential impact.*
- *Demographic risk of aging population is monitored and reported regularly.*
- *Regulatory risk of fractured best interest standards is actively monitored and reported regularly.*
- *ERM register*

From those who responded *Yes for some*:

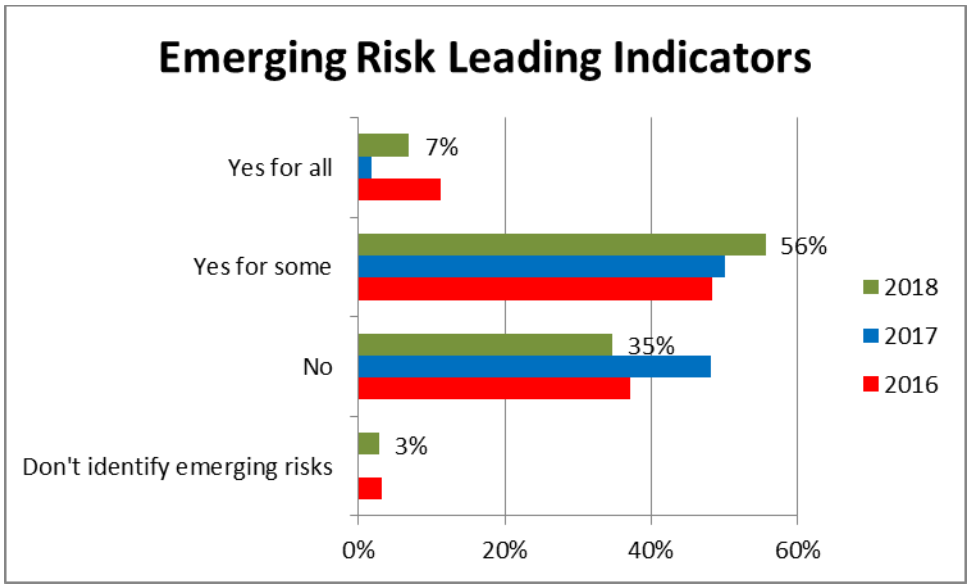
- *Changes in drivers of healthcare risk for large populations*
- *Cyber*
- *Closely monitor regulatory changes*
- *State Department STEP rating of travel risks*
- *Monitor what is happening about that factor*
- *Rising currency hedge cost, low interest rate*
- *Define thresholds for critical emerging risks and monitor their performance against these to determine their relevance to organization*
- *Latent bodily injury risk—we create dashboards derived from an external software to track our potential exposure to different types of threats (e.g. antibiotics in meat production).*
- *Consumer complaints roughly track emerging insurer integrity failures.*
- *Get training on methods that will work in the expected environment.*
- *Active participation on industry groups that monitor regulatory developments.*
- *Initiatives to address emerging risks are incorporated into business/strategic planning.*
- *Reported quarterly to Board; considered through strategic planning process*
- *Track emerging risk inventory and ongoing activities to monitor and manage risks*
- *Engage with business areas to understand strategy, proactively assist in developing risk management and mitigation activities, then participate in regular meetings to keep abreast of activities*
- *Active, ongoing data analysis with both humans and machines looking for issues*
- *Geopolitical and economic analysis*
- *Asset values projected*
- *Mortality/morbidity*
- *Annual report with rag ratings on each risk*
- *Emerging risk: changing regulatory rules for reserves; risk in inaccurate changes audited*
- *Demographic shift related to public pension systems*
- *Political and corruption risks: news trends and key behaviors to be detected*
- *We have an in-house index created for our purpose.*
- *We quantify as much as possible losses due to unusual and unforeseen events.*
- *Chronic health care conditions; demographic changes; provider cost structures*
- *Our company has a formal ERM process where risks are identified and scored, with contingency plans developed for the most severe/likely. An example is regulatory risk—the risk that state and federal requirements change in a way that adversely affects our business. We have addressed this through diversification of products and markets.*
- *We keep a list of emerging risks and a link to news articles and other items related to these risks.*
- *Regulatory environment—monitoring*

- *Cyber—moving from emerging to managed*
- *I have worked over the last eight years to try to educate actuaries on the transformation in the U.S. health system. Have reached some people, changed careers, and built skills. But the vast majority of actuaries mentally are tied to the old business model / paradigm. So ongoing work to track the health industry, providers, leaders/leading practices, credible results when they happen to be published, weak generic solutions discussed in public, etc. However, tracking and communication has not been sufficient for the deep change management needed.*
- *Significant effort spent on monitoring for emerging cyber, disruption and regulatory risks*
- *Climate change scenarios on various asset classes; various economic scenarios and how they affect asset classes*
- *ALM*
- *Nationalism and trade war*
- *We regularly track development of potential pandemics.*
- *Regular review of the status of each emerging risk by a core group*
- ***An emerging risk report is presented to the Board annually.***
- *Investment-related emerging risks are monitored and viewed inside of current limit structures.*
- *We run integrated scenarios to estimate risk.*
- *Regulatory changes—we track emerging regulations (e.g., privacy).*
- *Cyber risk, people risk*
- *Monitoring begins with reporting to the BOD on the emerging risk, mitigations in place and current status. Discussions begin to identify these mitigations and metrics for further monitoring.*
- *Financial and political risk*
- *Annual review of identified risk: Is the time line shortened? Are there examples of the risk manifesting itself currently?*
- *Pure and financial risks in the enterprises*
- *Climate risk*

Question 4. Once an emerging risk is identified, do you select leading indicators to measure changing likelihoods? (Example: In 2009, the threat of missiles fired by North Korea received much publicity. One company monitored investment flows to/from North or South Korea as an advance indication of the threat's credibility.)

Percentages back out respondents stating that the question is not applicable to them or they are not sure of the correct response.

- 7%/2%/11%/7% Yes for all
- 56%/50%/48%/57% Yes for some
- 35%/48%/37%/35% No
- 3%/0%/3%/1% We do not formally identify emerging risks

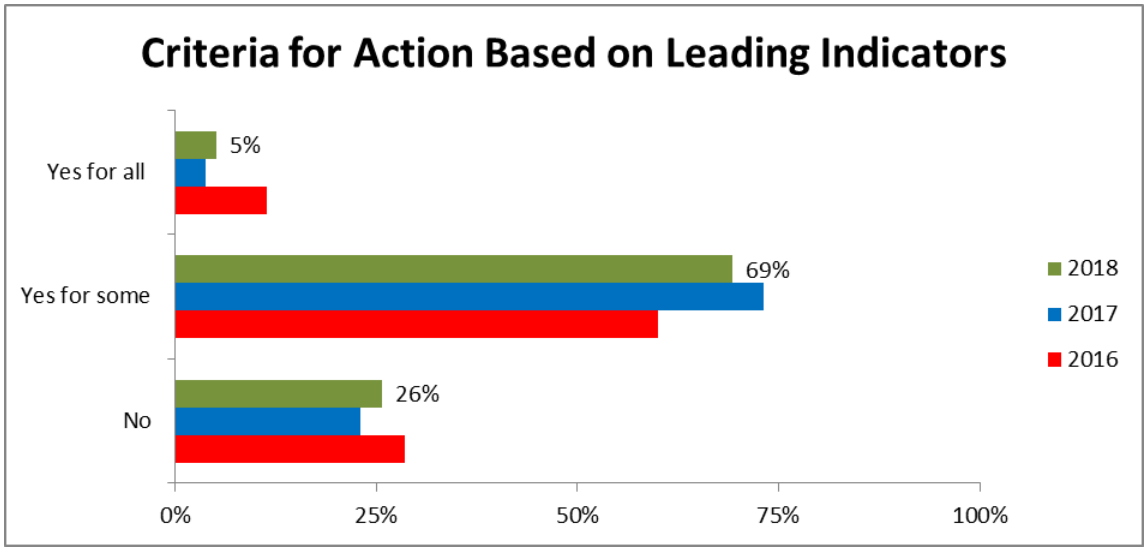


Question 5. If yes, please provide examples of these methods, including the specific emerging risk and leading indicators.

- *Climate change—monitor government and industry practice*
- *Civil and social unrest are tracked against political decisions. Economic and business disruptions are altered for changes in technology, politics and social norms.*
- *Financial risk: macro projection, leading indicator, turning point*
- *Proprietary information*
- *Poll numbers, subject matter experts, customer feedback*
- *Justified complaints as percentage of premium in line of business*
- *Regulatory changes that affect our business: likely election outcomes, state legislative activities, consumerist activity*
- *For risk of single-payer system in the U.S. health care market, watch political candidates pushing for it and their success in getting elected.*
- *Mostly related to cyber risk indicators*
- *Construction of a "risk wall": We periodically report about our greatest risks concerns. When the list mounts, we take specific actions.*
- *Corruption risk: number of citations in news of a PEP, monitoring of certain lists provided by regulators. political risk: number of disturbances to public order per day.*
- *In conjunction with cyber risk, we monitor and measure incidents.*
- *Far too complicated to describe. And based on the bias of this survey toward international, you won't do anything about it anyway, despite the many health actuaries whose careers will be impacted over the next five years.*
- *~10, e.g., used stress test to assess the energy price shock impact on investments*
- *The perception of the likelihood of North Korea firing missiles could be measured by investment flows, not the actual likelihood. This type of herd mentality often creates blind spots.*
- *Example: number of attempted phishing attacks, number of failed simulated phishing attacks*
- *Number of reported hacks*
- *Ebola cases*
- *3 to 5 emerging risks identified; annual review of status—informal*

Question 6. If you identify leading indicators of emerging risks, do you have criteria for when to take action to mitigate (or accept) the risk?

- 5%/4%/11%/13% Yes for all
- 69%/73%/60%/51% Yes for some
- 26%/23%/29%/36% No



Question 7. If yes, please provide examples.

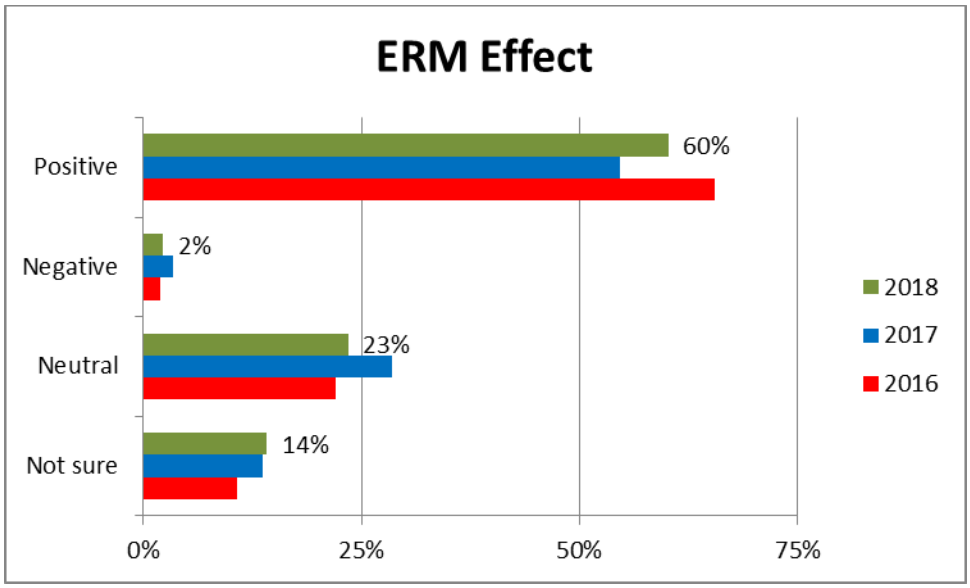
For those who said *Yes for some*:

- *When trends are accelerating at an increasingly rapid pace with no apparent stop in sight*
- ***Increase/decrease the hedge position***
- *As explained in the prior point*
- ***Action is taken when the 5% probability scenario crosses the risk appetite.***
- *Politically prominent insurance issues*
- *Refraction of business or closed monitoring of PEP*
- ***We evaluate risks in terms of impact to surplus and earnings and have established criteria where we will take corrective action—including exiting certain products or markets—if those criteria are triggered.***
- *ALM hedging*

Section C: Methodology

Question 1. Has enterprise risk management had a positive, negative or neutral effect in your company/industry?

