13th Survey of Emerging Risks

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

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It is impossible to comprehend the results of this survey without some context. The survey was open during November 2019. In retrospect this seems like a calm, stable time when few risks were emerging. But the seeds had been planted for an event that triggered other risks, and the coronavirus pandemic prompted a flurry of risk events where multiple emerging risks took center stage.

Early 2020 saw a competition for oil dominance where countries opened their taps hoping that they could outlast competitors as prices fell. Wildfires, especially in Australia, dominated the news as they destroyed land and property, leading to direct and indirect deaths. Economic growth was slowing despite low volatility in financial markets. Trade wars were raging and cyber-attacks so common that reactions were typically muted.

The pandemic hit hard worldwide starting in mid-March. An epidemic is an infectious disease that attacks a regional area. A pandemic is worldwide, and COVID-19 has become endemic in many parts of the world, using community spread for most infections. Economic growth and asset prices initially fell precipitously and demand for energy of all kinds dropped as economies were locked down. Central banks revisited the tools they had used during the great financial crisis, moving faster and expanding them further, and this helped asset prices. They added protections to junk bonds and municipal bonds, placing floors below their prices. In the U.S., stimulus of 15% of gross domestic product (GDP) was added and then expanded, effectively taking the debt to a GDP ratio over 130% and quarterly GDP reduction of nearly 10%. Despite these efforts, some measures of un(der)employment reached 30% and bankruptcies were common, especially among small businesses.

The pandemic did the unthinkable, moving climate change to a back burner. Lower economic activity initially slowed carbon dioxide emissions by about the annual amount necessary to meet the goals of the Paris Agreement. Offsetting this were the lower sulfate emissions and the feedback loops in the Arctic regions that have led to temperature increases there over double the world average. Ice at the poles is regularly in the news as it nears record low levels and ice shelves collapse.

Whether climate change, pandemics, cyber, war or financial volatility, the risk landscape is moving quickly and historical distributions are no longer stable. Unknown knowns, where historical distributions are no longer predictive, are becoming the norm for many risks. The good news is that it takes proficiency to recognize these impacts. It is difficult for artificial intelligence (AI) tools to predict these changes before the experienced practitioner. Perhaps the best analysis comes from experienced modelers working with AI tools. This has worked best in other settings, but will require the analyst to overcome the thought that markets are always and everywhere efficient. This survey attempts to track the thoughts of risk managers about emerging risks across time. It is the 13th survey of emerging risks sponsored 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). The researcher thanks them for their support. 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 innovative ways they think about risk. Each completed survey helps those who participate think more deeply about the topic, and it is anticipated that the reader will benefit in this way as well.

In this report, the Executive Summary contains a high-level overview of the survey and the 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, allowing the reader to scan specific sections or questions, and they include every comment received for the open-ended questions. Everyone has a different level of expertise and experience, and reading the comments will allow the reader to reach their own conclusions and pick out ideas that are useful to them. Appendix III provides a link for those interested in reviewing previous surveys in the series.

Section 1: Executive Summary

While not a blockbuster for risk events, 2019 endured its share of them. An Ebola outbreak in Congo, Cyclone Idai in Africa, the Typhoons Lekima in China and Hagibis in Japan, Hurricane Dorian in North America, heat waves in Japan and India, wildfires in Australia and flooding in the U.S. Midwest and across Europe were all material regional events. Geopolitical tensions and deglobalization continued, and 2019 was reported to be the second warmest year on record.[1] This evolution of risks is captured in the *13th Survey of Emerging Risks*, completed in November 2019. These events provide examples where recent occurrence of an event leads those who experienced it to overestimate its reoccurrence. This is called *recency bias*[2] and has consistently affected the results of this and other surveys.

The rotating question in this survey's iteration, where respondents are asked to choose up to three applicable risks, asked which emerging risks are undervalued and deserving of more attention over the next 20 years. Interestingly, *Climate change* and *Demographic shift* were the only risks selected by more than 10% of respondents.

The responses across all questions highlight a continued surge of perceived risk from climate change, along with concerns about financial volatility and a steady but large cyber risk. Using this report as a contrarian indicator can help a risk team anticipate future issues that are not currently in the public eye. An example in this iteration of the survey may be earthquakes and energy price shocks, which finished with the lowest responses when five emerging risks were chosen. Another risk to consider following concerns the supply of fresh water and potential implications on regional stability.

1.1 SURVEY FRAMEWORK

In addition to the top emerging 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.

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*

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[1] www.climate.gov/news-features/featured-images/2019-was-second-warmest-year-record

[2] Kahneman, Daniel. *Thinking Fast and* Slow. 2013. Farrar, Straus and Giroux. People tend to recall something that has happened recently more easily than something that occurred in the more distant past. This is recency bias, defined by Daniel Kahneman and Amos Tversky. This is among the psychological insights that resulted in Kahneman receiving the Nobel Prize in Economics in 2002.

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. *Wars (including 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/medical delivery*
20. *Demographic shift*
21. *Liability regimes/regulatory framework*

Technological Risks

22. *Cyber/networks*
23. *Disruptive technology*

1.2 TOP FIVE EMERGING RISKS

The results continue to show interesting trends, although some were broken in this iteration of the survey. 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 from the prior survey (26% of the total chosen when up to five emerging risks were selected), yet maintained the top category response, as Environmental moved into second place (20%), just ahead of Economic (18%), Technological (18%) and Societal (16%). The uppermost choices (although not ranked among the top five risks overall) from the Geopolitical category were *Wars (including civil wars)* (25% of respondents choosing it in their top five, up from 18% in the prior survey) and *Regional instability* (22%, up from 18%). After traditionally being in the top five emerging risks, with a high of 43%, *Terrorism* has dropped for this question over the past two iterations by 24% to 17%.

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

% of Responses in Given Year
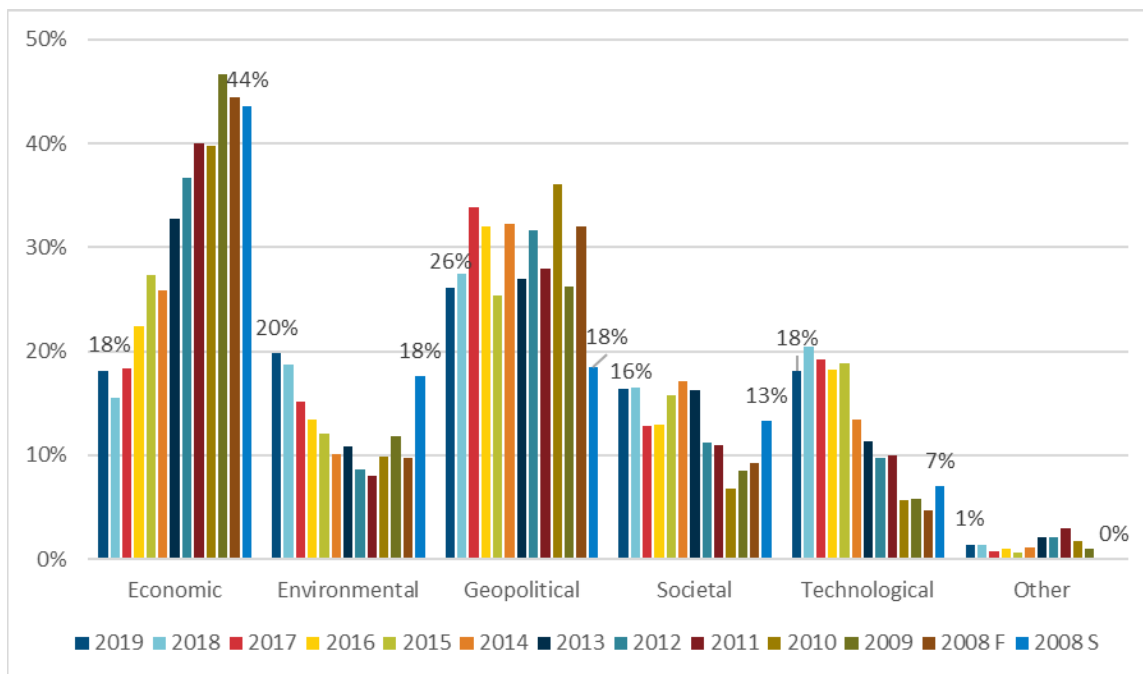
Risks with new highs across the survey history were *Climate change* (54%), *Natural catastrophe: severe weather* (16%), *Wars (including civil wars)* (25%), *Chronic diseases/medical delivery* (12%) and *Demographic shift* (33%). A new low was recorded by *Terrorism* (17%). From the prior iteration of the survey all five of the Economic risks were higher, with several bouncing off record lows.

The reductions in the Technological and Geopolitical categories are the source of gains for the Economic and Environmental categories (the change for the Societal category was immaterial). It may be that technology is becoming a risk that is expected to be managed on a regular basis and not an emerging risk, and geopolitical risk may have found a temporary stable level of perceived activity.

For the first time, *Climate change* is the top response, followed by *Cyber/networks* and *Disruptive 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 (the top five are consistent, with only the top two choices switching places). As shown in Table 1, several risks have remained consistently at the top over the past four years.

Table 1: Top Five Emerging Risks, 2016–2019

Year	2016	2017	2018	2019
1	Cyber/networks	Cyber/networks	Cyber/networks	Climate change
2	Financial volatility	Terrorism	Climate change	Cyber/networks
3	Terrorism	Disruptive technology	Disruptive technology	Disruptive technology
4	Disruptive technology	Regional instability	Demographic shift	Demographic shift
5	Retrenchment from globalization	Asset price collapse	Financial volatility	Financial volatility

Four risks increased materially from the previous survey when respondents were asked to choose their top five emerging risks. These included *Chinese destabilization*, *Climate change* and *Wars (including civil wars)*. Several risks were materially lower, including *Terrorism* (17%, down from 23%), *Failed and failing states* (19%, down from 25%) and both Technological risks, with *Cyber/networks* (51%, down from 56%) and *Disruptive technology* (35%, down from 40%) both maintaining rankings in the top three.

Figure 2 shows the results for the top five emerging risks from the most recent two surveys, listed in order of the rankings from 2018, highlighting the volatility between years for some risks.

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

% of Responses in Given Year
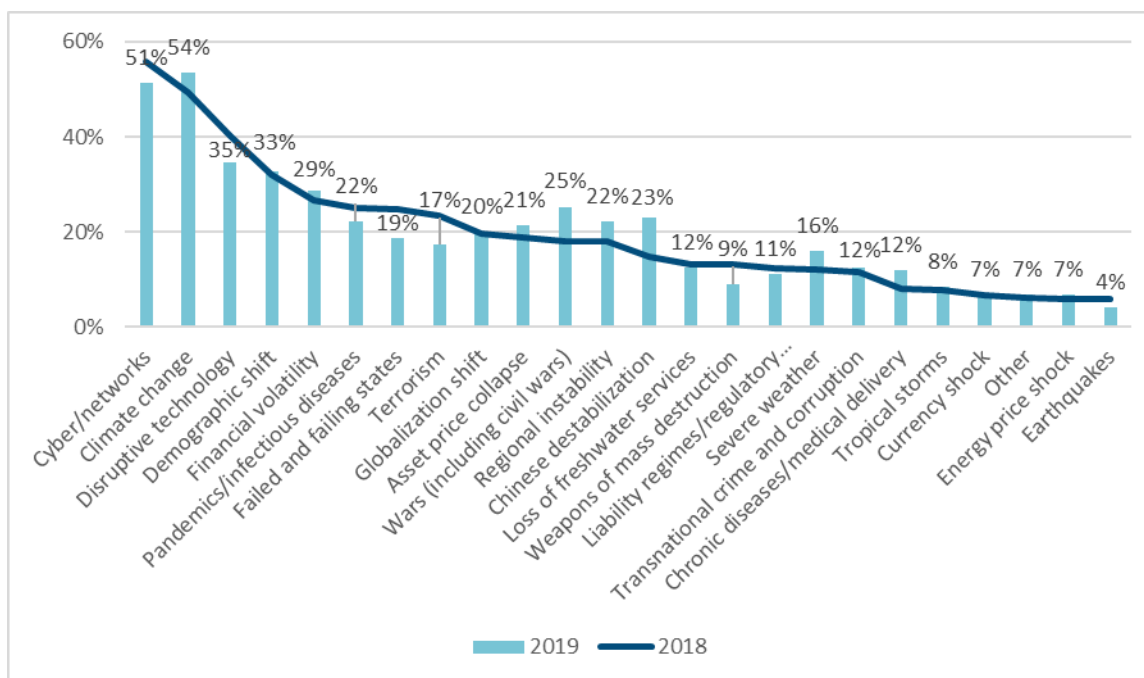
These results evolve over time, with risk responses ebbing and flowing. Figure 3 shows an example of how the responses for each risk have changed over time, displaying results from spring 2008, 2013 and 2019. (Note that risk number 5, *Financial volatility*, was not added until the 2011 survey.)

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

% of Responses in Given Year
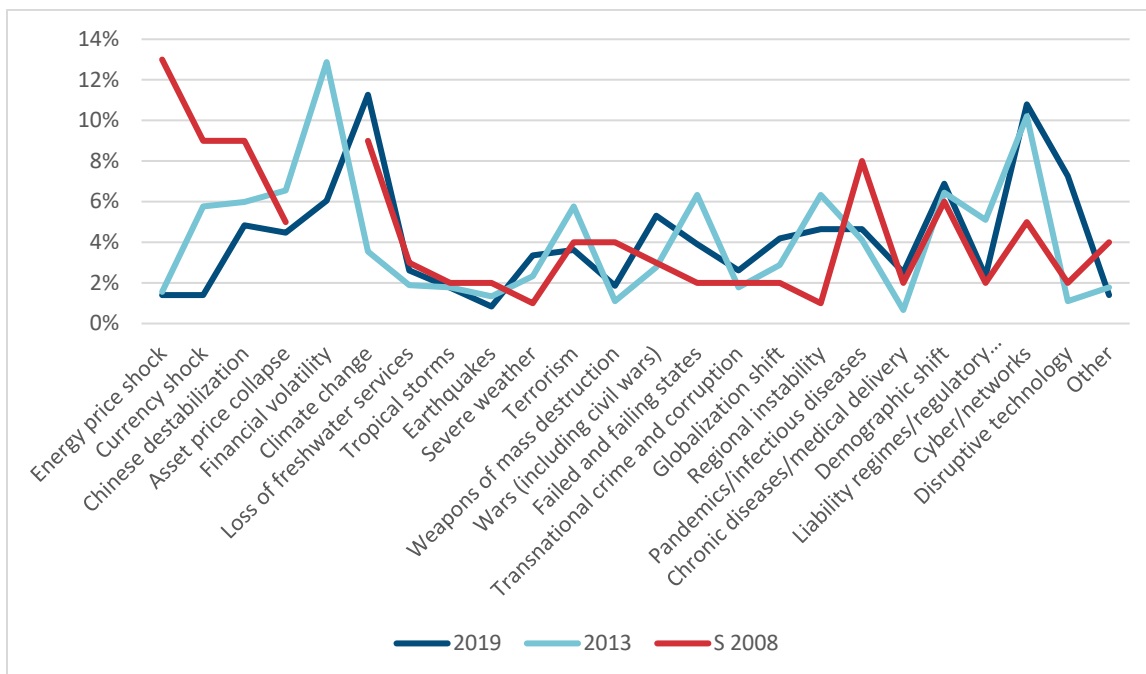
1.3 TOP EMERGING RISK

When asked for a single emerging risk from the respondents' top five, the results saw some repositioning, with *Climate change* increasing its lead and *Disruptive technology* moving up one place to second.

The results for the top emerging risk question were as follows (60% of respondents selected one of the top five, steady with the previous survey):

1. *Climate change* (27%, up from 22%)
2. *Disruptive technology* (11%, down from 13%)
3. *Cyber/networks* (10%, down from 15%)
4. *Financial volatility* (6%, up from 5%)
5. *Asset price collapse* (6%, up from 5%)

Demographic shift dropped out of the top five (remaining at 5%). All of the risks except *Natural catastrophe: earthquakes* were selected by at least one respondent as top emerging risk in this iteration of the survey. The increase in *Climate change* responses led to the highest Environmental category result over the history of the survey (32%, up from the previous year's former high of 26%).

Figure 4 shows how the categories have evolved over the lifetime of this survey, with Economic risks reductions offset by increases in Environmental and Technological risks.

Figure 4: Top Emerging Risks by Category – Single Greatest Impact

% of Responses in Given Year
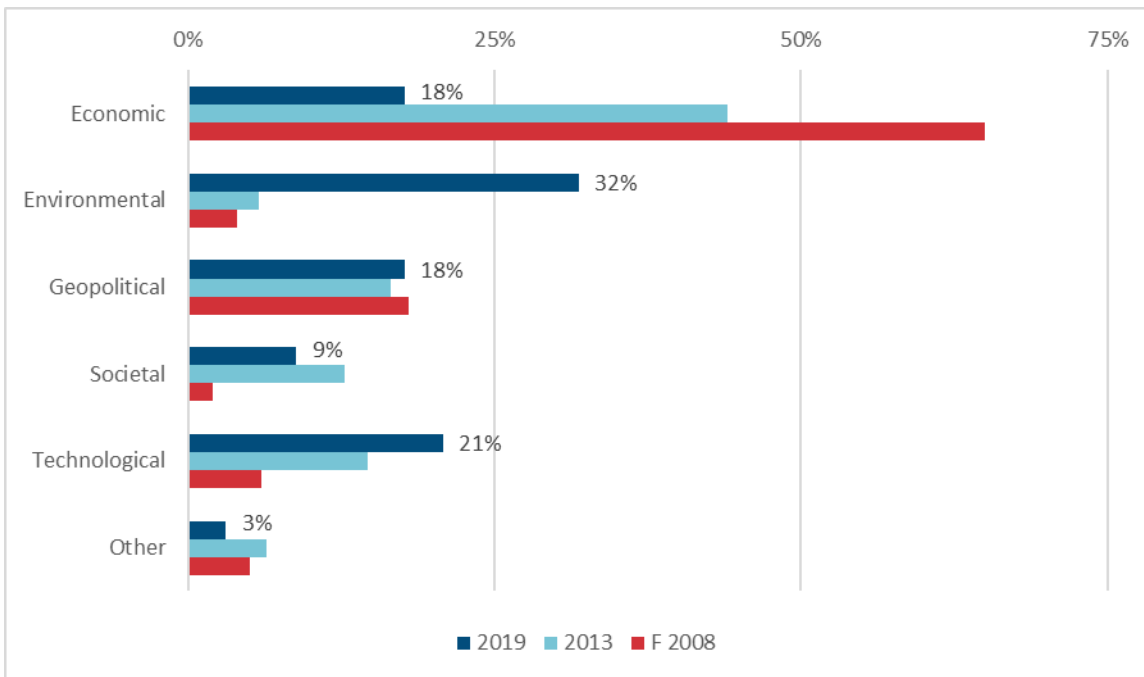
1.4 TOP CURRENT RISK

Following a close contest in the last survey, *Climate change* surged from 12% to 16% to beat out *Financial volatility* with 10%. *Cyber/networks* fell from 12% to 8% but was still in the top five.

Figure 5: Top Current Risk, Year-Over-Year

% of Responses in Given Year

1.5 RISK COMBINATIONS

There are several terms represented by *risk combinations* in this report. *Compound risks* are correlated risks that impact a specific result. An example of this would be the impact on climate change from financial growth and regional conflicts. *Risk clusters* do not require correlation, looking at multiple risks that an organization like an insurer or reinsurer could incur either in parallel or sequentially and that could threaten solvency. Risk combinations can be insightful, as readers can review which risks other risk managers think interact in ma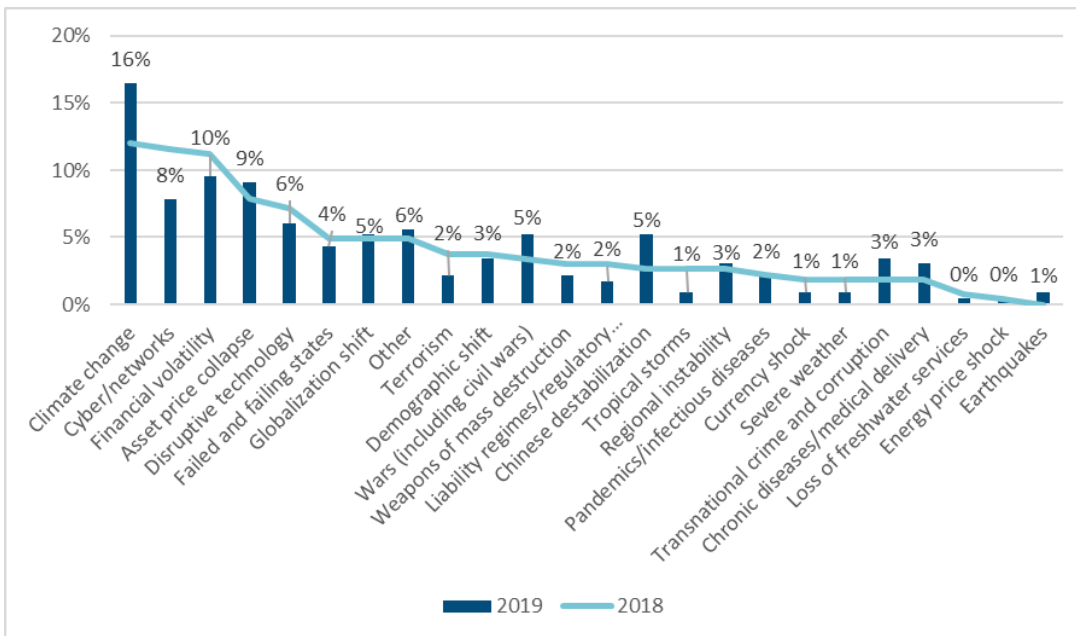terial ways. The top three risks chosen in combination were consistent with the previous survey: *Climate change*, *Cyber/networks* and *Financial volatility*. Interestingly, no combination of these three risks appears in the top 10. Moving into the top five, after being 10th in the prior survey, was the combination of *Wars (including civil wars)* and *Failed and failing states*. Overall, the categories were stable from the prior survey with none changing by more than 1%.

These are the top five combinations that were selected:

1. *Cyber/networks* and *Disruptive technology*—7%
2. *Climate change* and *Natural catastrophe: severe weather*—5%
3. *Climate change* and *Loss of freshwater services*—3%
4. *Asset price collapse* and *Financial volatility*—3%
5. *Wars (including civil wars)* and *Failed and failing states*—3%

Results this year for the top five combinations were less concentrated, with their total adding up to 21% after last year's comparable total of 27%.

There are 253 possible two-risk combinations of the 23 risks, and the risk concentration ratio is a metric showing how diverse results are. 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. A result of 100% would be comparable to the base year of 2009, which has turned out to be an outlier of concentrated risk, when respondents were dealing with the aftermath of the great financial recession. As shown in Figure 6, the distribution of results was less concentrated than in the prior year and at its lowest level since the question was added in 2010.

Figure 6: Risk Concentration Ratio (Base 2009 = 100%)
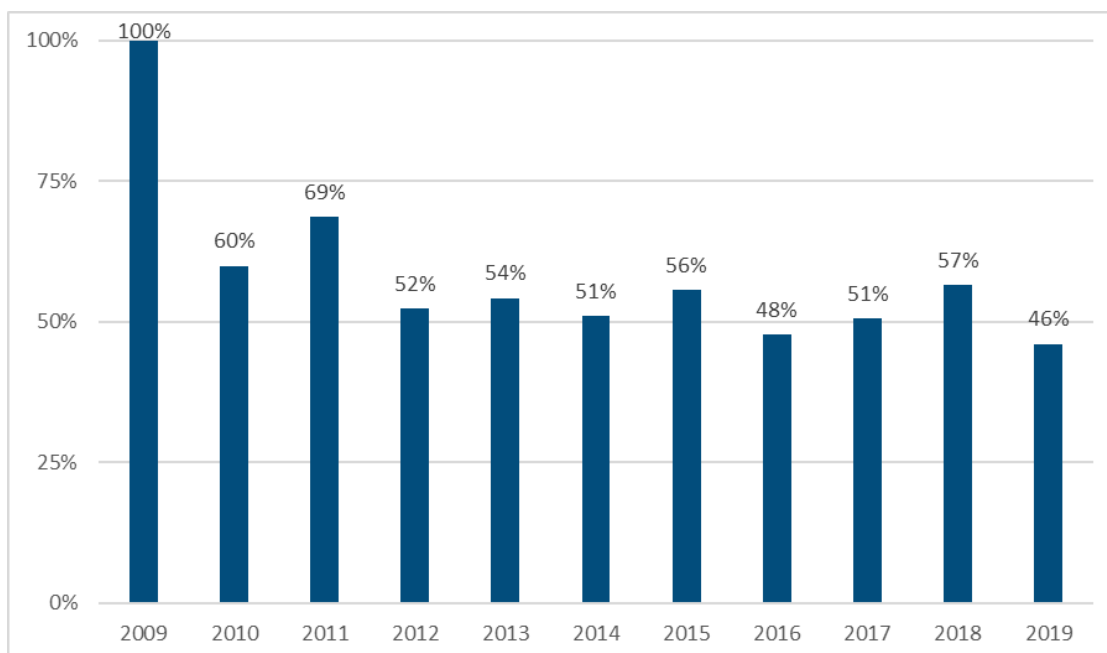
As a relative measure, the risk concentration ratio represents the current feeling among the risk management community. A low risk concentration ratio can be interpreted as reduced risk, or it may mean a greater variety of risks are being considered. This will be a telling metric to consider in the 2020 survey as there have been a number of major risk events.

1.6 TRENDING

Figure 7 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. Generally, the top five emerging risks and combination questions generate similar results, while the top current risks drive the top emerging risk categories higher.

Figure 7: Category Comparison Across Four Questions

% of Responses to Given Question
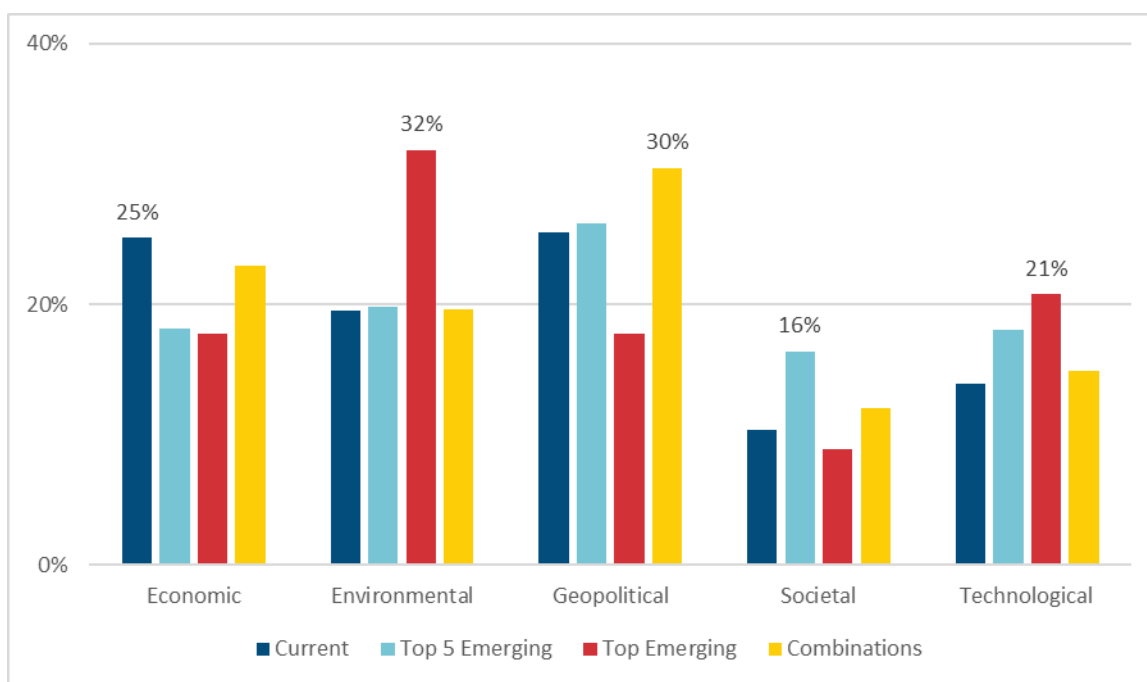
Figure 8 compares the current risk results with the top five, top emerging risk and combinations at the individual risk level. Hypothesizing why there are discrepancies is useful, and readers may have different viewpoints. The top three risks with the greatest disparity favoring the current risk over the top emerging risk are:

- *Financial volatility* (3.3% differential favoring current risk over top emerging risk)
- *Asset price collapse* (3.3%)
- *Chronic diseases/medical delivery* (2.6%)