- 60%/55%/65% Positive
- 2%/3%/2% Negative
- 23%/28%/22% Neutral
- 14%/14%/11% Not sure



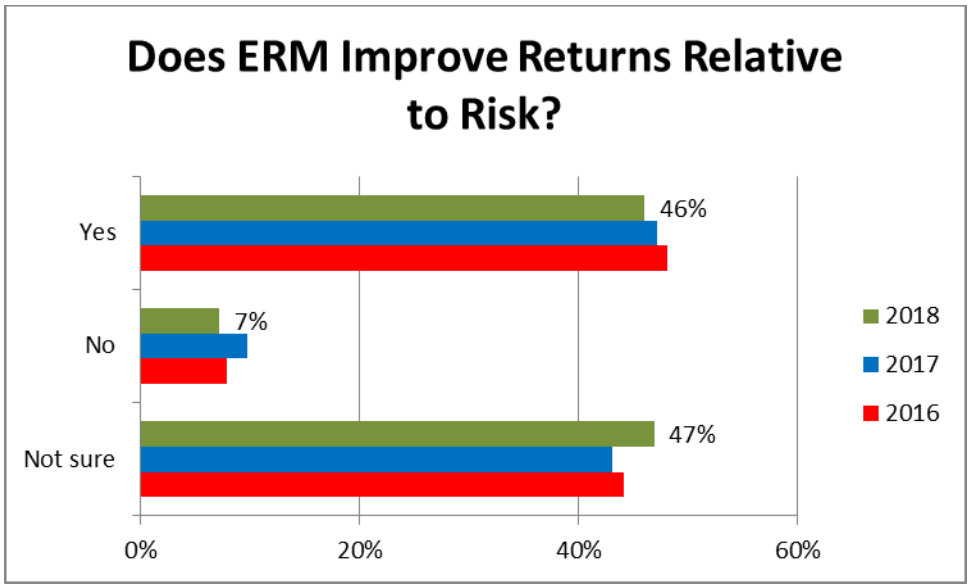
Question 2. Please share an example from the past year, if applicable, where another company (in any industry) used ERM in a positive way.

- *To identify risks to state program premium capitations (Medicaid)*
- *Increased ratings, data-driven conversations*
- *Nonprofit used ERM to organize its risk management activities and reporting*
- *The presence of strong ERM leaders is a constant reminder to management to be risk cognizant in their decisions. So the impact is more second order rather than a specific example where ERM has saved the day.*
- *Risk awareness*
- *Hedging equity risks for the guarantees in variable annuities*
- *It helped to identify some unlikely but significant risks. Once identified, it forced a serious consideration of those risks.*
- *Insurer was able to increase business upon realization that risk:surplus ratio was lower than historical.*
- *N/A*
- *Good examples are hidden inside the company.*
- *To build up the RAF and set risk limit; also capital allocation to increase RAROC*
- *Not sure*
- *My current company uses ERM to analyze risks above our risk threshold independent of product line or business development staff.*
- *No idea*
- *Setting performance indicators*
- *Air Canada's entrance into the annuity market to manage DB pension plan risk.*
- *ERM has been looking at how various economic environments would be addressed by our company. However, I have not seen research as to how those economic environments would emerge.*
- *Provide a better understanding of true risk to allow formal risk reward analysis to occur*
- *The ERM framework was on the base of the strategic decisions*
- *Reinsurance programs that take into account significant credit risks*
- *Available health plans change as ACA requirements have changed.*
- *Economic Scenario Generator work*
- *I have not seen many companies fully embrace ERM.*

- *By establishing and maintaining an ERM program, the company uncovered several areas that could have posed a major issue for them.*
- *Not sure*
- *ERM maintains a list of near-term and emerging risks. They generate economic capital for unfavorable scenarios for each of the risks and monitor against a risk appetite/threshold.* ***ERM also works with Corporate Audit to ensure that the audit plan is aligned with near-term risks; audits are being performed to evaluate control frameworks intended to mitigate near-term risks.***
- *ERM may be helpful in other lines of business. However, I have yet to see ERM from the Society deal with the professional implications for health actuaries.*
- *Many organizations are actively trying to direct the health changes in their favor, such as the United Healthcare purchasing leading organizations across the entire health industry (Optum, actuaries, etc.). There is no comparable activist organization for health actuaries.*
- *I believe many companies have improved their cyber security as a result of understanding a way to identify and quantify their exposure to cyber security risk.*
- *Looking at nonfinancial risks for our business and addressing them*
- *Limited resources for internal auditing are focused on subjects involving large risks and important controls.*
- *To decide whether or not to go into a new product line*
- *Creation of leading and lagging indicators related to sales of new products*
- ***ERM is generally necessary to be successful in most industries. If it is successful, you see an absence of issues. It is easier to give examples of situations where ERM was clearly inadequate, e.g., Facebook, Tesla, etc.***
- *Consideration of acquisition*
- *P&C companies utilize ERM to ensure risk caps and limits are set to avoid catastrophic outcomes.*
- *Cyber residual exposure was much higher than tolerance, so additional mitigations were implemented.*
- *Property exposure management to named storms for a property & casualty insurance company*
- *A company I work with reviewed their investment process and intermingled it more with the liabilities to improve ALM and liquidity.*
- *Not any that I Know*
- *I don't have any.*

Question 3. Does implementing ERM improve company returns relative to the amount of risk? (Please select one.)

- 46%/47%/48% Yes
- 7%/10%/8%/9% No
- 47%/43%/44% Not sure



Question 4. Why or why not?

For those who answered *Yes*:

- ***More data driven decision making***
- *Decision making is better when relevant risk information is readily available. Can save money by not implementing high risk strategies.*
- ***It reduces the risk of catastrophic failures within the company that can undermine the company value. Most companies are probably slightly overvalued due to lack of accounting for this risk. When the risks begin to materialize, the losses may compound as the public, and stakeholders will lose all trust in company.***
- *Insights into risk enable better corporate management.*
- *Implementing ERM should optimize risk-adjusted returns, allowing companies to make better-informed decisions.*
- *Allows a company to implement a robust system of governance.*
- *When used properly, ERM optimizes the cost of control to the potential for loss.*
- *Creates transparency and shared understanding of the risk/reward trade-off of both strategic and business and usual decisions.*
- *Helps company avoid circumstances that produce outsized loss*
- *If done correctly, ERM can help companies improve the use of capital to take advantage of opportunities.*
- *Enables proactive management*
- ***Helps reject/select among alternative courses of action***
- *Knowing the risks when there are still several options allows more conscious decisions to be made.*
- *Reduces uncertainty, focuses resources better, helps execs make better decisions with awareness of risk*
- *It should. We can optimize where we take the risk, knowing the likely return as well as the potential return under different scenarios.*
- *Over the long run, it establishes a discipline to pricing and underwriting.*

For those who answered *No*:

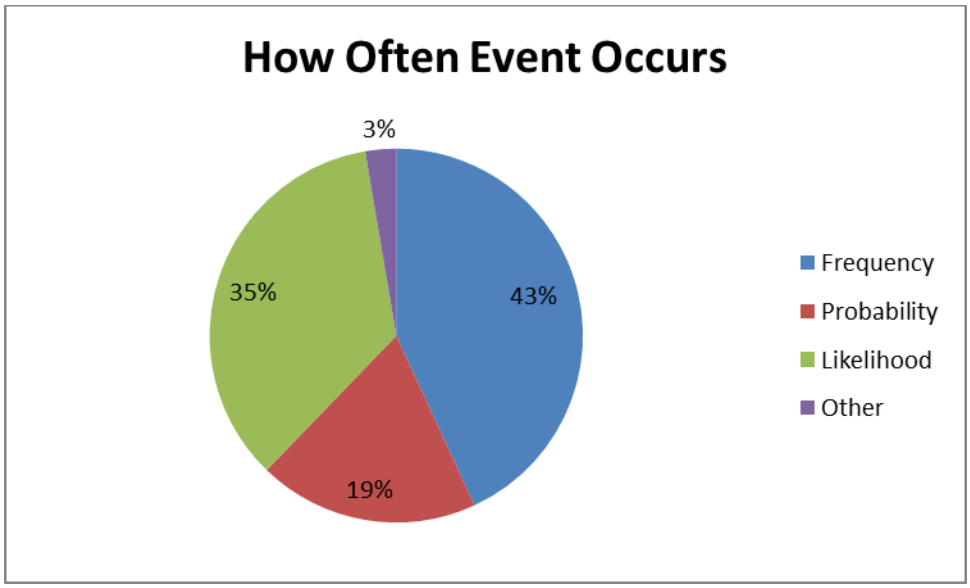
- *To repeat, have seen no ERM work in the health industry. There is no "emerging" risk. The risk is already here.*
- *Misalignment of incentives; failure to accurately assess risks and their impact on return*
- *Regulator*

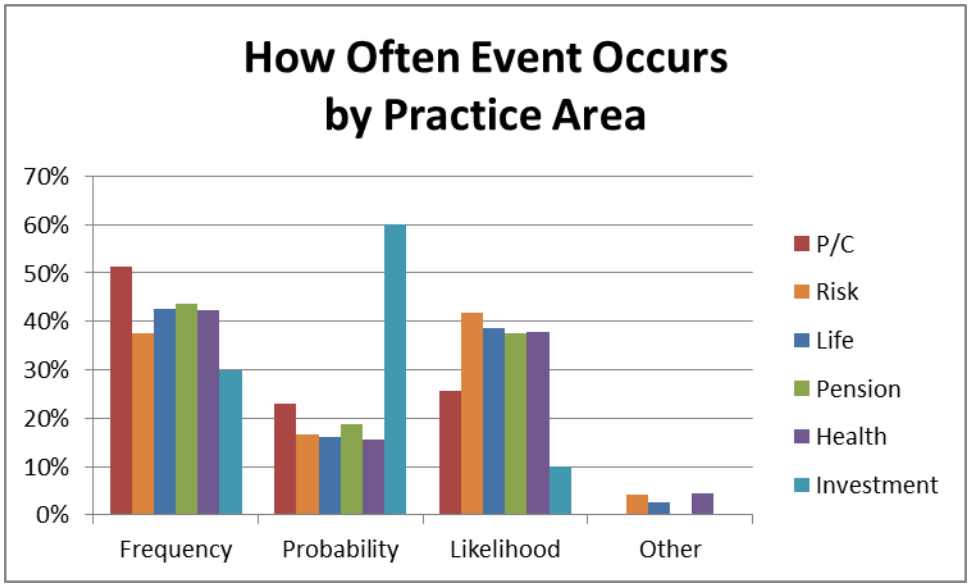
For those who answered *Not sure*:

- *It would depend on the original risk profile, but in the majority of situations, I believe it would.*
- ***I don't think it does directly. The benefits are indirect: helping you identify what risks you want to take—and ideally avoid those you don't—and in helping develop preparedness/plans for certain risks.***
- *Not clear whether the "risk premium" paid for an ERM framework compared to the additional benefits of managing risks is not entirely clear. Seems like the regulatory emphasis and buzz of ERM creates a need for companies to do something formal to satisfy having an "ERM" function, but the efficiency and effectiveness of having such a function is not always clear. Sometimes seems like a way for senior management to sound like they are fulfilling best practices.*
- *There are formidable complications in measurement.*
- *Very dependent on what the goal of the ERM program is and how mature the program is. Over time, I think it adds value, but early on could be viewed as a distraction.*
- *Answer varies by company; you can't answer blanketly.*
- *Yes, it improves returns, but not necessarily net of the ERM costs.*
- *ERM not fully implemented in my company. Hard to tell.*
- *No specific measures*
- *It's hard to quantify, especially as actions now may have unseen (good or bad) impacts far down the road.*
- *Return is not always related to risk.*

Question 5. Which of these terms do you prefer to describe how often an event occurs? (please select one)

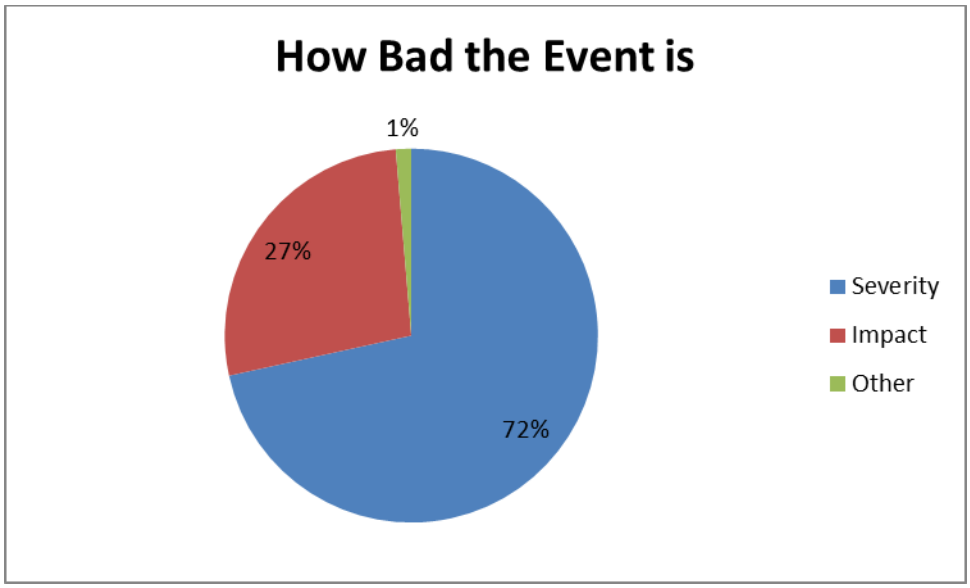
- 43% Frequency
- 19% Probability
- 35% Likelihood
- 3% Other
    - *A specific depending on event*
    - *Possibility*
    - *Incidence*
    - *All of the above*
    - *Yes, all three and severity*

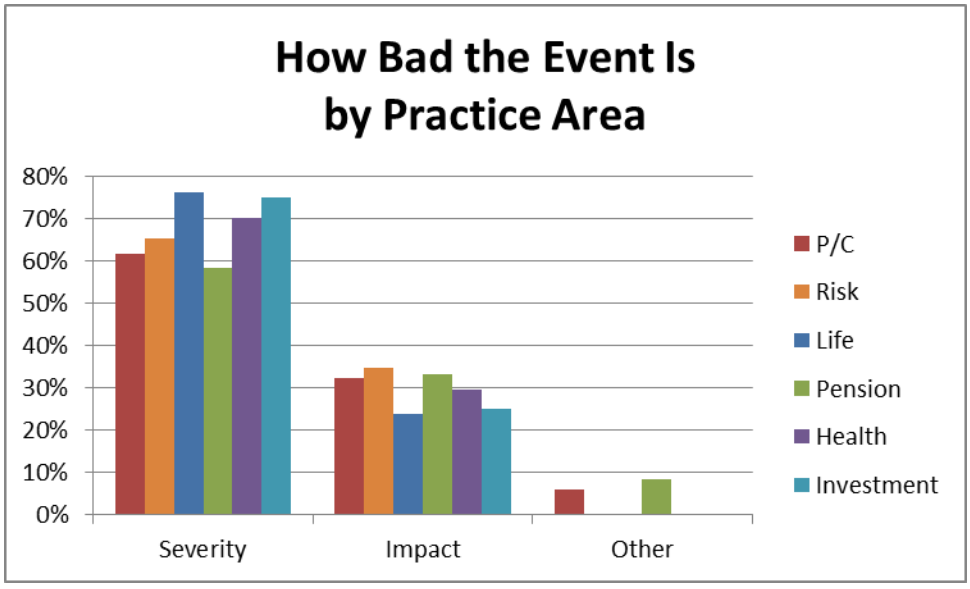




Question 6. Which of these terms do you prefer to describe how bad the event is? (please select one)

- 72% Severity
- 27% Impact
- 1% Other
  - A specific depending on event
  - It depends on the event

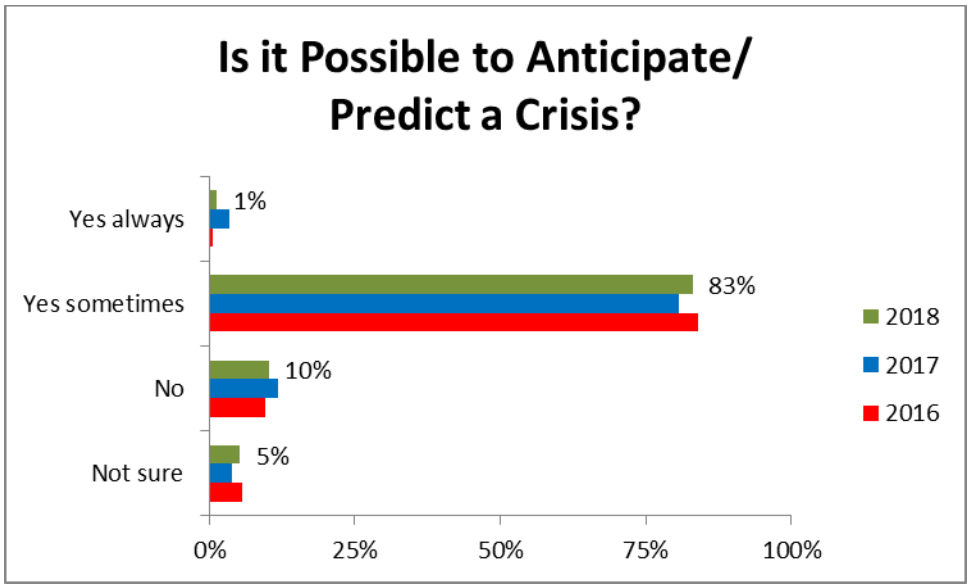




Section D: Predictions

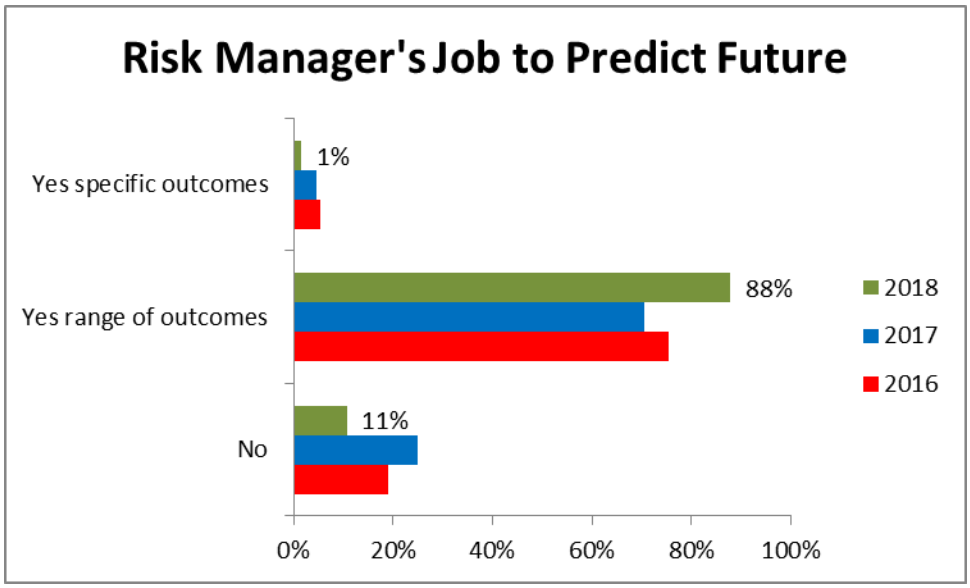
Question 1. Is it possible to anticipate/predict a crisis? (Please select one.)

- 1%/3%/1% Yes always
- 83%/81%/84% Yes sometimes
- 10%/12%/10% No
- 5%/4%/6% Not sure



Question 2. If you consider yourself a risk manager, is predicting the future part of your job?

- 1%/5%/5% Yes—specific outcomes
- 88%/70%/75% Yes—range of outcomes
- 11%/25%/19% No

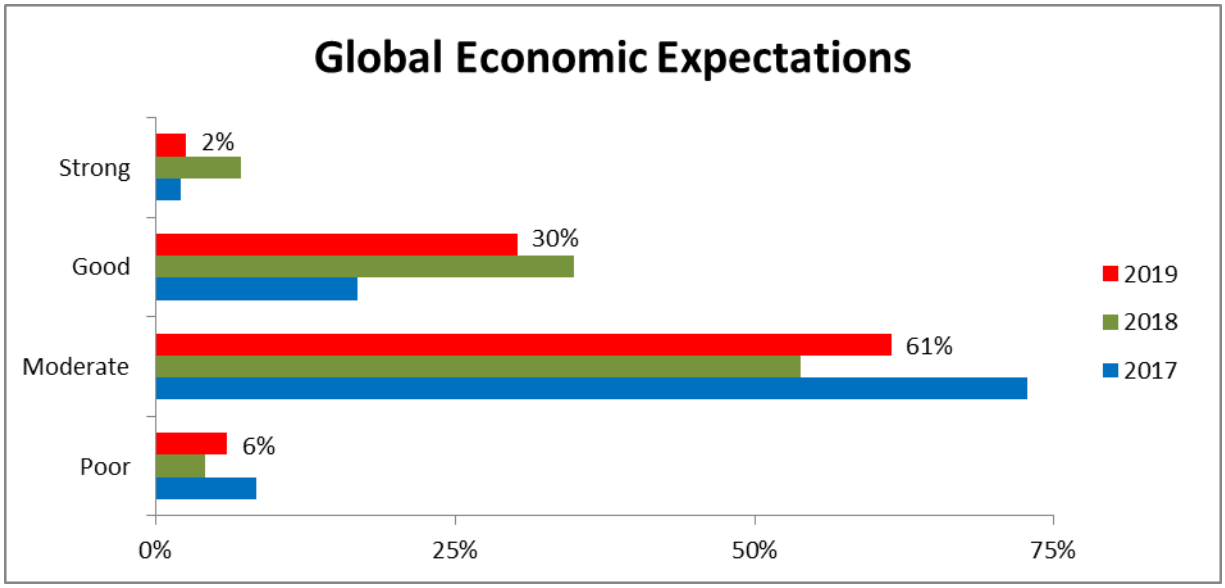


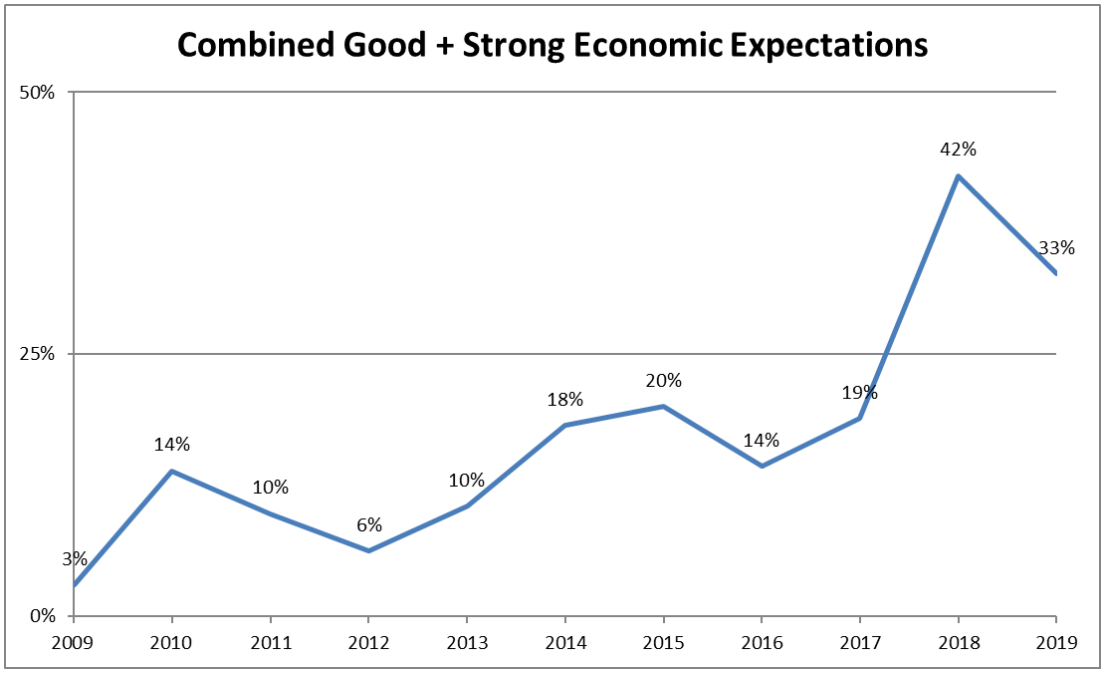
Section E: Current Topics

Question 1. Your expectations for the 2019 global economy are:

- 6%/4%/8% Poor

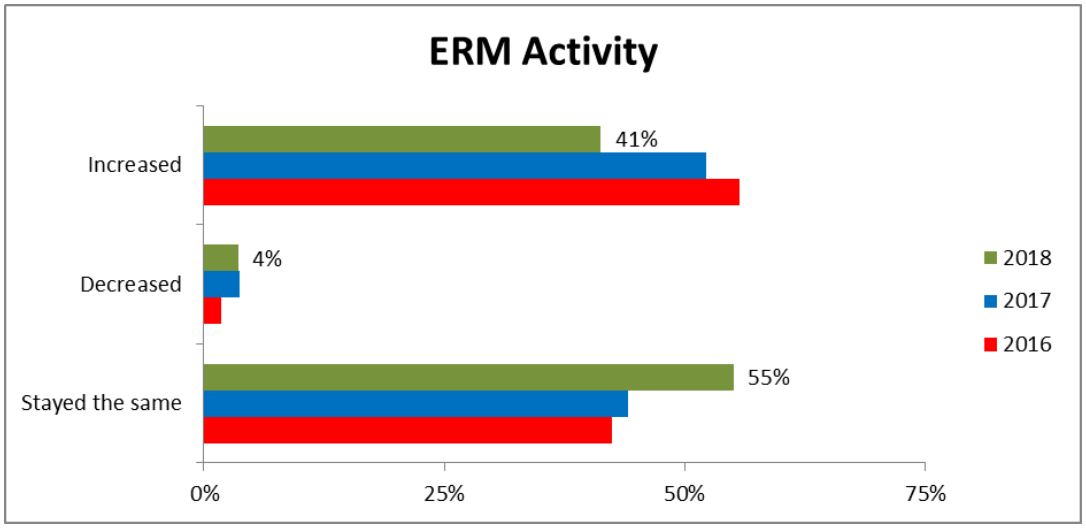
- 61%/54%/73% Moderate
- 30%/35%/17% Good
- 2%/7%/2% Strong





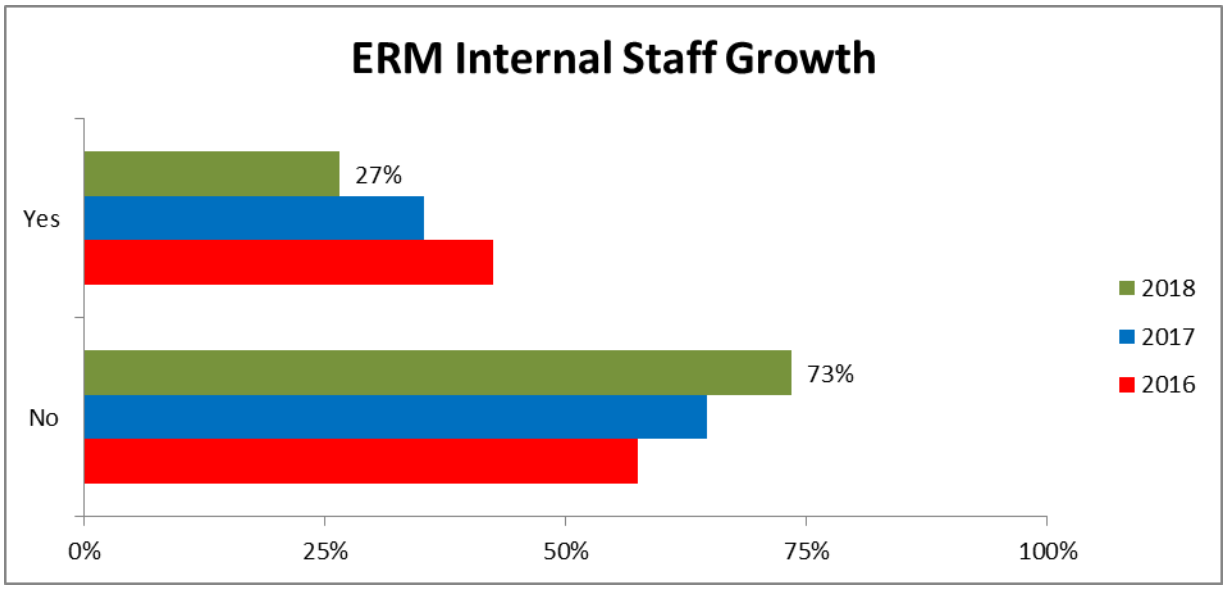
Question 2. Did you experience a change in the level of ERM-focused activities for your organization or clients in 2018?

- 41%/52%/56% Increased
- 4%/4%/2% Decreased
- 55%/44%/42% Stayed the same



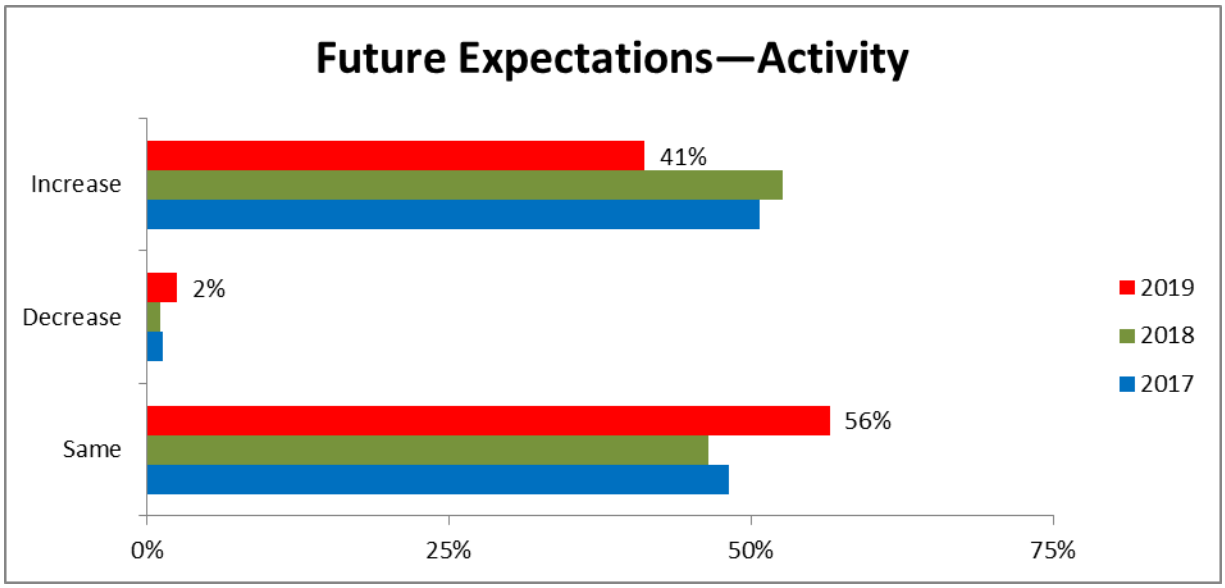
Question 3. Did your internal ERM staff increase in 2018?

- 27%/35%/43% Yes
- 73%/65%/57% No



Question 4. Do you anticipate a change in the level of ERM-focused activities for your organization or clients in 2019 relative to 2018?