Figure 8: Risk Comparison Across Four Questions

% of Responses to Given Question
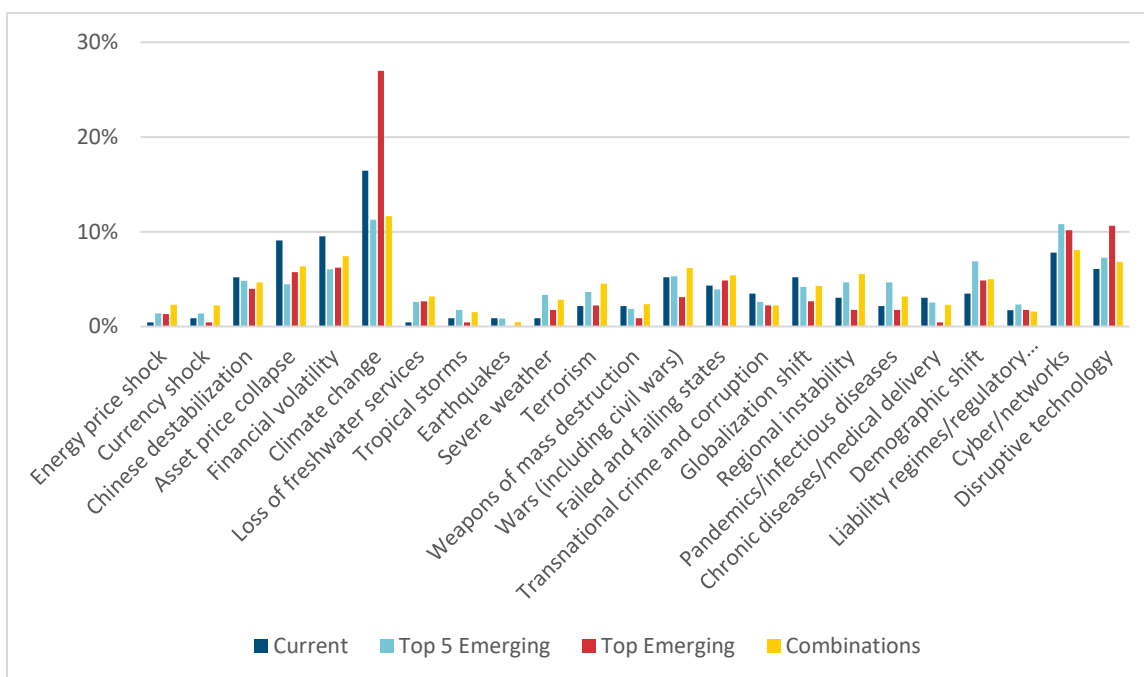
The top three risks with the greatest disparity favoring the top emerging risk over the current risk (the analysis in this section ignores the "Other" category) are:

- *Climate change* (10.5%)
- *Disruptive technology* (4.5%)
- *Cyber/networks* (2.4%)

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

- *Regional instability* (2.9%)
- *Pandemics/infectious diseases* (2.9%)
- *Wars (including civil wars)* (2.2%)

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

- *Climate change* (15.7%)
- *Disruptive technology* (3.3%)
- *Asset price collapse* (1.3%)

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

- *Climate change* (5.2%)
- *Asset price collapse* (4.6%)
- *Financial volatility* (3.4%)

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

- *Demographic shift* (3.4%)
- *Cyber/networks* (3.0%)
- *Pandemics/infectious diseases* (2.5%)
- *Natural catastrophe: severe weather* (2.5%)

1.7 UNDERVALUED RISKS

Risks that deserve more attention over the next 20 years were deemed to be "undervalued" in the survey. *Climate change* (11%) and *Demographic shift* (10%) were the top two choices, followed by a group at 7% including *Pandemics/infectious diseases*, *Cyber networks*, *Loss of freshwater services* and *Disruptive technology*. Each of the 23 risks was selected by at least 1% of the respondents. Geopolitical risks were followed by the Environmental and Societal categories. Results by risk are shown in Figure 9.

Figure 9: Undervalued Risks

% of Responses to Selected Question
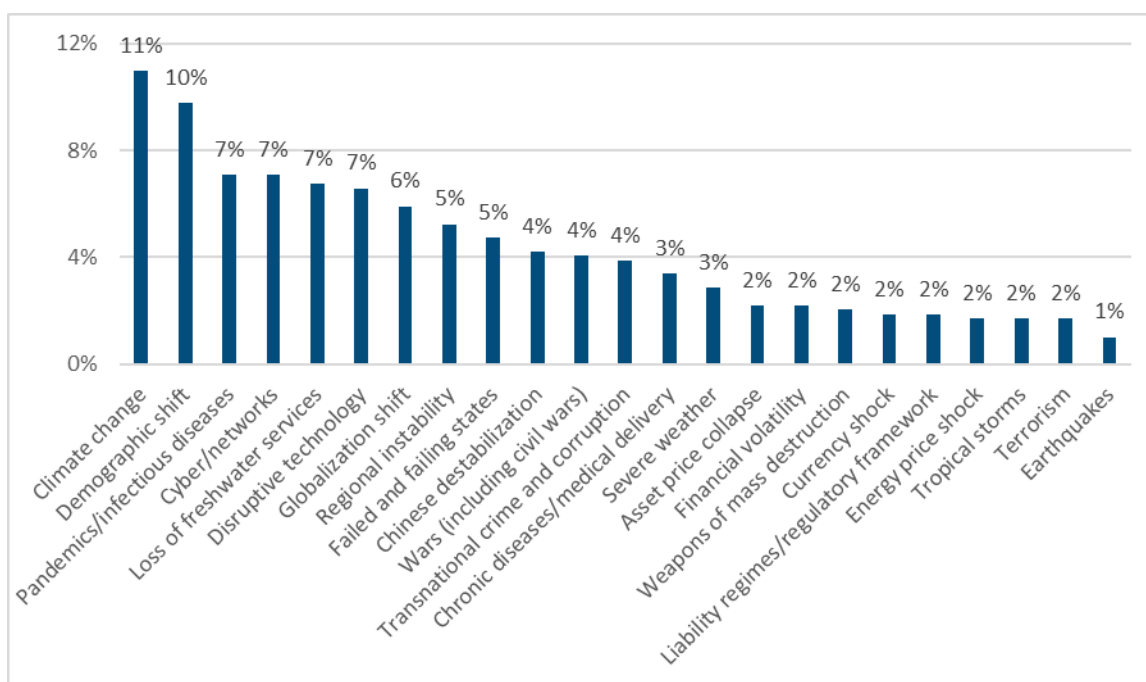
1.8 EMERGING OPPORTUNITIES

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. Most did not list specific opportunities but are actively looking to take advantage of competitors as their risk appetite changes during a downturn. One shared their de-risking strategy so they would be ready during the next downturn with capital available.

1.9 BUBBLES

While a few respondents argued that there is no such thing as a bubble (that is, market prices are always deemed correct), other respondents identified quite a few potential bubbles. These included a wide variety of asset classes, programs with government subsidies, the marijuana industry, the Chinese banking system, housing and the fossil fuel industry.

1.10   UNKNOWN KNOWNS

Unknown knowns, where the analyst is ignorant of the future event probability distribution despite possessing historical data (thus the results are not predictive of the future), will be a great challenge for the next generation of actuaries. Most respondents manage the risk using scenario testing or hold additional capital. Some in the group named pandemics as their concern, while others shared risks from cyber, long-term care, low interest rates, increasing natural catastrophes, liquidity and climate change generally.

1.11   LEADING INDICATORS

As formal risk appetite policies and regulatory processes stabilize, less than half of firms formally identify emerging risks. A subset of this group identifies leading indicators for emerging risks, and most who do also have criteria for action based on them. Examples of the process include tracking disease outbreaks and processes to identify tipping points.

1.12   RISK VERSUS RETURN

Over half of respondents (54%) said that enterprise risk management (ERM) had a positive effect in their company/industry, and 41% noted that ERM improved returns relative to risk (with only 9% saying it did not). Examples of positive ERM related to improved strategy and proactive risk mitigation. Respondents noted the positive impact on their rating and the importance of having a plan.

One respondent who answered *No* stated, *That's not what it's for.* Others referred to window dressing and the small likelihood that you could predict the actual crisis that might occur. Another referred to ERM as *Largely a fad with a mixed, if not unsuccessful track record.* The responses to this question generally describe the risk culture at individual firms, and different organizations have found processes they believe work best for them.

The respondents who answered *Not sure* about the effect of ERM at their company noted the difficulty in measurement and the lack of action during long periods of stability. Another concern is the "paralysis by analysis" argument that accomplishes little.

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 were fairly upbeat about global economic expectations for 2020, holding steady with the second-highest percentage (33%) reporting *Good* or *Strong* expectations, as shown in Figure 10. Interestingly, the respondents choosing *Poor* doubled from 6% to 13%. As you know from earlier comments, the survey closed in November 2019, well before the pandemic-induced impacts to the financial markets in 2020.

Figure 10: Combined Good + Strong Economic Expectations

% of Responses
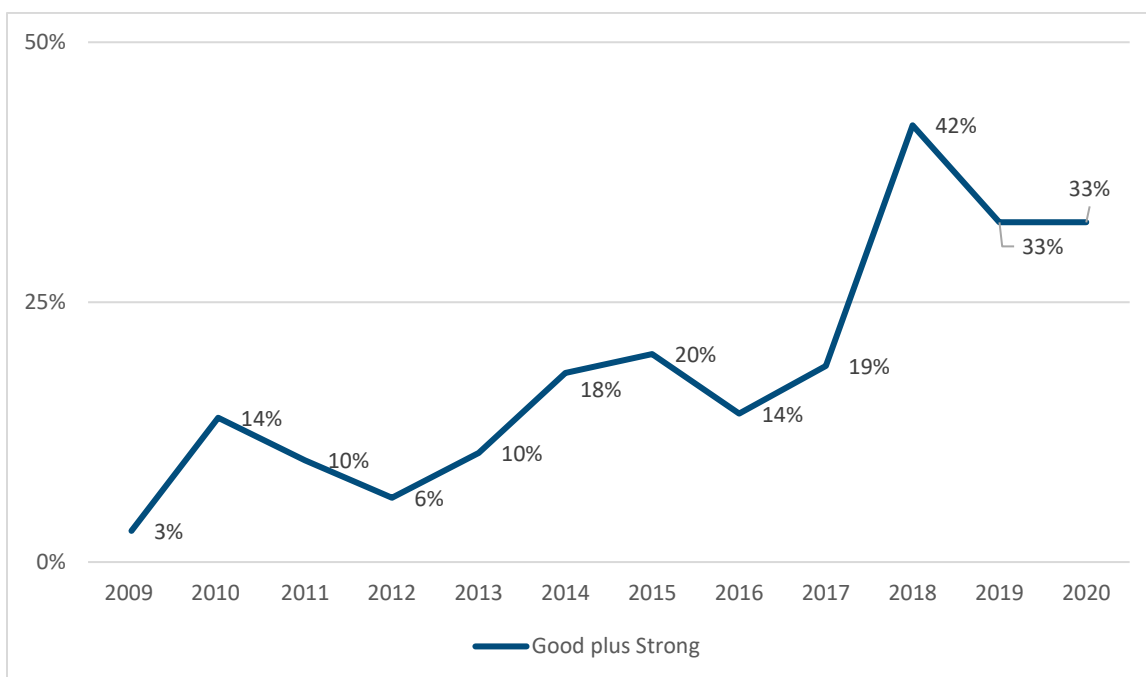
1.14 TECHNOLOGICAL SCENARIOS

Risk managers report that cyber risk scenarios have been developed that consider events including hacking, data breaches, phishing malware, power outages, denial of service and privacy issues.

Disruptive technology scenarios shared dealt with potential new competitors like insurtechs and Amazon, new approaches to delivering care (e.g., telemedicine) and war-related technologies that could impact their businesses directly and indirectly.

1.15 RISK ACTIVITIES

Activities related to ERM continued to grow in 2019 (but only 21% of respondents reported experiencing staff growth), with 39% expecting activity growth in 2020. As seen in Figure 11, only 23% of respondents anticipate an increase in funding. Risk managers continue to improve efficiency as they complete implementation of projects related to regulatory requirements.

Figure 11: Anticipated ERM Levels in 2020

% of Responses to Given Question
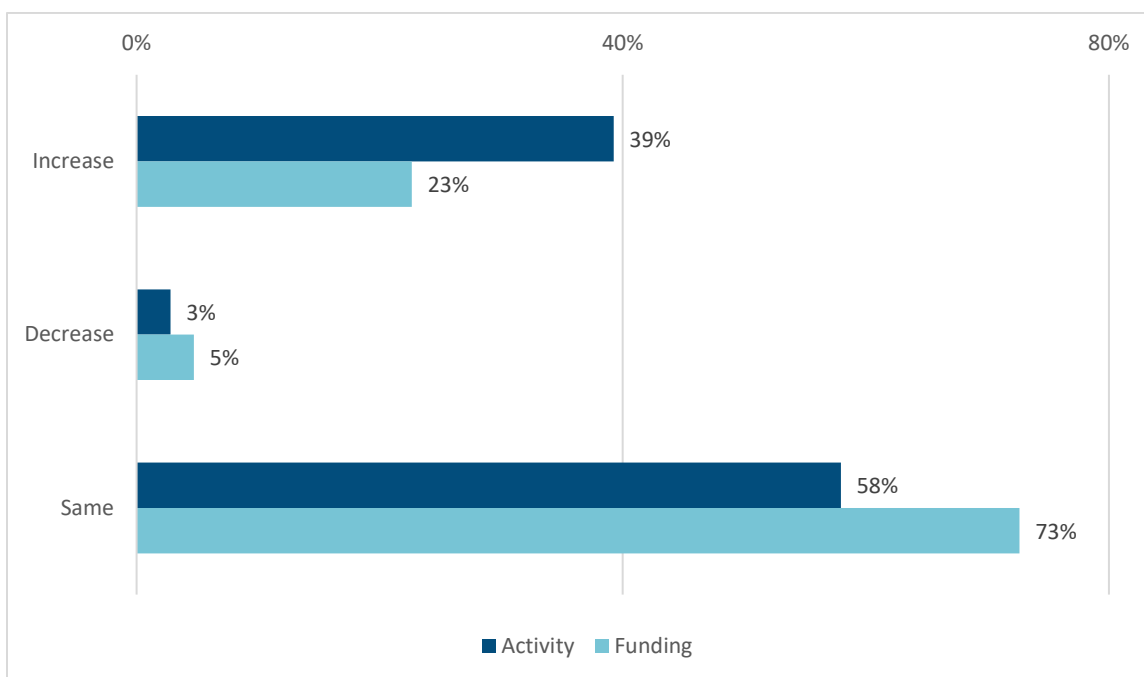
1.16 STRATEGIC OPPORTUNITY

Risk managers reported a higher level of inclusion in decision making surrounding strategic opportunities than in the past (49% have input and a vote, and only 4% have no input). Respondents have been recognized positively for things like anticipation of risk concentrations, adjusting risk limits and acquisition targeting, and negatively for not reflecting all the risks of an acquired block.