- 41%/53%/51% Increase
- 2%/1%/1% Decrease
- 56%/46%/48% Stay the same



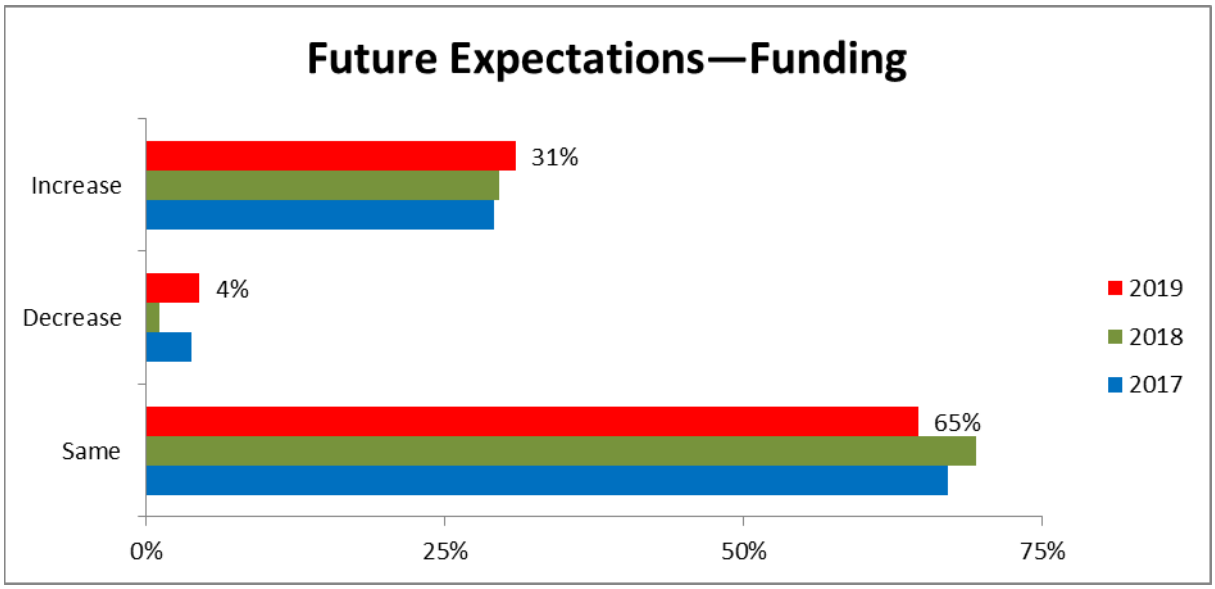
Question 5. What types of Cyber/network infrastructure scenarios do you analyze?

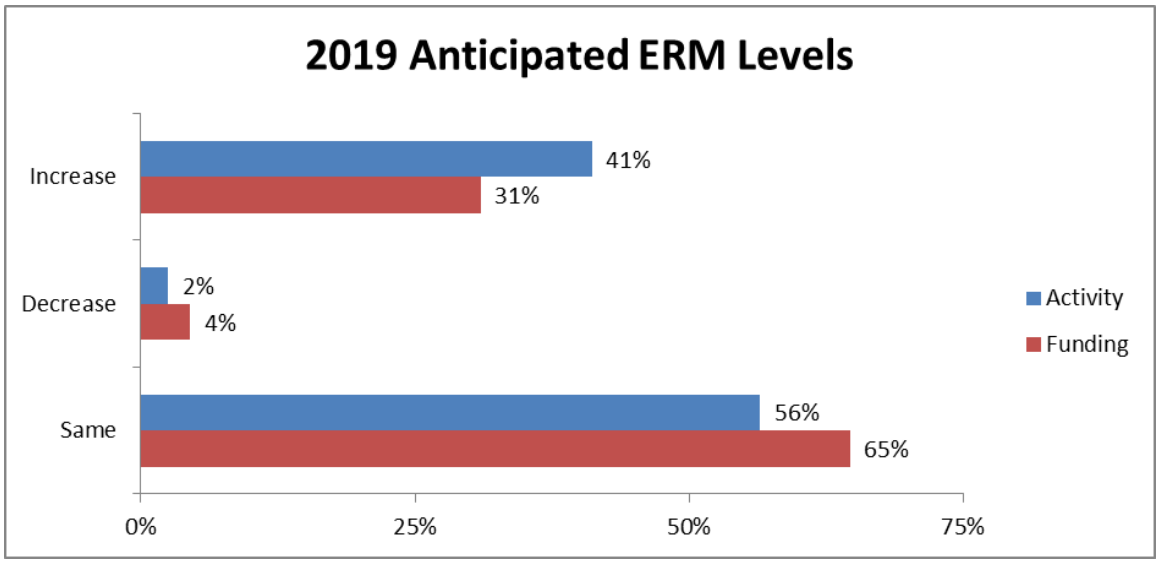
- *An overall cyber event and the cost to measure credit scores, forensics and then changes to systems so "it" does not happen again.*
- *None*
- *Phishing, denial of service*
- *Currently expanding our limited scenario list*
- *A single cyber security failure*
- ***Transactional fraud, hacker damaging systems, theft of client data***
- *None*
- ***An extreme scenario where there is an extremely material impact to revenue and expenses***
- *Health insurer data breaches have had a lot of information. Severity (cost per record) is much more manageable and realistic than experts (ex. Ponemon).*
- *Cyber attack*
- *Partial or complete shutdown*
- *Rogue software (not an attack, but unintended consequences, or a bug)*
- *Personal/company data protection, hacker*
- *None*
- *Cyberterrorism attack on energy or chemical facilities, attack on cloud service provider, malicious code attack, cyberstrike against state, major software flaws, etc.*
- *Cyber threat of Russia/China hacking based on past experience*
- *None*
- *Data breach/theft, system penetration by an external party, malware attacks, phishing scenarios, denial of service. Most scenarios are focused on understanding point of entry weaknesses, potential cost of an event, and the company's ability to quickly react and contain.*
- *Internal and external data theft*
- *N/A*
- *Internal threats and external bad actors*
- *Uncertain*
- *Worm/virus attack*
- *Data breach/disruption/manipulation*

- *Not scenarios specifically, but we look at trends in activity for the company as well as monitoring industry and more broadly.*
- *Data breach, technical failures, catastrophes that contribute to technical failures*
- *Phishing, attacks worldwide*
- *Medium to very large events, internally and externally sourced, and a wide range of reputation outcomes*
- *Data breach, identify theft*
- *Various by entity within the group, building on prior scenario analysis*
- *Hacking*
- *Reading people's thoughts; inflicting pain through ultrasound or EM radiation*
- *Attacks, loss of data or of integrity, or violation of privacy*
- *Data breach, data held to ransom*
- *None*
- *Loss of clients' data if attack by hackers*
    - *Restore/rebuild infrastructure*
    - *Company's reputation*
- *We have an operational risk component to our risk appetite. A portion of the operational risk component is based on a severe cyber attack scenario.*
- *Breach of large amount of records*
- *Beginning to talk about record manipulation*
- *Use IBM cyber warfare center to set scenarios*
- *None*
- *Theft of client data, unavailability of systems*
- *We analyze a variety of scenarios, including*
    - *Misuse of data the company maintains*
    - *Breach of data the company maintains*
    - *Data scenarios involving our customers*
- *Scenarios may include legal, strategic, regulatory, financial and reputational consequences.*
- *N/A*
- *I cannot provide that information.*
- *Multiple—DNA, ransomware, various types of interruptions*
- *Phishing attempts, firewall security, access rights, physical security*
- *None*
- *It's not a scenario process; it's a "correcting exposures" process.*
- *Not applicable*
- *Reviewed by outside audit every other year, we use those findings to analyze further and prevent/avoid/reduce exposures as possible. We train our people to hopefully reduce the number of possible impacts on our infrastructure.*
- *I am not involved in such things.*
- *Security breach leading to personal data leak*
- *Loss of servers for a number of days—more of a business continuity/disaster recovery scenario*

Question 6. Do you anticipate a change in the level of funding dedicated to ERM-focused activities for your organization or clients in 2018 relative to 2017?

- 31%/29%/29% Increase
- 4%/1%/4% Decrease
- 65%/69%/67% Stay the same





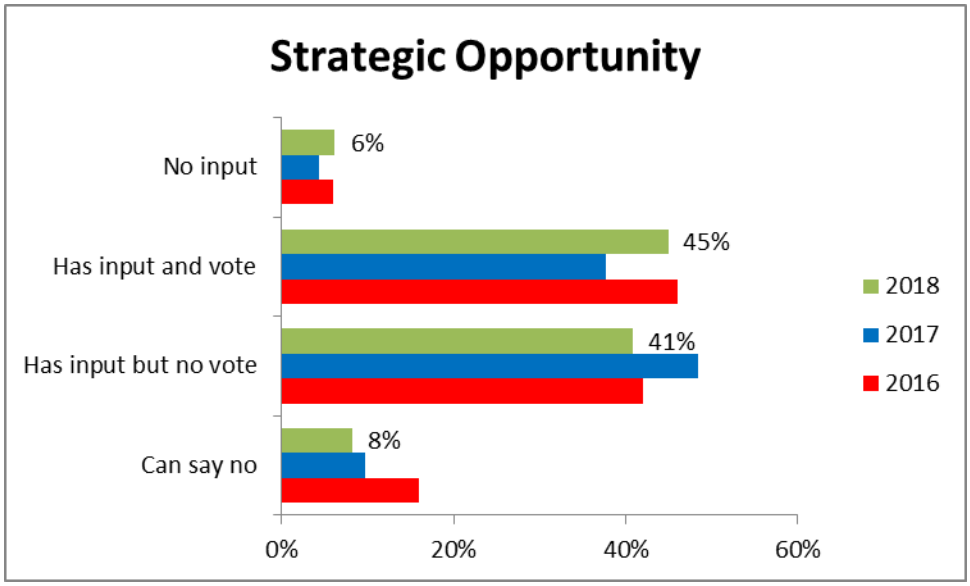
Question 7. The true measure of an ERM program is how it is received by the board and senior management. Which of these is true in your situation? (Please select all that apply.)

Percentages back out respondents stating that the question is not applicable to them.

- 8%/10%/16% Our ERM function can say no to a strategic opportunity.
- 41%/48%/42% Our ERM function has input but not a vote when a strategic opportunity is being considered.
- 45%/38%/46% Our ERM function has input and a vote when a strategic opportunity is being considered.

- 6%/4%/6% Our ERM function has no input when a strategic opportunity is being considered.

- ***Input is increasing when looking at strategic opportunities.***
- *ERM should ensure return/risk trade-off is properly considered in all decisions. That doesn't mean the ERM function participates in the decision.*
- *The risk function has to approve any M&A or significant new business relationships.*
- ***We are a small company. ERM and management are the same people.***
- *The vote would come from our CRO.*
- ***If a strategic opportunity met the criteria to perform an ad hoc** ORSA, the board risk committee would consider the output of the risk review prior to the strategic initiatives.*
- *I don't know.*
- *Often, input is after a decision has all but been made—essentially part of crossing the t's and dotting the i's.*



Question 8. Please share an example where the ERM department was recognized, either positively (e.g., proactive mitigation) or negatively, following a risk event.