An interesting comment was *Usually ERM function doesn't get credit for risks that don't happen, but in fact they are often responsible for avoiding those risks.* This is the opposite of the managers who lock in their gains and socialize their losses. This makes them rich. Risk managers do the opposite, getting little credit when they avoid a risk and being held accountable when a risk hits the financial statements.

1.17 ANTICIPATION: PANDEMIC/INFECTIOUS DISEASES

As 2019 came to its end, pandemics were on the minds of risk managers, but no more so than they had been in the years following the last major Ebola outbreak. While soon to explode onto our consciousness, at that point in time climate change was the risk on everyone's mind, with some movement toward Economic risks and compound risks. The next iteration of this survey will most certainly lean toward this risk, and will include questions asking what was unexpected about the 2020 event so future risk managers can learn from their mentors.

To help describe what the reader sees in Figure 12, 2009 was the last influenza pandemic and an Ebola outbreak occurred in 2014.

Figure 12: Response Rates for Pandemic/Infectious Diseases, by Survey Question

% of Responses
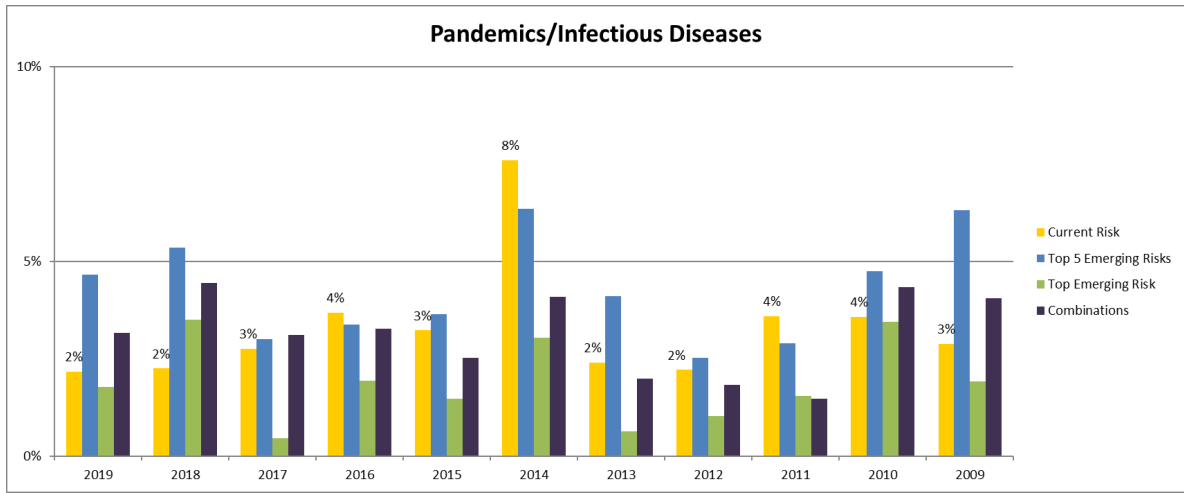
Section 2: Top Takeaways

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 be the first-ranked risk across all questions, with an increase from 22% to 27% for top emerging risk.
- By category, Technological risks continue to be highly ranked. *Cyber/networks* risk concerns have stabilized but remain near the top of the rankings, joined by an increasingly cited *Disruptive technology* risk.
- The Geopolitical category maintained its top ranking for top five emerging risks despite having no individual risks ranked in the top five.
- The Economic category rebounded, following three consecutive years of reduced results. The Environmental risk also rose, and the Technological category fell.
- Global economic expectations remain high, with 33% of respondents expecting 2020 to be good or strong, but with 13% expecting a poor economic outcome.

2.2 LEADING-EDGE ACTIONABLE PRACTICES

- ERM has had a positive effect for many, with improved returns relative to risk when the culture encourages engaged discussions.
- Leading indicators are being generated for emerging risks and actionable criteria established for some risks at best-practice companies.
- Undervalued risks like *Demographic shift*, *Pandemics/infectious diseases* and *Loss of freshwater services* should receive greater attention as competitive forces evolve over the next 20 years.
- Risk managers need to do a better job of being recognized for avoiding downside risks and encouraging upside risks.

2.3 CONCLUSIONS

Emerging risks always seem to be just over the horizon, allowing current management to ignore them and usually get away with it. The year 2019 was such a year. Risks continued to occur, but none changed the way companies operated (although some organizations were looking more closely at climate change and low growth). These types of years can build up preparation, but many of the risk managers sampled have spent the last decade completing regulatory tasks that attempt to build resiliency through accumulation of capital. This forces every assumption into a quantitative assessment of risk and often ignores emerging risks. Many of the undervalued risks over the next 20 years could be assessed qualitatively using Boolean logic that creates a storyline for *Yes, it occurs* and one for *No, it doesn't occur*. Nuances are less important for these risks than getting them on the table and discussing their ramifications. For example, if climate change is going to alter investment time horizons, how can an insurer price a whole-life policy for someone with a new family as a young adult who could live for 80 years or more?

The risk manager does not know which risk is just over the horizon, but President Eisenhower's quote about plans is useful here:

> *Plans are worthless, but planning is everything.*

What he means by this is that the process of scenario planning forces the strategic team to think about a wide variety of possible outcomes, so that even if one of those specific events does not occur, another one will and the team has developed flexibility. It is an ongoing process, not a one-time project.

Only time will tell if risk managers are asked to accept responsibility on behalf of senior executives for the risks that occur in 2020 (and beyond) that were not prepared for and mitigated in advance. It seems many managers prefer strategies where they are ignorant of the risks rather than actively pursuing environmental scans.

Risk culture remains an important component of best-practice risk management. Risk managers who are encouraged to provide input on strategic decisions and recognized for actions taken are more likely to evolve to lead best-practice risk teams.

Emerging risks play a key part in preparing for the future. Unknown knowns, where historical data is not predictive, do not interact well with AI. Discontinuities require experienced practitioners to anticipate assumption changes.

The role for risk managers is key. Are we ready?

Section 3: Background

This research project was sponsored by the JRMS of the CIA, CAS and SOA.[3] 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, the CERA Global Association, the International Actuarial Association (IAA) ERM Section and social media such as Twitter and LinkedIn groups related to risk management. A total of 232 responses were received. This represents a material percentage relative to the number distributed (more than 2,500 to the JRMS). This is the 13th 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, November 2017 and November 2018. The current-year survey was conducted in November 2019. All articles, podcasts and previous research reports can be found at:

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

April 2008—First survey

- Max J. Rudolph, International Survey of Emerging Risks, International News (SOA), August 2008, pages 18–21, 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: www.soa.org/research-reports/2009/research-2009-emerging-risks-survey/

December 2009—Third survey

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

October 2010—Fourth survey

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

October 2011—Fifth survey

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

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

October 2012—Sixth survey

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

October 2014—Eighth survey

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

November 2015—Ninth survey

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

November 2016—10th survey

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

November 2017—11th survey

- Research report and Research Insights podcast: 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: www.soa.org/globalassets/assets/Files/resources/research-report/2018/11th-emerging-risk-survey.pdf

November 2018—12th survey

- Research report and Key Findings: www.soa.org/resources/research-reports/2019/12th-emerging-risks-survey/

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. 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, Brian Fannin, 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 and 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 *13th Survey of Emerging Risks*, sponsored by the JRMS and its parent organizations (CAS, CIA, SOA), includes sections covering current risk, emerging risks, leading indicators, methodology and current topics. Highlights of each section are presented here, with complete results found in Appendix II. Respondents submitted a total of 232 surveys (down from 267 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, 40% of respondents reported that they also participated in the past. 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, 2008–19
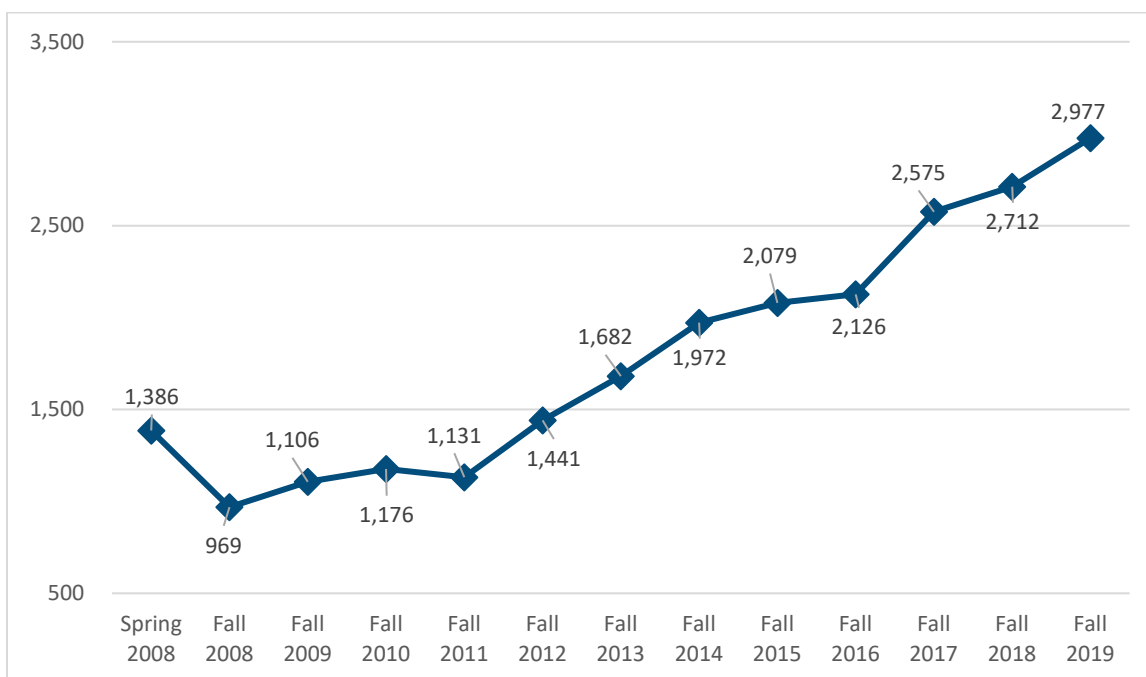
Source: S&P Dow Jones Indices LLC, S&P 500 [SP500], retrieved from FRED, Federal Reserve Bank of St. Louis;
https://fred.stlouisfed.org/series/SP500, February 24, 2020.

Figure 14: Price of Oil, 2008–19
$ per barrel
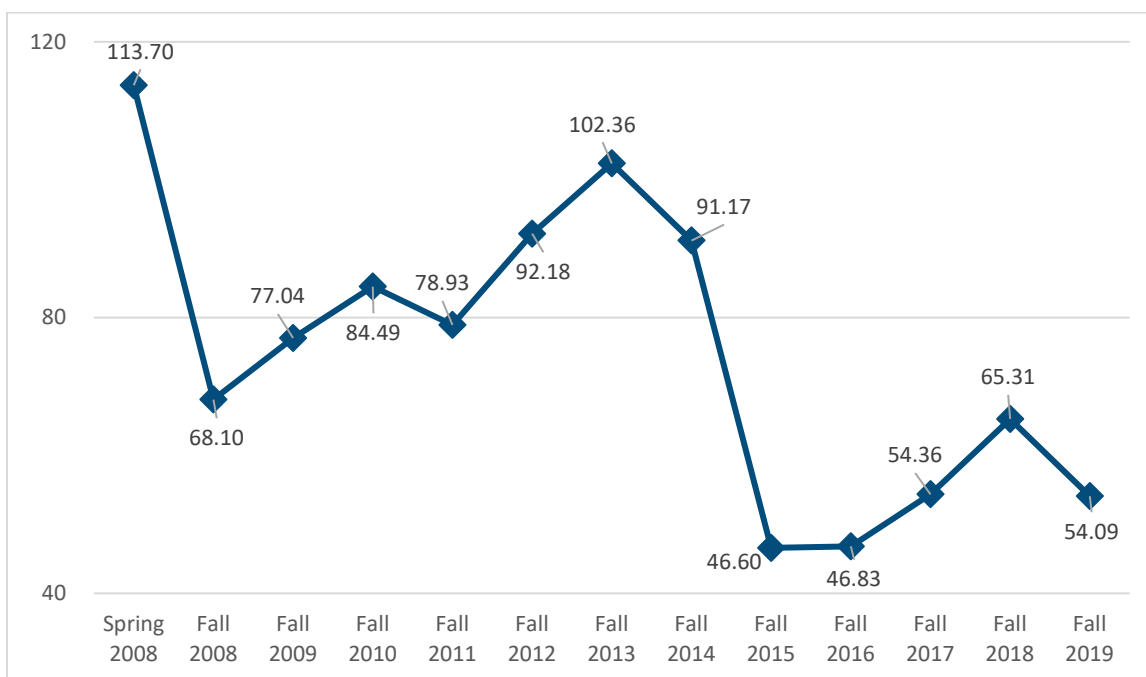
Source: U.S. Energy Information Administration, Cushing, OK WTI Spot Price FOB,
www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D

Figure 15: Exchange Rate, U.S. Dollars per Euro, 2008–19
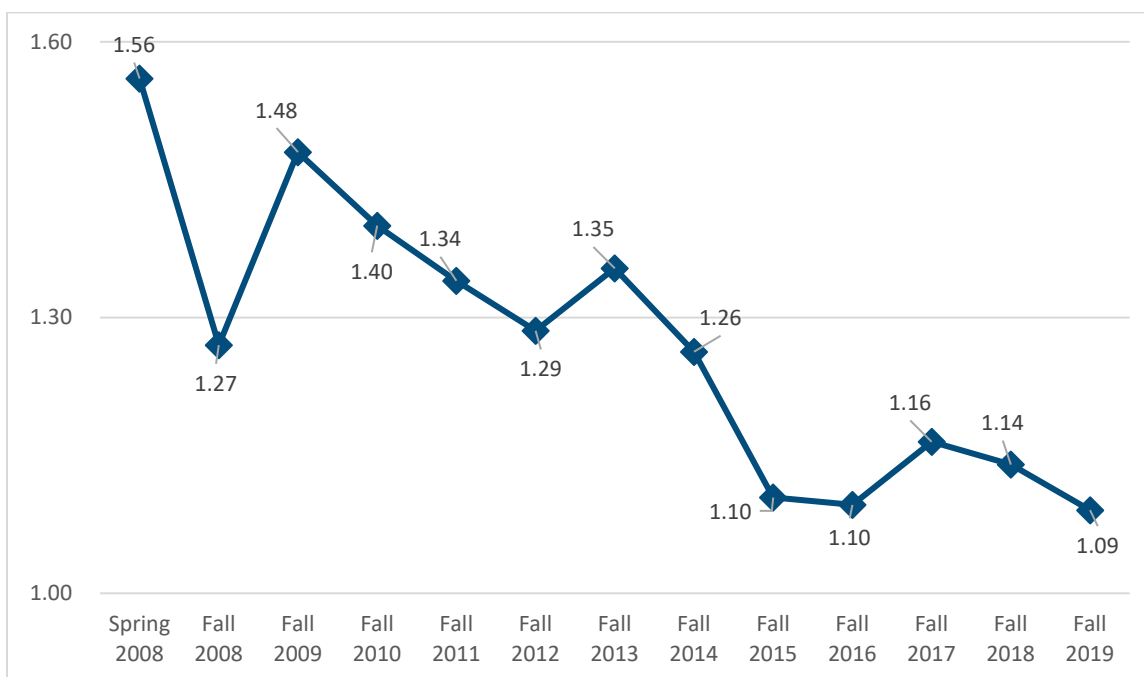
Source: Board of Governors of the Federal Reserve System, Foreign Exchange Rates (H.10): Historical Rates for the EU Euro, www.federalreserve.gov/releases/h10/Hist/dat00_eu.htm

Recency bias influences the results of any survey. Climate change was constantly in the news during 2018, with ice sheets in Greenland and Antarctica melting faster than expected, increased awareness of the melting Arctic ice and interactions with the jet stream (polar vortex) and permafrost (releasing methane), strong monsoons in India, wildfires around the globe, heat waves, flooding, storms and the UN climate change summit dominating the news. The geopolitical environment, while tension continued in regions such as the Middle East and South America, was not on the front page as often. Financial markets and infectious diseases became active again in 2020, but were regional stories in 2019.

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 U.S. 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.[4]

Survey 10 (November 2016)

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

Climate events were recognized around the world as many people seemed to better understand the ramifications of a warming planet as it impacted their daily lives. The geopolitical situation remained tense but became less of an outlier.

Survey 13 (November 2019)

1. *Climate change* (54%)
2. *Cyber/networks* (51%)
3. *Disruptive technology* (35%)
4. *Demographic shift* (33%)
5. *Financial volatility* (29%)

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[4] 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, www.swissre.com/media/news-releases/2017/nr20171220_sigma_estimates.html.

4.3 INTRODUCTORY QUESTIONS

Respondents have varying definitions of the greatest "strategic impact related to risk." Possible responses follow combinations of three groups (world economy; me personally or my firm/industry; lives, habitat and safety) and two types of impact (financial, disruption). Among the response options for defining strategic impact, four were selected by at least 15% of respondents. As shown in Figure 16, the most commonly selected definition was *Disruption to lives, habitat and safety* (25%).

Figure 16: Greatest Strategic Impact

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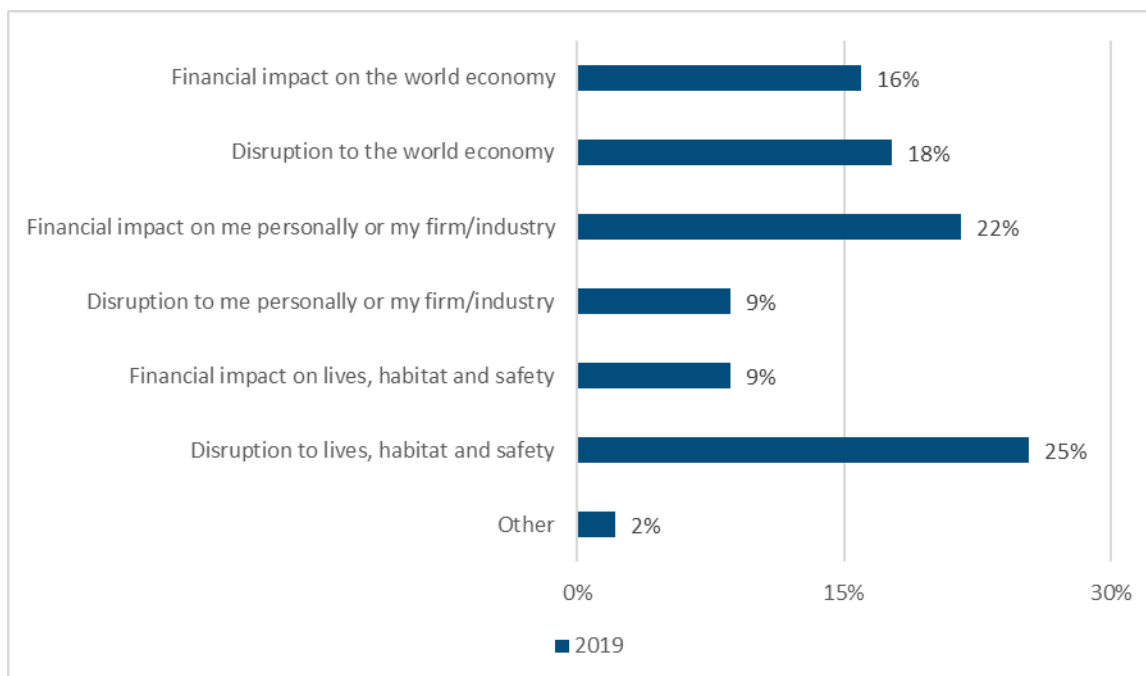
Respondents also were asked to consider 23 risks and identify the risk with the greatest strategic impact. Complete definitions of the risks are provided in Appendix I, but they are also listed here for convenience.

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. *Wars (including 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/medical delivery*
20. *Demographic shift*
21. *Liability regimes/regulatory framework*

Technological Risks

22. *Cyber/networks*
23. *Disruptive technology*

4.4 CURRENT RISK

Each year a benchmarking question is asked about the top current risk. Before 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 five risks, and six risks had their definitions updated. Some of the changes were to clarify that demographics could impact *Chinese destabilization* and ecosystem biodiversity impacts *Climate change.* The *Chronic diseases* risk was expanded to include changes in medical delivery due to respondent suggestions. Minor changes were made to the definitions of several other risks.

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

- Economic   25%/24%/22% (2019/2018/2017 surveys)[5]
- Environmental   19%/17%/16%
- Geopolitical   26%/24%/33%
- Societal   10%/11%/10%
- Technological   14%/19%/18%
- Other   6%/5%/1%

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[5] All tables include the most recent results, starting with the current survey and working backward, as shown here.

As shown in Figure 17, the Geopolitical category retained its top ranking for the risk currently having the greatest impact, closely followed by the Economic category. The largest decrease, at 5%, was in the Technological category. The Environmental and Geopolitical categories increased by 2 percentage points.[6]

Figure 17: Current Risk with Greatest Impact

% of Responses in Given Year
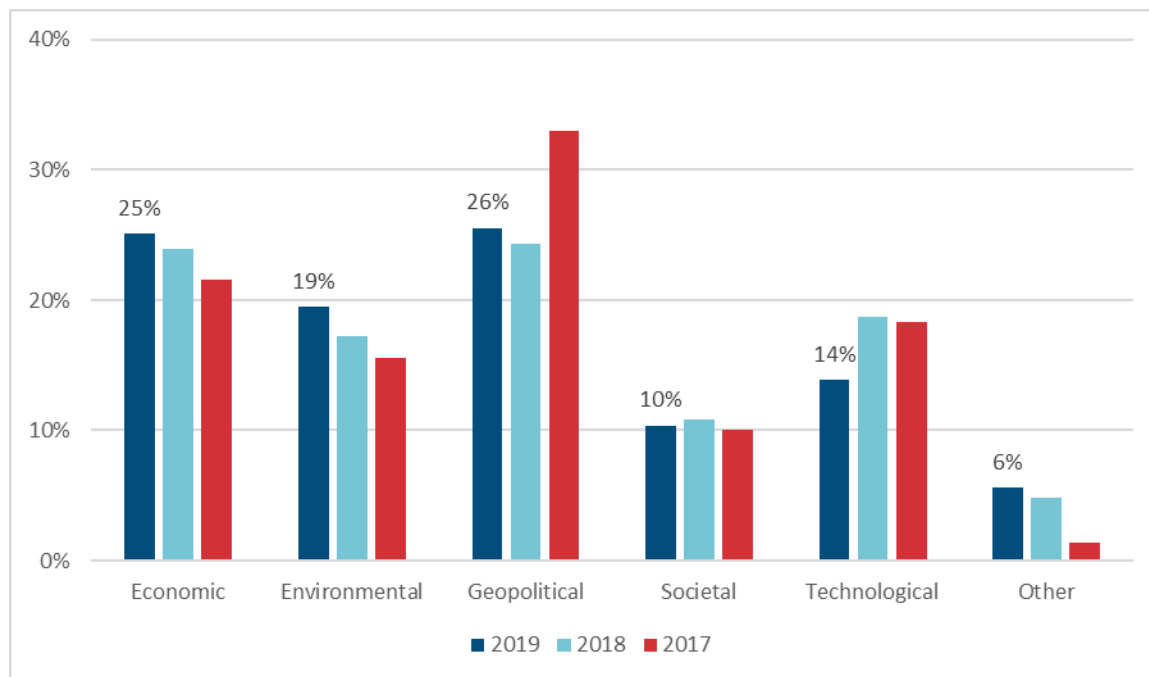
From an individual risk perspective, *Climate change* maintained the top spot, increasing to 16% of respondents selecting it as having the most impact, and also increased the most from the prior survey (4%). It finished well ahead of *Financial volatility* and *Asset price collapse* from the Economic category and *Cyber/networks* (also the risk that fell the most at 4%) and *Disruptive technology* from the Technological category.

Each risk was chosen as the top current risk by at least one respondent. *Energy price shock* and *Loss of freshwater services* were each chosen once in the survey as the top current risk.

Figure 18 shows how current risks can change between surveys. Interestingly, two of the bottom five risks chosen least in the prior survey moved above the 10 lowest choices. Data labels reflect 2019 results.

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[6] 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 18: Top Current Risk, Year-Over-Year

% of Responses in Given Year
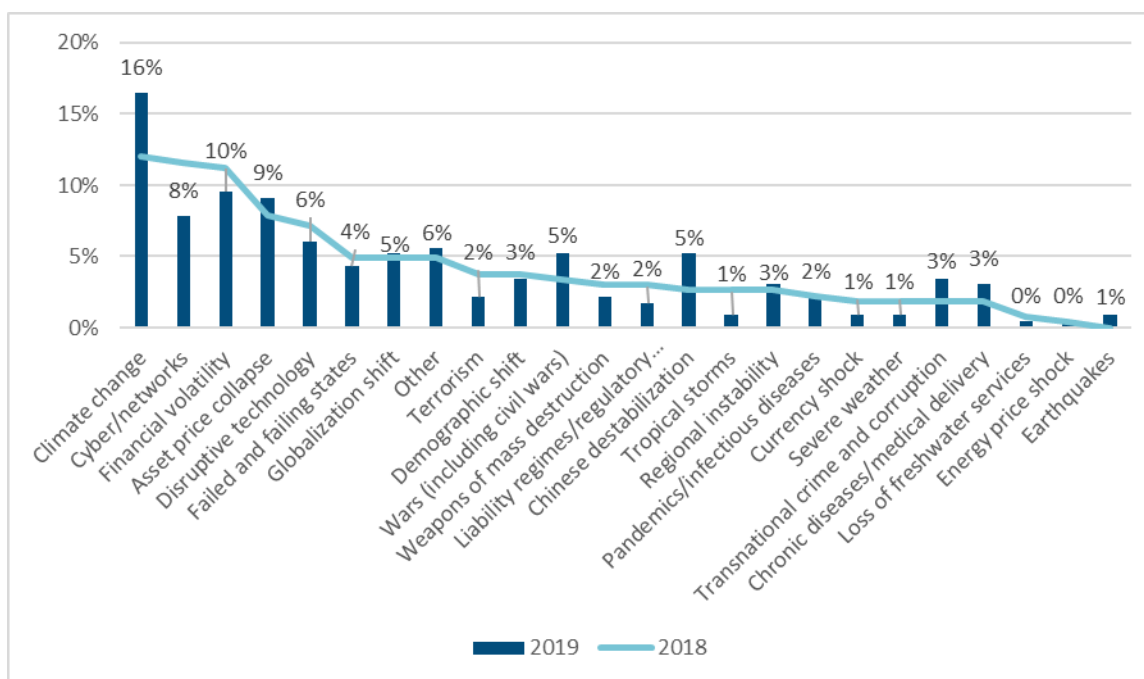
The second through fourth current risks were very close, separated by a total of four responses. These were the top five current risks chosen, in a different order but the same five from the prior survey:

1. *Climate change* (16%)
2. *Financial volatility* (10%)
3. *Asset price collapse* (9%)
4. *Cyber/networks* (8%)
5. *Disruptive technology* (6%)

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: Economic Risks Increase

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 comes at a unique time in history.

While 84% of respondents chose the full complement of five risks, the average number selected was up to 4.75. 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 (26% of the total selections came from this category), despite placing no individual risks higher than sixth (*Wars (including civil wars)*), with the Environmental category in

second place, followed by Economic (after finishing last in the prior survey), Technological and Societal. The results distributed by category (using percentages of total responses) are as follows:

1. Geopolitical   26%/27%/34% (2019/2018/2017 surveys)
2. Environmental   20%/19%/15%
3. Economic   18%/15%/18%
4. Technological   18%/20%/19%
5. Societal   16%/17%/13%

As Figure 19 shows, each category has its own story across the history of the survey. Both Technological and Economic risks may have changed direction in this survey, with Economic increasing from its low point and Technological falling from a peak. Environmental risks have grown materially over time. Geopolitical and Societal risks also 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
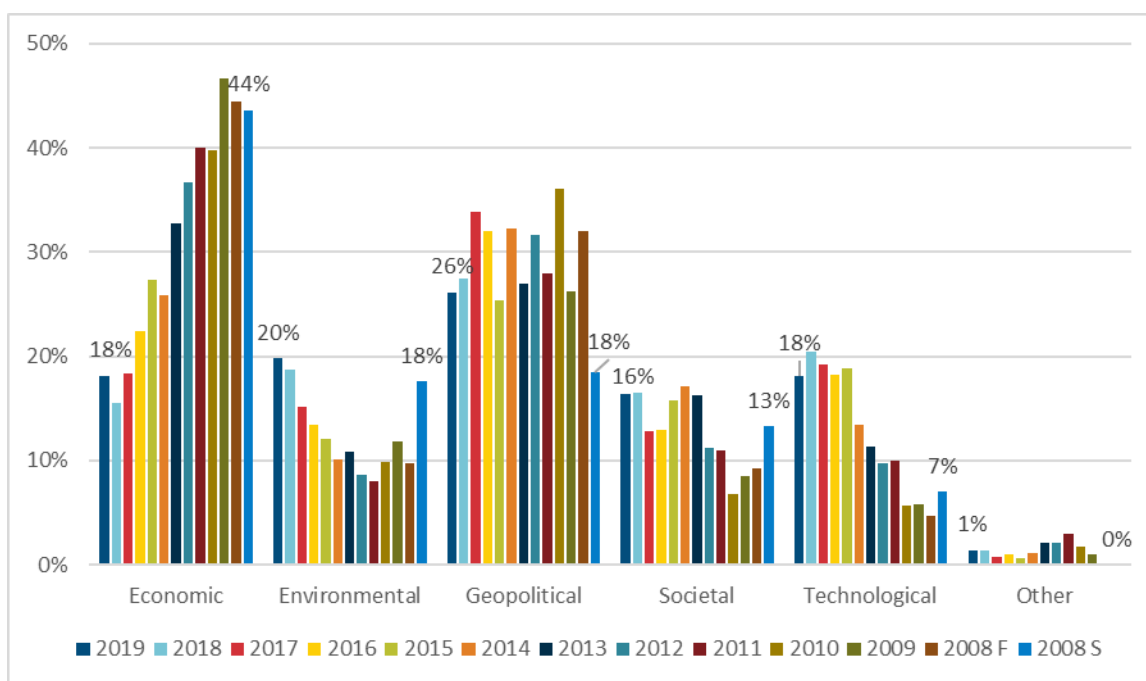
The reader will note that some graphs show 2008 S and 2008 F. In the survey's first year, two iterations were completed, with versions in both spring and fall.