- *Can't think of one*
- *I can't think of an example where they had enough impact to be recognized.*
- *Previous management was not proactive in managing risks, and issues were raised surrounding the handling of the environment, which potentially contributed to a* (Ed. Note: this was the complete response)
- *N/A*
- *See negative examples from the Australian Royal Commission.*
- *To help manage the exposure*
- ***During the significant property catastrophe activity of 2017, our ERM team received credit from management for having directed the purchase of additional reinsurance, given our assessment that the pricing made sense relative to our risk levels.***
- *ERM analyzed the enterprise risks of a specific large project independent of project development and presented to the risk committee. The risk committee decided that the project involved too much risk to continue, and it was canceled.*

- *No major risk events recently*
- *As a small firm, there is no dedicated ERM department.*
- *We have developed a set of sensitivity tests that we run quarterly. Having these readily available helps address questions quickly when financial markets move. It has also allowed us to be more proactive in managing the business. This is recognized positively by senior management and the board.*
- *A shift deliberately toward introduction of recurring premium products to mitigate interest volatility was recognized positively.*
- *Ogden discount rate change*
- ***Resiliency funding strategy (that is, sources of liquidity in a stress scenario)***
- ***Response to a recent power outage that impacted one of our buildings***
- *Risk events cannot be disclosed.*
- *Appropriate reinsurance turned an outlier gross year into a moderately above-average net year; this was positively recognized.*
- ***Our ERM team performed a reputation risk assessment related to affiliating with external individual.***
- *ERM weighed in on numerous business opportunities—supporting some, rejecting others.*
- *Not applicable*
- *Don't really get positive recognition in these cases. An example: Historical life reinsurance contracts had no language to support exiting the contract under adverse circumstances (reinsurer purchased, declining surplus, declining rating agency scores). After ERM became involved, due to concern about financial stability of existing reinsurer, changes were made: no longer write new policies with that reinsurer, and new reinsurer contracts contain some protective language. All good. But ERM was seen as causing troubles where there was no current risk of insolvency. ERM was just being difficult and didn't understand the business.*

Question 9. Some risk managers seek ways to exploit risk by finding opportunities that are mispriced or provide diversification. Which, if any, emerging "opportunities" do you monitor?

- *ESG, private assets*
- *New product or business opportunities*
- *Swaps market to hedge future interest rate risk*
- *N/A*
- *Natural hedges, inappropriate capital frameworks*
- *Reinsurance. We look to see if we can retain, or shed, risk as the prices dictate.*
- *Technology disruption*
- *Overreaction and mean reversion*
- ***This is how we started writing cyber insurance—we felt the market was mispricing.***
- *Technology upside risk, major project upside*
- *We are a consulting actuarial firm. Keeping alert to new consulting areas is very important for us.*
- *None*
- *N/A*
- ***Catastrophic risk coverage in a holistic way. Some lines of business provide a natural hedging to other LoB.***
- *No opportunity specifically, but rather we try to* ***engage with business units to provide different perspectives****—looking for ways we can better diversify risk or manage it more tightly to allow continued business development.*
- *Any areas with negative correlations to other risks are pursued. Self-insuring cases where stressed losses are manageable has also occurred.*
- *Ogden discount rate change*
- *None*

- *No*
- *Mortality/longevity risk offsets*
- *Opportunities for taking additional investment risk, when market conditions indicate risk will be rewarded*
- *Mortality and morbidity diversification*
- *Risks to our customer base are examined carefully for an opportunity to provide a service to help ensure better financial outcomes for them (the customers).*
- *None*
- *We do not currently directly monitor opportunities.*
- *None*
- *Investment returns, by sector*
- *Various asset classes and specific assets within them, of course; also commodities and currencies*
- *Not applicable*
- *Lack of perpetuation by competitors in the form of client service teams creating opportunity to take customers from competition*
- *Merger and acquisition opportunities to diversify and grow*

Question 10. Are there bubbles that you have identified in today's environment?

- *None that I can think of*
- *Bay Area (CA) economy is a bubble in my opinion.* ***Real estate prices in Bay Area and Los Angeles are a bubble.***
- *Before recent pullback, we would have considered stocks near bubble territory.*
- *No*
- *Global debt levels, government debt, public pension underfunding, technology company valuations*
- ***CLOs***
- *The "underwriting" cycle in health reinsurance still exists. This can be taken advantage of as a purchaser of reinsurance.*
- *Asset valuation is high.*
- *College tuition—it is way too expensive for the benefits it provides students.*
- *On the ceded side, many classes of P/C reinsurance are still underpriced, so we are buying more than our competitors.*
- ***Government-supported energy****.*
- *No*
- ***The Belt and Road Initiative that China is working on*** *is on an unimaginable scale; no other country has a similar project to this. The world will gravitate toward China and Asia in the short term.*
- *Asset prices; housing values; household debt (and low savings)*
- *N/A*
- *Financial markets, real estate*
- *It´s not my specialty, but* ***housing in Colombia*** *seems overpriced (although prices have decelerated recently), and financial assets worldwide also seem too high.*
- *Nothing that I can think of*
- ***Asset prices for virtually all investment classes***
- *Market prices*
- ***Car finance credit bubble***
- *Bubble of trust: trust is evaporating due to demographic shifts and government hidden use of technology to control people.*
- *Residential-property prices*
- *It's a bit late now, given the last month, but the market decline has been on the horizon for a while now.*

- *Yes*
- *The U.S. economy and stock market*
- *Equity prices and some private-market assets are very highly valued right now. Canadian housing market also.*
- *Bubbles?*
- *None that can be disclosed on this survey.*
- *No*
- *No*
- *No*
- ***The Fed is trying to unwind a subsidized economy without bubbles bursting—unlikely to happen, bonds, equities with high levels of debt, highly levered countries, companies, individuals in general***
- ***Given its sociological and political risks, the internet/communication sector appears grossly overvalued.***
- *Perpetuation, aggregation through severe leveraging by national competition, short-term thinking on how advice is provided that when realized will allow us to differentiate from competition*

Question 11. List an unknown known (where you have historical data, but it is not predictive) and how you adjust to manage the risk.

- *Pandemic risk—mostly intuitive adjustments (concentration of insured, travel, etc.)*
- ***The availability and readiness of auction participants for liquidation purposes in a systemic risk event***
- *Equity markets typically recover quickly after a significant decline. Given each economic downturn is somewhat unique, will markets recover after the next decline, or will the exposure to further significant decline remain?*
- *Global pandemic—capital is held to cover a worst-case scenario.*
- ***Most strategic risks are of this nature. Do scenario testing.***
- *Managing the risk comes down to having extra capital.*
- *Policyholder behavior—healthy lapsation, dynamic lapse*
- *2019 property catastrophe activity*
- *Contraction of my industry. The risk is managed by analysis of independent data sources, as well as internal subject matter expert input.*
- *Policyholder reaction to a severe economic event. Margins are held based on policyholders reacting in a way that negatively impacts the company, and scenario testing is completed to monitor the size and trend of this exposure.*
- *Monetary policy regime shifts—by various nations*
- *N/A*
- *Financial markets: even if I think it is overvalued, historic data is not useful in predicting when a decline might happen.*
- *In Colombia, the minimum wage is critical variable for life annuities, but it is a political risk. After years of negotiation, the government assumed the risk for certain new life annuities. For the stock, insurance companies still hold the risk, but each year, in the measure we can, we have built reserves to absorb future shocks.*
- *We haven't looked at this explicitly.*
- *Regulatory risks are mostly unknown known risks and are mitigated with analysis of multiple scenarios.*
- ***Keep buffer in the capital, i.e., ESR above 100% is the buffer.***
- *Hidden social structure used to control people. Analyze humanity starting with prehistory.*
- *Changes in the U.S. health system—approaches mentioned previously*
- *Mortality trends—how relevant is historical data to future? Rely on a mix of historical data, internal expertise, and conservatism.*

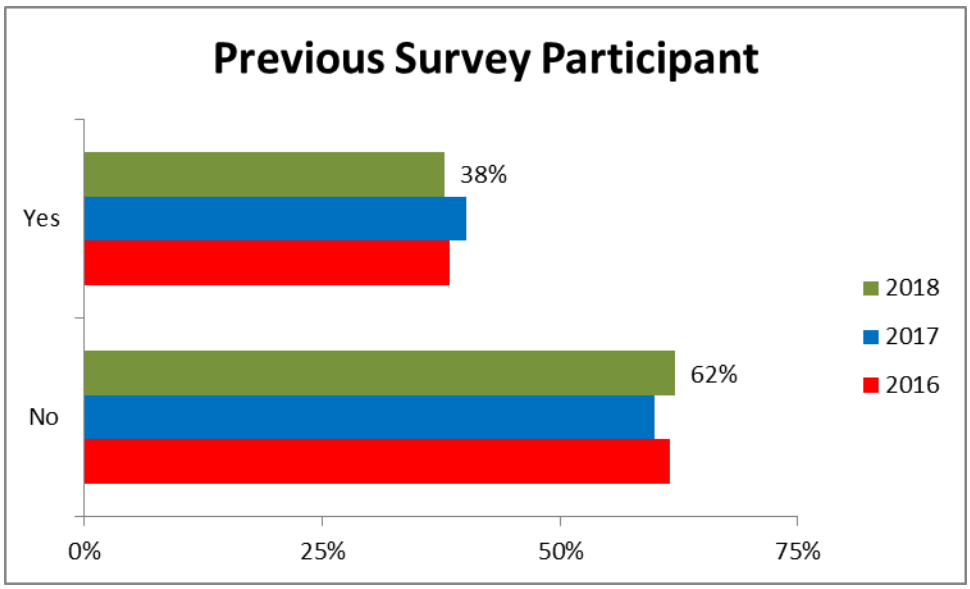
- *The possibility that the **capital markets are temporarily interrupted or not functioning well** over an extended period, mitigated by monitoring, war-gaming, asset/liability management, and established lines of credit.*
- *New riders on some products where there is no historic data. Manage through conservative pricing and monitoring of leading/lagging indicators.*
- *Morbidity improvement in LTC insurance*
- *I don't know.*
- ***Cybersecurity risk—we rely heavily on consulting firm expertise.***
- ***Longevity improvements.** Potential for significant change, likely longer. Unlikely to be as predicted by mortality improvement scales. Model for disruptive changes, such as doubling of life expectancy within a generation.*
- ***Time horizon: climate change will force a review of insurance products with more than a 5-year life.***
- *Historical mortality improvement data: address by understanding drivers of improvement and the future prospects for those drivers.*

Section F: Demographics

If you are retired, respond based on your most recent career path.

Question 1. Have you completed this survey in the past?