There were material increases in several individual risks. *Chinese destabilization* was selected by 23% of respondents, up from 15% in 2018, its highest result since 2015. *Wars (including civil wars)* increased nearly as much, from 18% to 25%.

Material decreases were led, for the second consecutive survey, by *Terrorism* as it fell by 6%, from 23% to 17%, while both Technological risks fell by 5%.

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 195%, and each risk (the same five as the prior survey) was selected on at least 29% of the surveys.

1. 54%/49%/29% (2019/2018/2017) *Climate change*
2. 51%/56%/53% *Cyber/networks*
3. 35%/40%/38% *Disruptive technology*
4. 33%/32%/23% *Demographic shift*
5. 29%27%/29% *Financial volatility*

Trends of at least two consecutive years may act as a leading indicator. Increasing trends include *Climate change* (six years), *Natural catastrophe: severe weather* (three years) and both *Demographic shift* and *Energy price shock* (two years). Decreasing trends include *Terrorism*, *Weapons of mass destruction* and *Liability regimes/regulatory framework* (two years). *Chinese destabilization* broke a string of eight consecutive drops with an 8% increase.

The Other category had 15 responses. While many could have fit into the standard 23 risks, interesting ideas include cryptocurrency and food chain risks.

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 categories were higher than their average over the 13 survey cycles. Environmental (20% vs 13% average), Societal (16% vs 15% average) and Technological (18% vs 12% average) each satisfied this criterion, while Economic (18% vs 33% average) and Geopolitical (26% vs 29% average) were lower. Among individual risks, 9 of the 23 had above-average results. The greatest positive differential was 5% for *Climate change*. Several other risks were above average by more than 1%, with *Disruptive technology* up 3%, and *Cyber/networks*, *Wars (including civil wars)* and *Chronic diseases/medical delivery* higher by 2%. Ten trended below average, including all of the Economic risks. These were led by *Currency shock*, *Energy price shock* and *Financial volatility*, all 4% below their average. *Asset price collapse* at 3% below average and *Terrorism* at 2% below average were the only other risks that fell more than 1%.

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 more often than in the previous survey, except for *Currency shock*, which stayed steady, as shown in Figure 20.

Figure 20: Emerging Risk Trends: Economic Risks

% of Total Responses

Figure 20: Emerging Risk Trends: Economic Risks
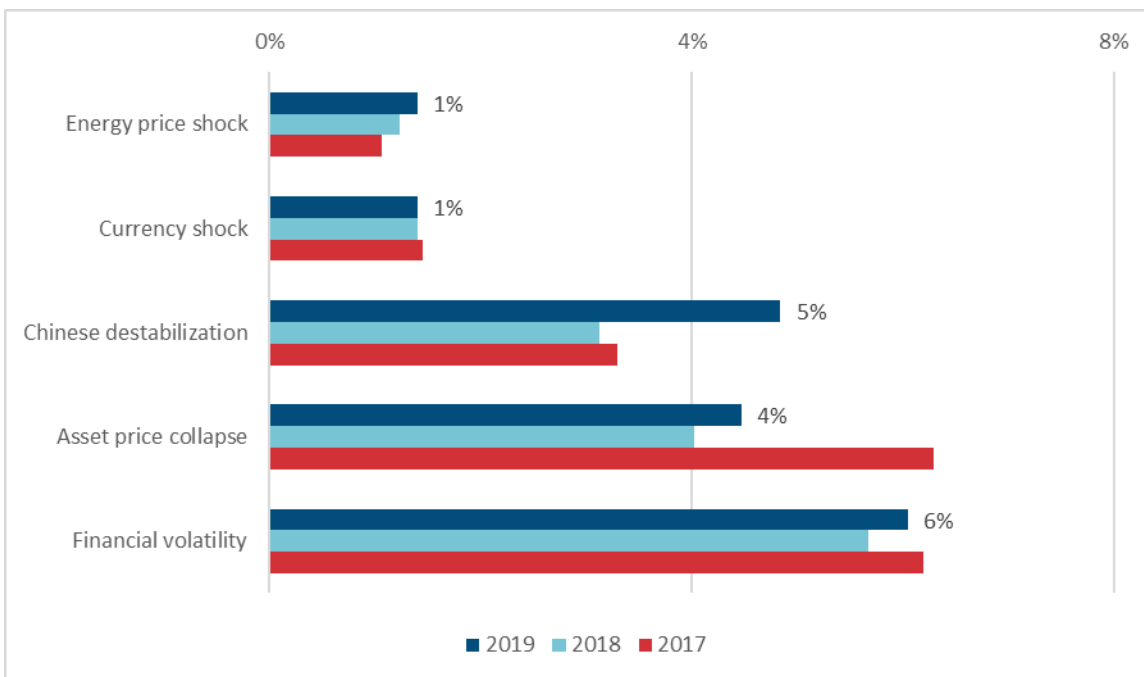
As shown in Figure 21, Environmental risks were selected more often in the current survey, except slight reductions for *Loss of freshwater services* and *Natural catastrophe: earthquakes*.

Figure 21: Emerging Risk Trends: Environmental Risks

% of Total Responses
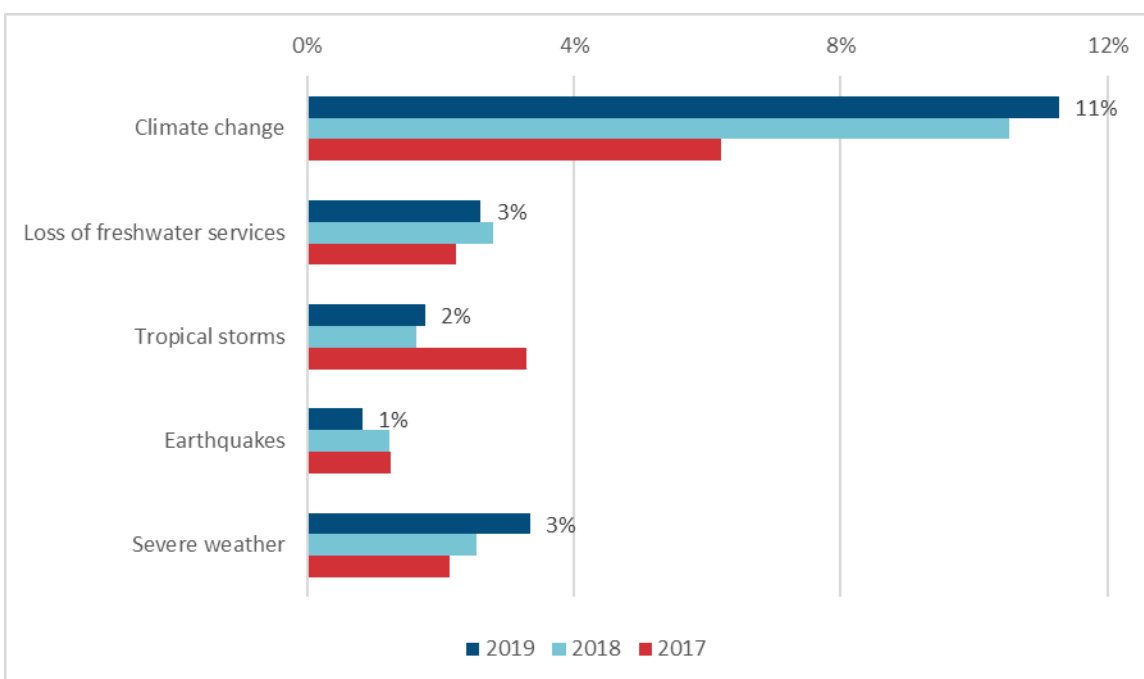
In the Geopolitical category, the rate of selection decreased in the current survey for three of seven risks—some materially, as shown in Figure 22. However, *Wars (including civil wars)* and *Regional stability* were selected more frequently.

Figure 22: Emerging Risk Trends: Geopolitical Risks

% of Total Responses
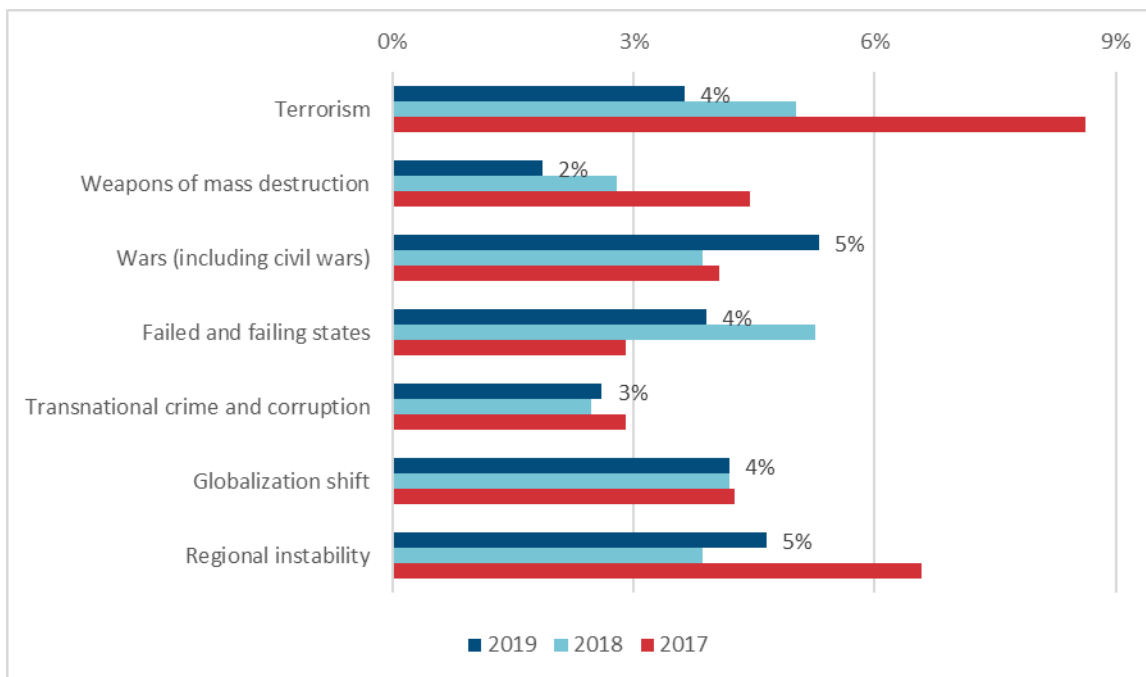
Chronic diseases/medical delivery moved up in the current survey, possibly due to the specific inclusion of medical delivery (e.g., move to a single-payer system). This can be seen in Figure 23.

Figure 23: Emerging Risk Trends: Societal Risks

% of Total Responses
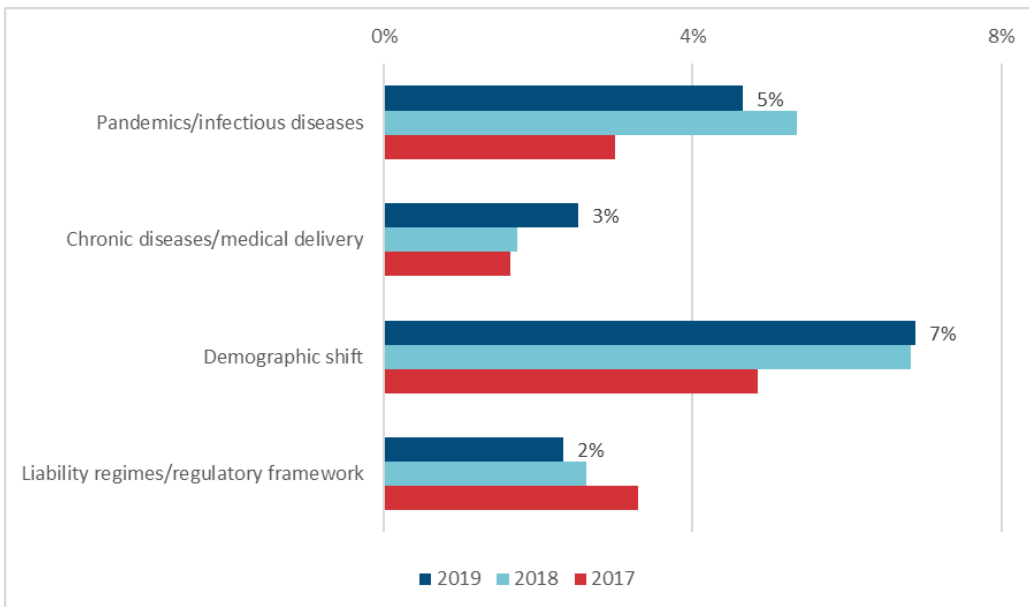
Both of the Technological risks were selected less often than in 2018, as seen in Figure 24. Although it is possible they have peaked, *Disruptive technology* and *Cyber/networks* remain among the top three overall selections.

Figure 24: Emerging Risk Trends: Technological Risks

% of Total Responses
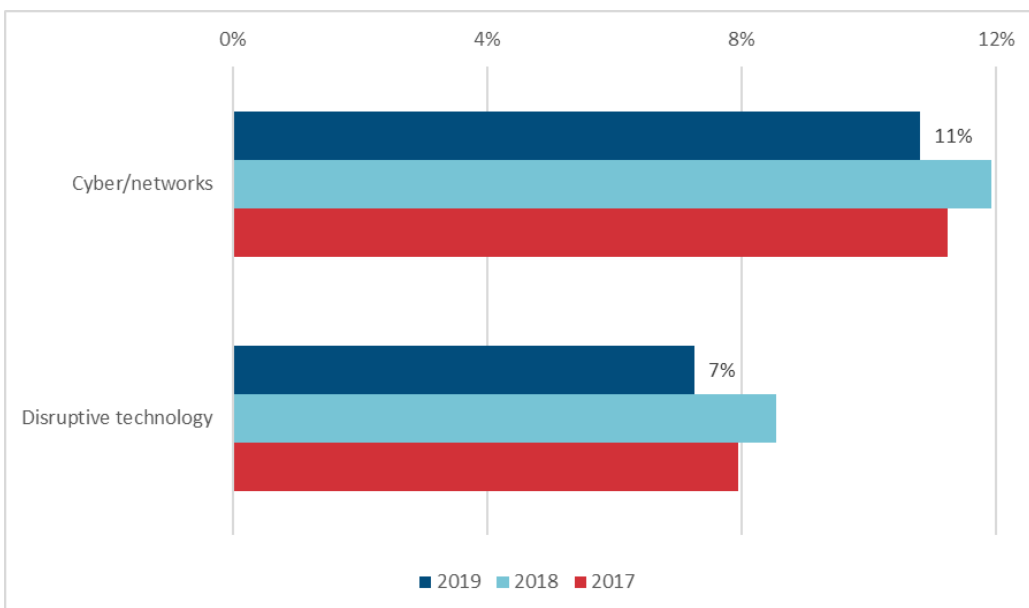
Some of the changes over time are highlighted in Figures 25 and 26. It is interesting to see how certain risks have become relatively more or less widely cited by respondents over time. Note that the first chart lists the risks in order as presented in the survey, not sorted as in some others (note that risk number 5, *Financial volatility*, was not added until 2011 so was not measured prior to that). The data labels presented in Figure 26 are from 2019, with risks sorted based on 2018 results.

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

% of Responses in Given Year
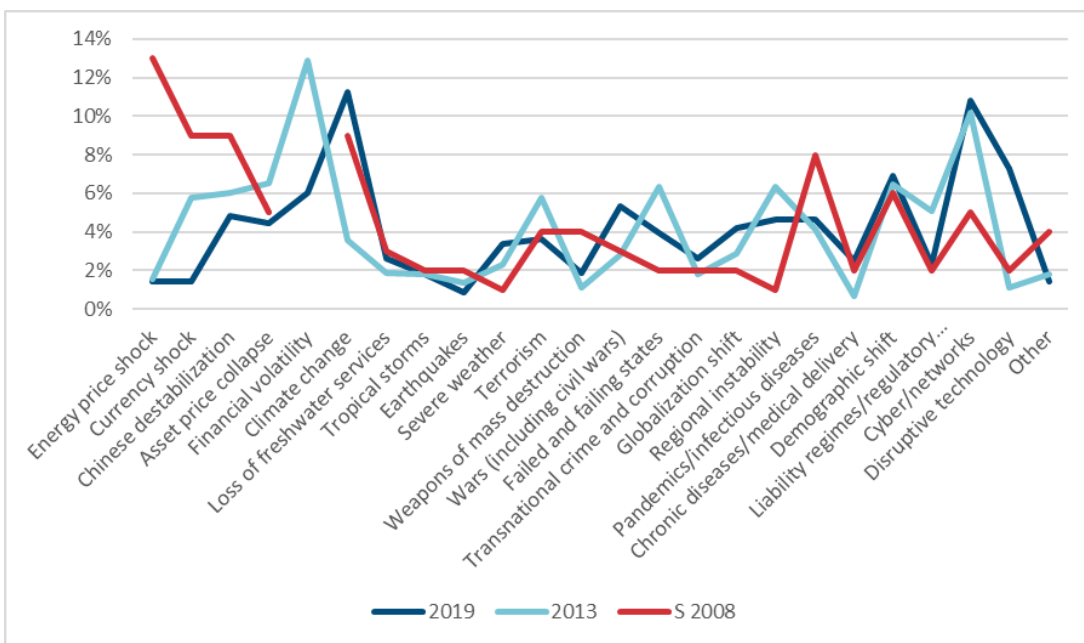
Figure 26: Year-Over-Year Emerging Risks (Up to Five Risks Chosen)

% of Responses in Given Year
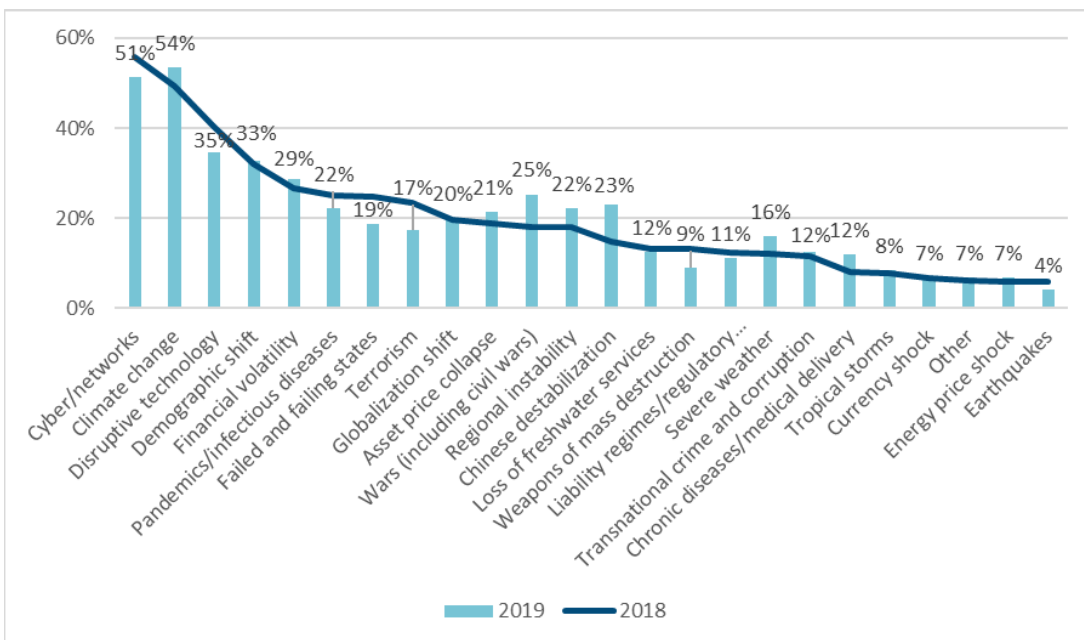
4.5.2 Top Emerging Risk: *Climate change*

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 have occurred recently. That volatility between years resulted in entire categories of risks shifting in prominence. The Environmental category moved past the Technological category into the top spot. *Climate change*, increasing another 5% to 27%, would be the leading category all by itself and is well ahead of second place *Disruptive technology* with 11%. The Geopolitical and Economic categories tied for third place overall, and Societal finished last. The largest drop was *Cyber/networks*, from 15% to 10%, while still finishing third overall.

1. 32%/26%/9%   Environmental
2. 21%/28%/26%   Technological
3. 18%/18%/32%   Geopolitical
4. 18%/13%/20%   Economic
5. 9%/12%/11%   Societal

Figure 27 compares the top emerging risks at the category level from the Fall 2008, 2013 and 2019 surveys. The chart shows how the top risk category has shifted since the financial crisis. While the Geopolitical category appears stable over these specific surveys, there has been a lot of volatility along the way both in total and within specific risks (see Appendix II). Risk perceptions in the Economic category have fallen dramatically (despite recent increases), feeding increases over time for the Environmental and Technological categories.

Figure 27: Emerging Risk with Greatest Impact, by Category

% of Responses in Given Year
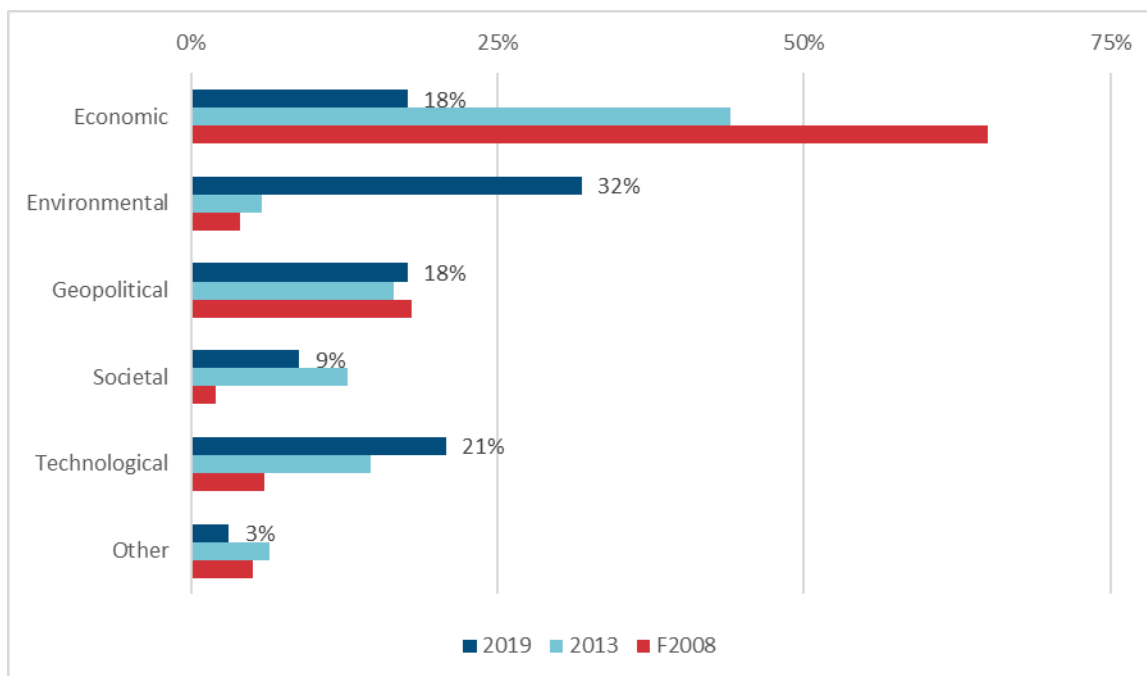
The top emerging risk in this iteration of the survey remained *Climate change*, which now dominates each of the survey questions. *Disruptive technology* is now second, ahead of *Cyber/networks*. Here are the

leading responses (note that responses for *Climate change* are about the same as the next three ranked risks):

1. 27%/22%/7%   *Climate change*
2. 11%/13%/10%   *Disruptive technology*
3. 10%/15%/16%   *Cyber/networks*
4. 6%/5%/6%   *Financial volatility*
5. 6%/5%/12%   *Asset price collapse*

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 a resurgence in four out of the five risks, with two of the top five overall.

Figure 28: Top Emerging Risks—Economic

% of Total Responses
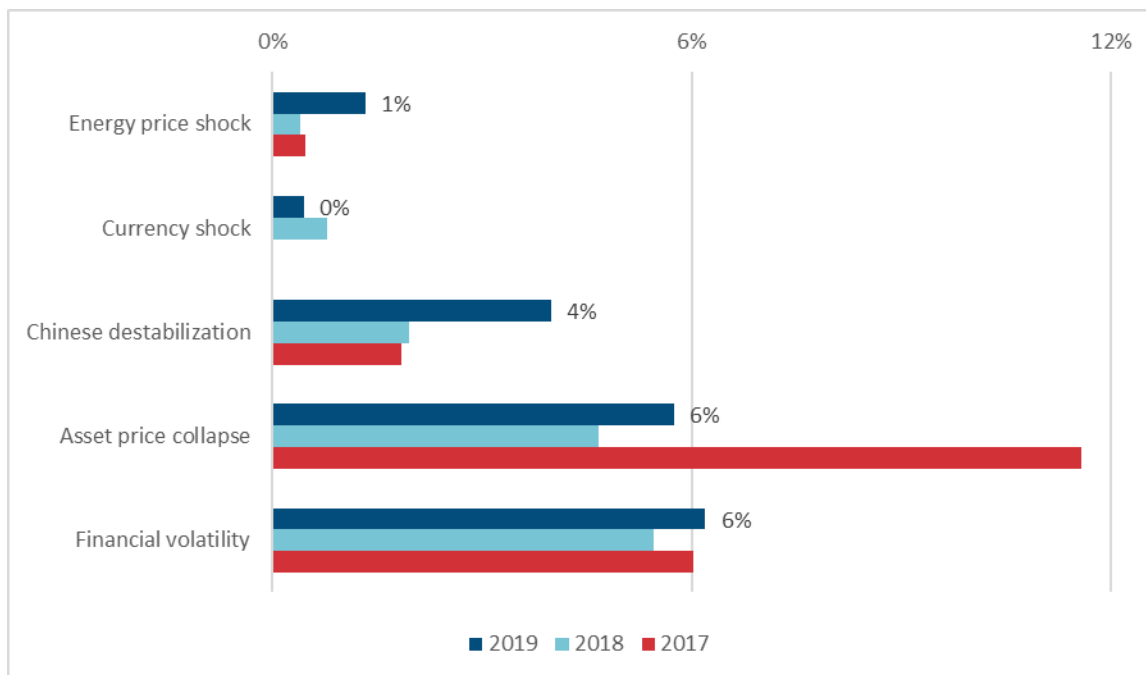
Environmental category risks, shown in Figure 29, remain small, except for *Climate change*, which is the top overall risk. *Loss of freshwater services* and *Natural catastrophe: severe weather* both showed increases for the second consecutive year.