- 38%/40%/38% Yes
- 62%/60%/62% No



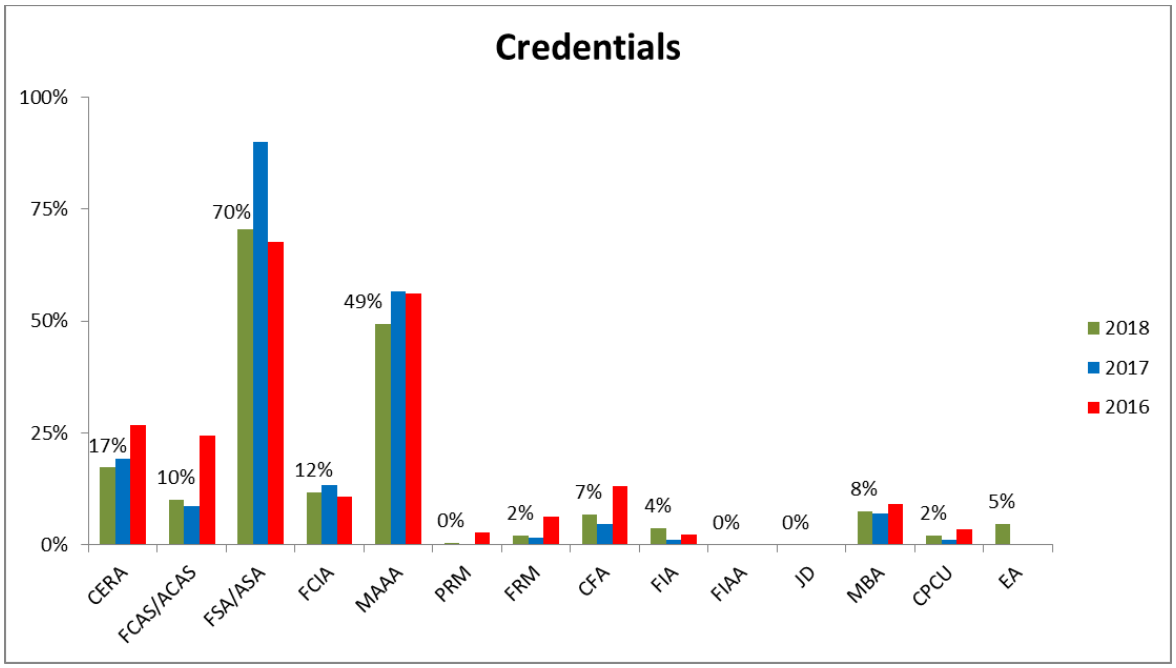
Question 2. What credentials do you currently hold? (Please select all that apply.)

442 responses from 237 surveys (average of 1.9 responses per survey)

Percentages are based on 237 surveys.

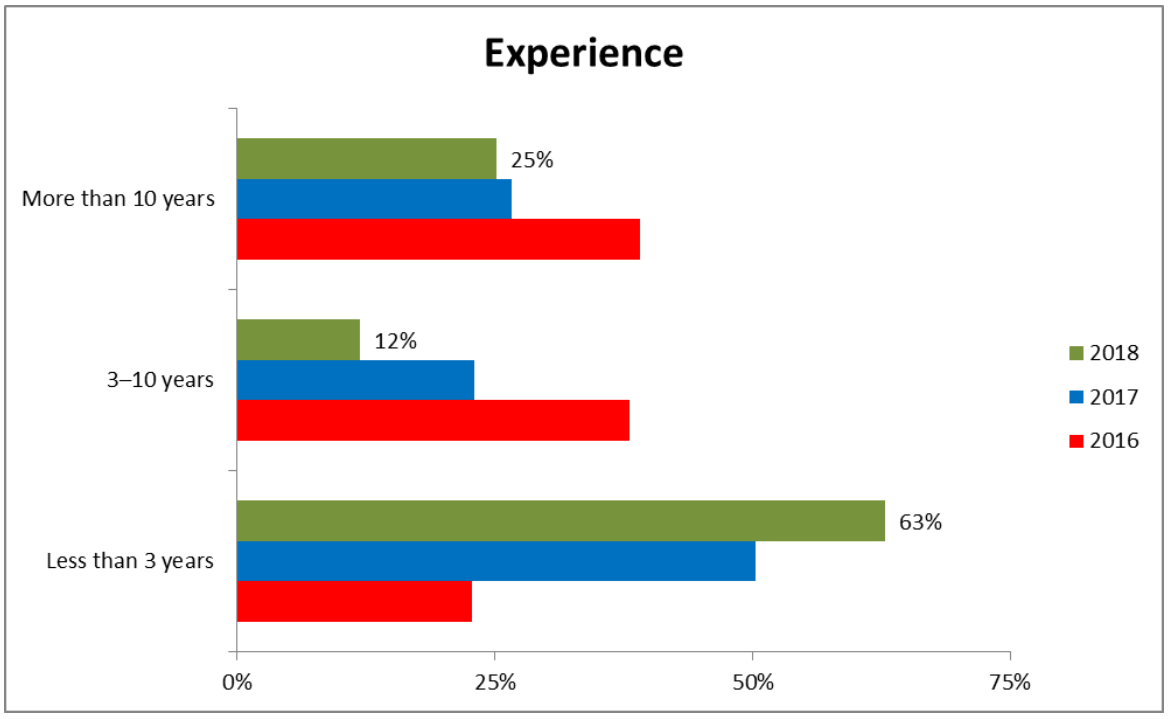
- 17%/19%/23% CERA

- 10%/9%/11% FCAS/ACAS (Fellow/Associate, Casualty Actuarial Society)
- 70%/90%/81% FSA/ASA (Fellow/Associate, Society of Actuaries)
- 12%/13%/15% FCIA/ACIA (Fellow/Associate, Canadian Institute of Actuaries)
- 49%/57%/52% MAAA (Member, American Academy of Actuaries)
- 0%/0%/3% PRM (Professional Risk Manager, PRMIA)
- 2%/2%/3% FRM (Financial Risk Manager, GARP)
- 7%/5%/11% CFA (Chartered Financial Analyst, CFA Institute)
- 4%/1%/3% FIA (Fellow, Institute of Actuaries)
- 0%/0%/1% FIAA (Fellow, Institute of Actuaries of Australia)
- 8%/7%/8% MBA (master of business administration)
- 2%/1%/4% CPCU (Chartered Property Casualty Underwriter, The Institutes)
- 0%/4%/7% Ph.D. (doctor of philosophy)
- 3%/9%/3% Other actuarial credential (please specify)
    - MSPA
    - Certified Pension Actuary
    - Institut des actuaires (France)
    - FIAJ
    - FIAJ
    - Actuary (Argentina)
    - AIAJ
    - FSAI
- 8%/14%/19%/19% Other non-actuarial credential (please specify)
    - LLIF
    - FLMI
    - CRSC
    - CAIA, CFP
    - FLMI, CPCU, ARM
    - CIA
    - MSC
    - ARM
    - CISA
    - ARe
    - Master of engineering, PMP
    - FLMI
    - CCP
    - FLMI
    - CPA
    - FLMI
    - FLMI, CEBS
    - FLMI, RHU
    - CRM, ERMCP



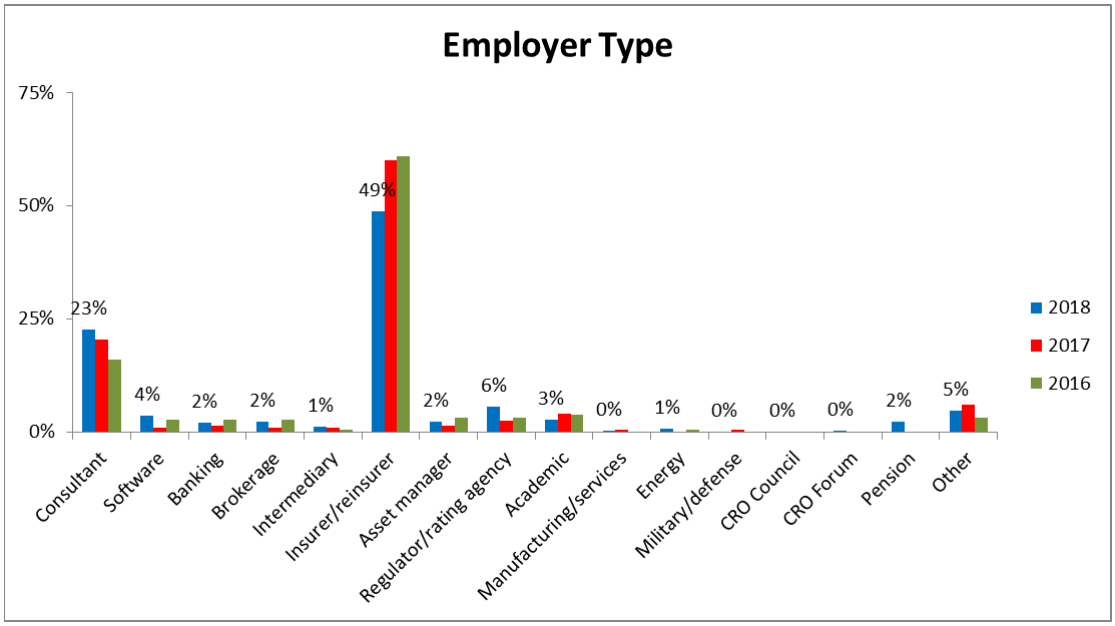
Question 3. How long have you been a risk manager?

- 63%/50%/23% Less than 3 years
- 12%/23%/38% 3–10 years
- 25%/27%/39% More than 10 years



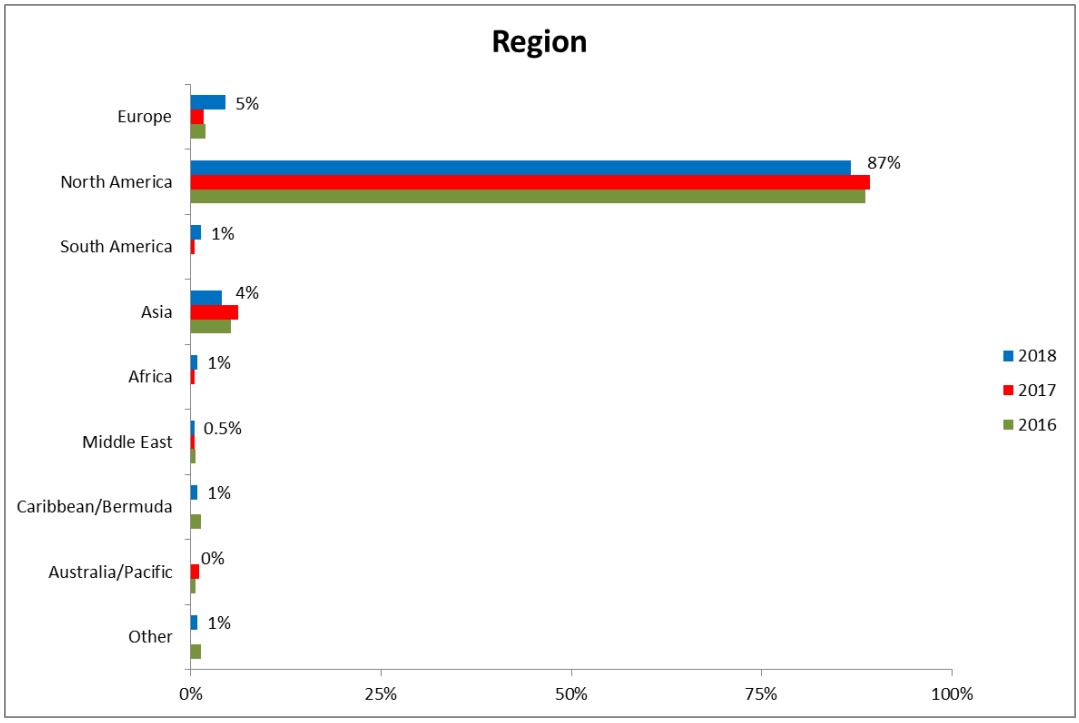
Question 4. Employer type (Please select all that apply.)

- 23%/21%/16% Consultant
- 4%/1%/3% Software
- 2%/2%/3% Banking
- 2%/1%/3% Brokerage
- 1%/1%/1% Intermediary
- 49%/60%/61% Insurance/reinsurance company
- 2%/2%/3% Asset management
- 6%/3%/3% Regulator/rating agency
- 3%/4%/4% Academic
- 0%/1%/0% Manufacturing/services
- 1%/0%/1% Energy
- 0%/1%/0% Military
- 5%/6%/3% Other
  - RIA
  - TPA
  - Government
  - Government
  - Financial nonprofit
  - Technology
  - Data and analytics vendor to the insurance industry
  - Organization serving the insurance industry
  - Service organization for P&C industry



Question 5. Primary region (Please select one.)

- 5%/2%/2% Europe
- 87%/89%/89% North America
- 1%/1%/0% South America
- 4%/6%/5% Asia
- 1%/1%/0% Africa
- 0.5%/1%/1% Middle East
- 1%/0%/1% Caribbean/Bermuda
- 0%/1%/1% Australia/Pacific
- 1%/0%/1% Other
    - Global (2)



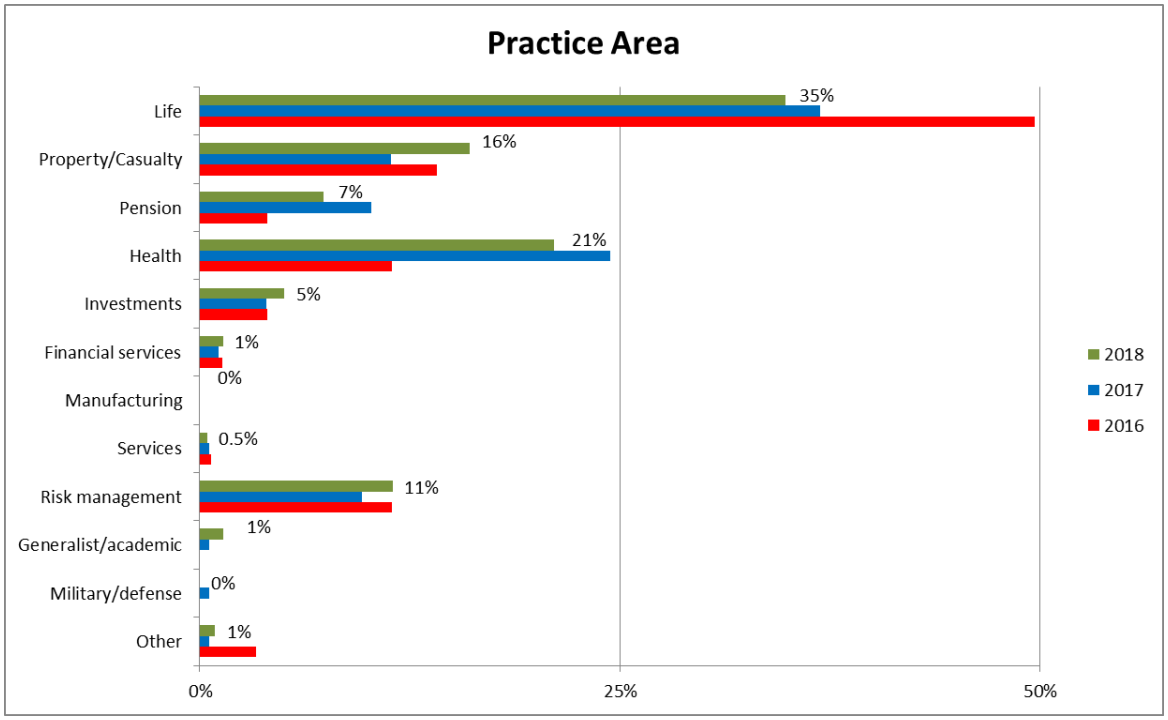
Question 6. Primary area of practice (Please select one.)

- 35%/37%/50% Life
- 16%/11%/14% Property/casualty (general insurance, nonlife)
- 7%/10%/4% Pension
- 21%/24%/11% Health
- 5%/4%/4% Investments
- 1%/1%/1% Financial services (noninsurance)
- 0.5%/0%/1% Manufacturing/services
- 11%/10%/11% Risk management
- 1%/1%/0% Generalist/academic
- 0%/1%/0% Military/defense

- 1%/1%/3%

Other

- Actuarial evidence and retirement planning
- Life and P/C



Question 7. What sources do you find valuable when scanning for emerging risks (list up to 3)?

- *Wall Street Journal*
- *American Council of Life Insurance Companies' news releases*
- *Wall Street Journal, **results from this survey***
- *New York Times, Economist, McKinsey*
- *Phys.org, google*
- *Industry-specific media (e.g., FierceHealth articles)*
- *Actuarial-related conferences*
- *World economic report, World Bank*
- *Weather report from NOAA*
- *Infectious-disease report from CDC*
- *Financial publications*
- *Risk-oriented publications*
- *Advisen*
- *The Actuary magazine*
- *Internal Auditor magazine*
- *Internal government news materials*
- *Gartner, CRO Council, World Economic Forum*
- *AAA*
- *SOA*
- *Besides the SOA: Swiss Re, Zurich, CRO Forum*
- *New Scientist, Scientific American, The Economist*

- *Science fiction*
- *My fervid imagination*
- *CRO Forum, GARP, actuarial website (e.g. SOA)*
- *Swiss Re Sonar report*
- *World Economic Forum*
- *Industry news sources, paid research, Fox News (political uncertainty risk)*
- *Audio*
- *Video*
- *Conferences*
- *Editorial cartoons*
- *Stephen Colbert*
- *Weather reports*
- *Reading the Wall Street Journal newspaper and The Economist magazine; reading on the internet; talking with new people.*
- *WSJ*
- *News, white papers, AAA/SOA data, census data, CDC data*
- *Daily brief news from Quartz*
- *Independent local advisers*
- *Industry news feeds, CLHIA industry committees, professional-association news feeds and articles*
- *World Affairs Council "Daily Chatter"; Al Jazeera*
- *PWC Insurance Banana Skins*
- *Swiss Re emerging risks*
- *Internet*
- *Newspaper*
- *Friends and acquaintances*
- *Pensions & Investments magazine*
- *Actuarial associations; insurance trade union; Twitter*
- *World Economic Forum, CEB/Gartner, Sonic survey by Swiss Re*
- *National news, health publications, sources from the SOA*
- *Keep up with media reports*
- *The Economist*
- *SONAR Report*
- *The Guardian*
- *Actuarial trade literature*
- *The Wall Street Journal*
- *WSJ, daily political news, biomed research*
- *Consultancy emerging-risk reviews*
- *Reinsurance emerging-risk surveys*
- *GIRO papers*
- *Peer-reviewed scientific literature*
- *Social media; conspiracy theories; politically incorrect websites*
- *Newspaper*
- *Websites*
- *Discussion with other staffs*
- *News, research*
- *Control Risks*
- *SOA*
- *Industry reports; national/international surveys; news articles*
- *Technology and science news services*
- *SOA website; conference/Internet (WSJ, financial reports, ...)*

- *Industry publications, mostly online*
- *The Economist, Reuters*
- *ISO Emerging Risk survey*
- *New England Journal of Medicine; general news feeds*
- *Reinsurer emerging-risk surveys*
- *WSJ*
- *CRO Forum*
- *Protiviti*
- *Google in general*
- *World Bank reports*
- *IMF reports*
- *SOA, NACD, firm-sponsored surveys (e.g., Protiviti)*
- *Media*
- *ISO's emerging-issues portal*
- *Industry newsletters*
- *Newspapers*
- *Trade publications*
- *Professional meetings*
- *Internet*
- *Internet newspapers*
- *IT websites/blogs*
- *CDC/WHO/PAHO mailing lists*
- *Gartner quarterly top-risk list*
- *Other annual emerging-risk surveys (PWC, EY)*
- *Academic research, nonfiction books, science fiction*
- *Internet news feed*
- *Discussions with other ERM practitioners*
- *Discussions with company management*
- *Health facts, GDP and components as a % of GDP*
- *General business press, litigation awards, science news*
- *Review industry publications such as the Swiss Re SONAR study*
- *Just regular reading n news, actuarial publications*
- *WSJ*
- *Industry research*
- *Best's Reports*
- *Berkshire Hathaway annual meeting, National Geographic, Smithsonian, Economist*
- *Reports of hot technologies*
- *IPCC climate reports*
- *CMS studies and publications*
- *SOA/AAA studies and publications*
- *ISO's Emerging Issues portal*
- *AM Best*
- *Other trade publications*

Question 8. Do you have any comments or suggestions for future iterations of this survey?

- *Look into emerging risks connected to health care.*
- ***Keep the conversations going.***
- *Good survey*
- *N/A*

- *Add a definition of emerging risk.*
- *No*
- *Break down by area of practice (life, health, casualty, etc.).*
- *Nil*
- *No*
- *Risk list is outdated and does not apply outside of finance/insurance.*
- *Some questions do not follow.*
- *No*
- *No*
- ***Include questions on the purpose of a company's ERM program. Is the goal to prevent risk events (e.g., reduce likelihood), develop better resilience (e.g., reduce impact), or a combination of the two?***
- *I was very surprised of the fragility of democratic counter-powers (in the USA, de-credibility of media, little check-and-balances in the separation of power when Congress + president + Supreme Court are from the same party; in Europe and elsewhere, rising of strong leaders with little respect for the rule of law (Brazil, Philippines...)). Questions around these could be interesting.*
- *The power of influence of social media is also an area worth analyzing.*
- *Put a master page/question navigator at the top. Right now, I'd like to see the answers that I put on pages 1 and 3 (because the questions seemed almost the same), but don't want to hit the right- and left-arrow buttons over and over again, so I'm merely completing the survey.*
- *No*
- *Look at banned content on the Internet.*
- ***There seems to be a built-in bias in favor of a formal ERM function. If this survey is given to people outside the actuarial profession, that bias should be removed. For optimal value, the survey should be distributed to boards of directors of companies who have formal ERM areas. That's the only way to really determine usefulness.***
- *No*
- *This was far too long, far too internationally focused, far too biased toward ERM. There was no opportunity to talk about risks to the profession or me in my daily work. It was also annoying, since it appeared that you were fishing for my solutions, sources, tactics, approaches without giving any content in return.*
- *Reduce the number of similar strategic risk categories—too much overlapping.*
- *This is a good exercise that I recommend continuing.*
- *Nope*

Thanks for your participation!

Researcher's Notes for Future Questions

- Add questions probing:
  - What low-probability crisis do you worry about?
  - What actions do you take between crises to remain influential?
  - How prepared is your firm for a major risk event that has never happened before (resilience)?
- Make clear in survey intro that a long time horizon should be used for Section 1 but that other questions will have varying time horizons.
- Create a question that talks about avoiding a bad outcome, rather than "timing the market"—seems like this is where winners reside.
- Add pension fund as employer.
- Include glossary link in the email.
- Section 6: Add categories EA.
- Send to all with CERA credential internationally.

- Section 2: Ask how many leading indicators they have identified.
- Section 5: In question 3, add “shrink” to options.

Appendix III: Survey Results 2017 and Earlier

Detailed results for prior surveys can be found at https://www.soa.org/resources/research-reports/2015/research-emerging-risks-survey-reports/