Figure 29: Top Emerging Risks—Environmental

% of Total Responses
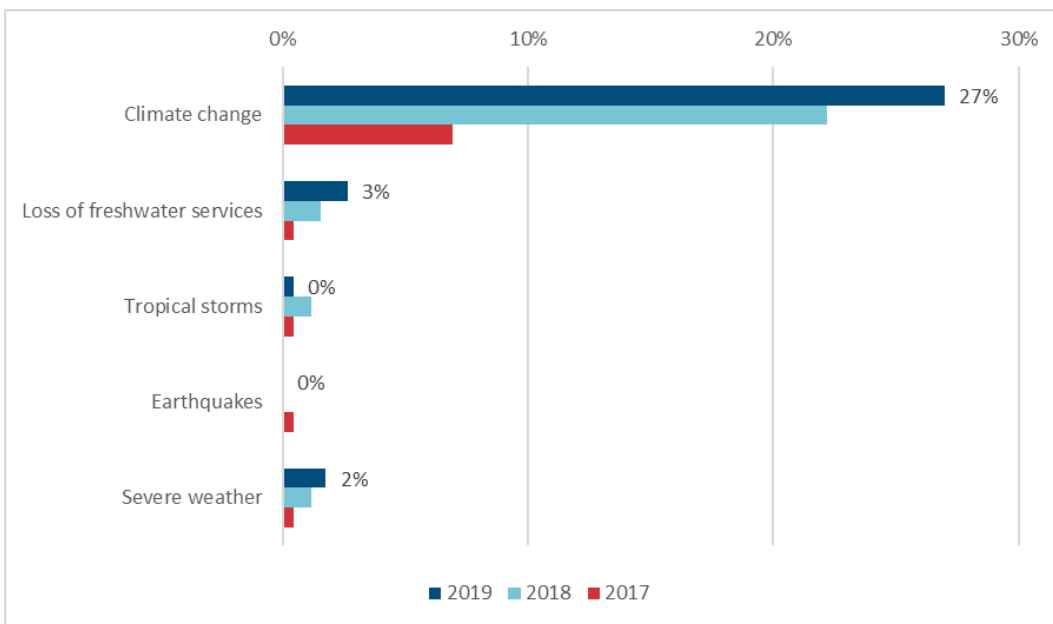
Geopolitical risks tend to be the most volatile in the survey, so it is not surprising to see in Figure 30 that many of these risks whipsaw, with 2019 being a mixed year.

Figure 30: Top Emerging Risks—Geopolitical

% of Total Responses
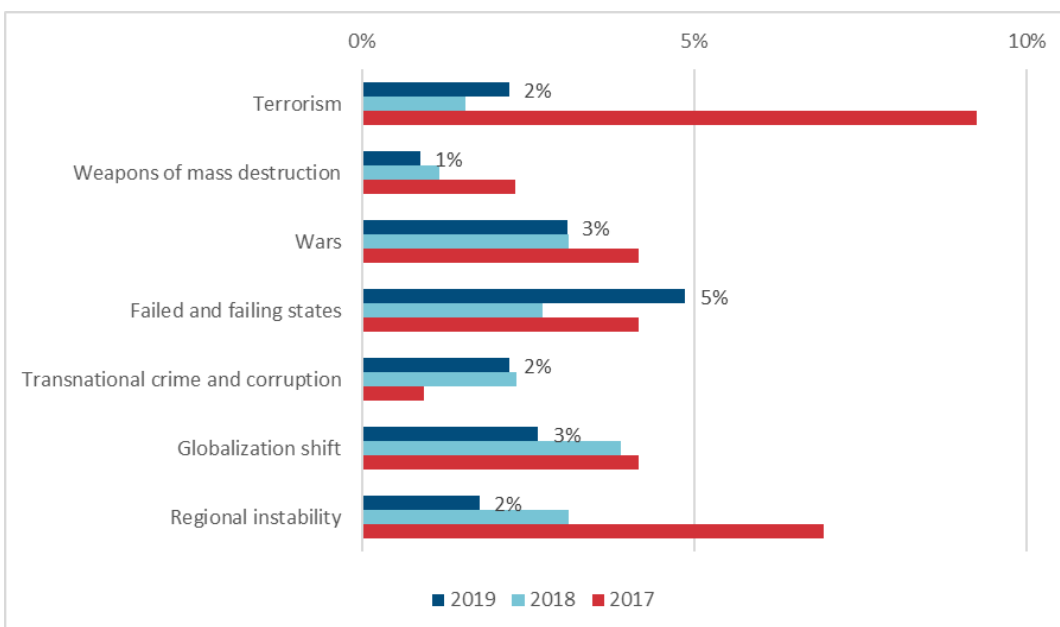
The changes in the Societal category results, shown in Figure 31, were down. *Pandemics/infectious diseases* were down as the Ebola crisis failed to spread beyond Africa, but with recency bias will likely have a large increase in future surveys.

Figure 31: Top Emerging Risks—Societal

% of Total Responses
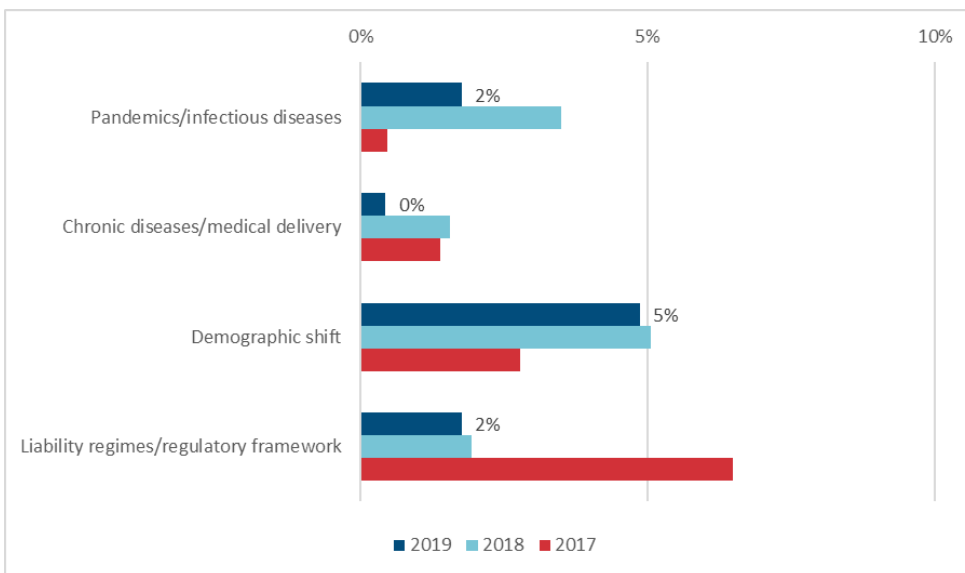
In the Technological category, shown in Figure 32, *Disruptive technology* and *Cyber/networks* are both decreasing.

Figure 32: Top Emerging Risks—Technological

% of Total Responses
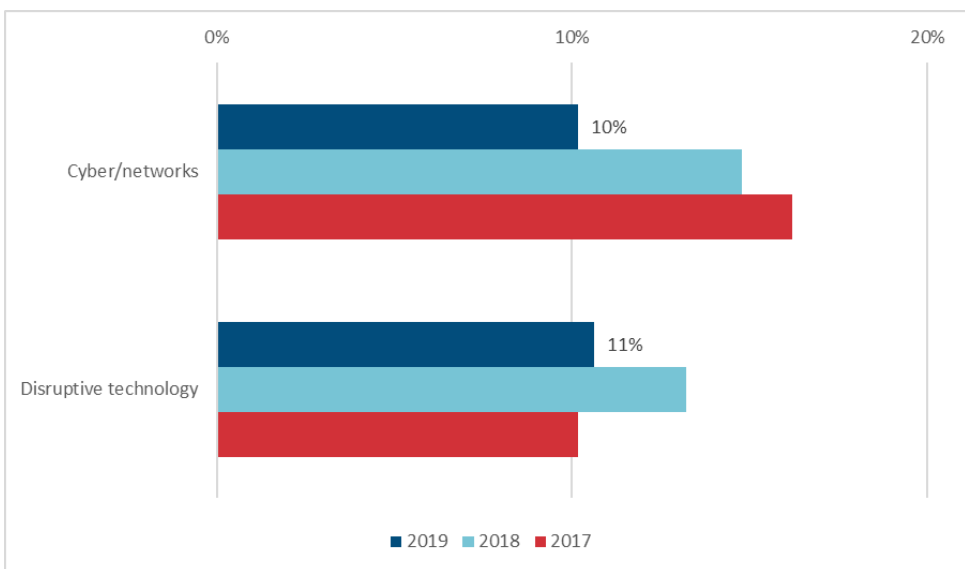
Figure 33 compares the percentages selecting each risk as the top risk with the percentages selecting each risk as one of the five top risks. For several risks, these two measures of perceived importance vary. If we use the highest absolute positive differential to mark the importance of being the top overall risk relative to inclusion in the top five list, that risk was again *Climate change*, at 16%. The greatest negative differential was a tie between *Regional instability* and *Pandemics/infectious diseases*, at −3%.

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

% of Responses to Given Question
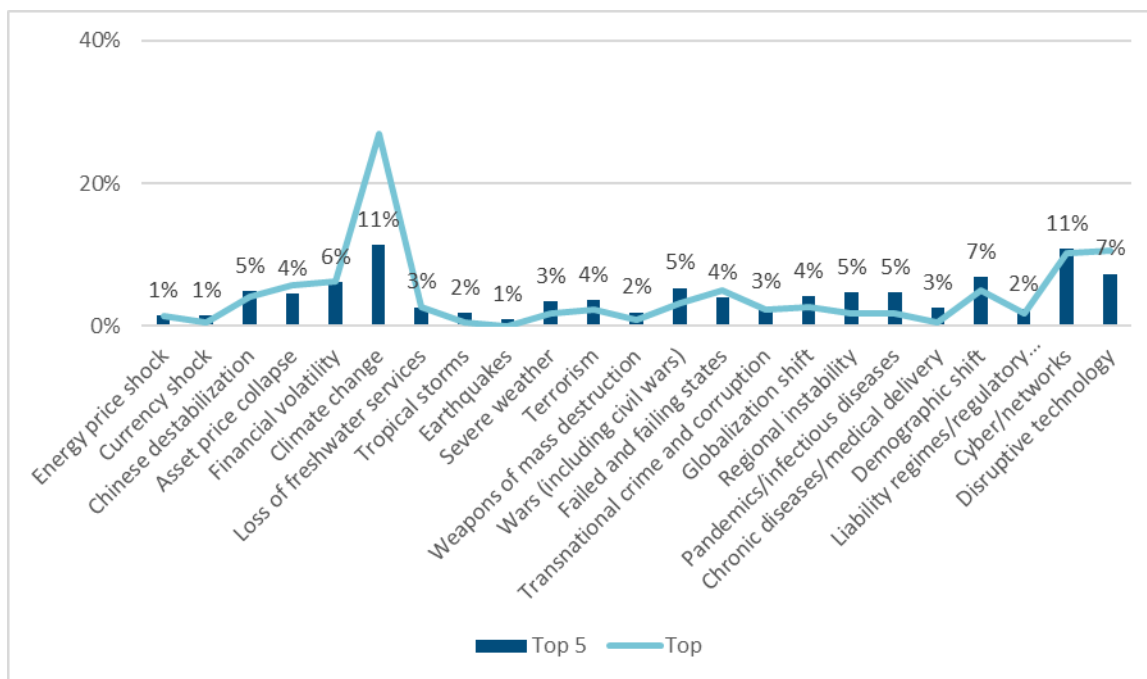
An interesting comparison is to look at which of the three metrics—current risk with the greatest impact, top five emerging risks and top emerging risk—is highest for each risk category. The results of this comparison are shown in Figure 34. Risks were identified as current risks more frequently than as emerging risks in both the Economic and Other categories. Risks in the Geopolitical and Societal categories have the highest percentages as top-five emerging 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
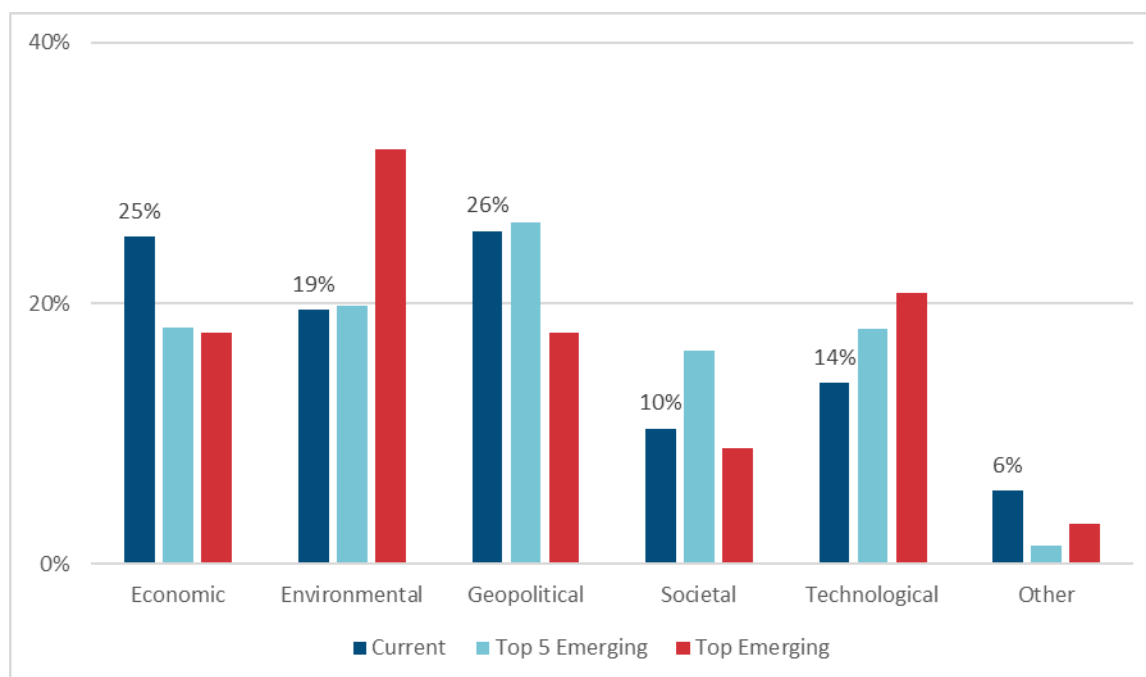
A comparison of the top current risk and top emerging risk suggests which risks are expected to be relatively more important in the future. The largest absolute negative differential (current less than top emerging risk) is *Climate change*, with 10%, followed by *Disruptive technology* and *Cyber/networks*. The largest absolute positive differentials, suggesting an expectation of lower risk in the future, are *Financial volatility* and *Asset price collapse* (both at 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 *Disruptive 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 they 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 11 risks: *Energy price shock*, *Currency shock*, *Natural catastrophe: tropical storms*, *Natural catastrophe: severe weather*, *Terrorism*, *Wars (including civil wars)*, *Regional instability*, *Pandemics/infectious diseases*, *Demographic shift*, *Liability regimes/regulatory framework* and *Cyber/networks*. Where a risk has its highest representation with the top emerging risk is also interesting. Four risks meet that characteristic: *Climate change*, *Loss of freshwater services*, *Failed and failing states* and *Disruptive technology*. The remaining eight risks are highest for the current risk question.

Figure 35: Risk Perception, by Risk and Question

% of Responses to Given Question
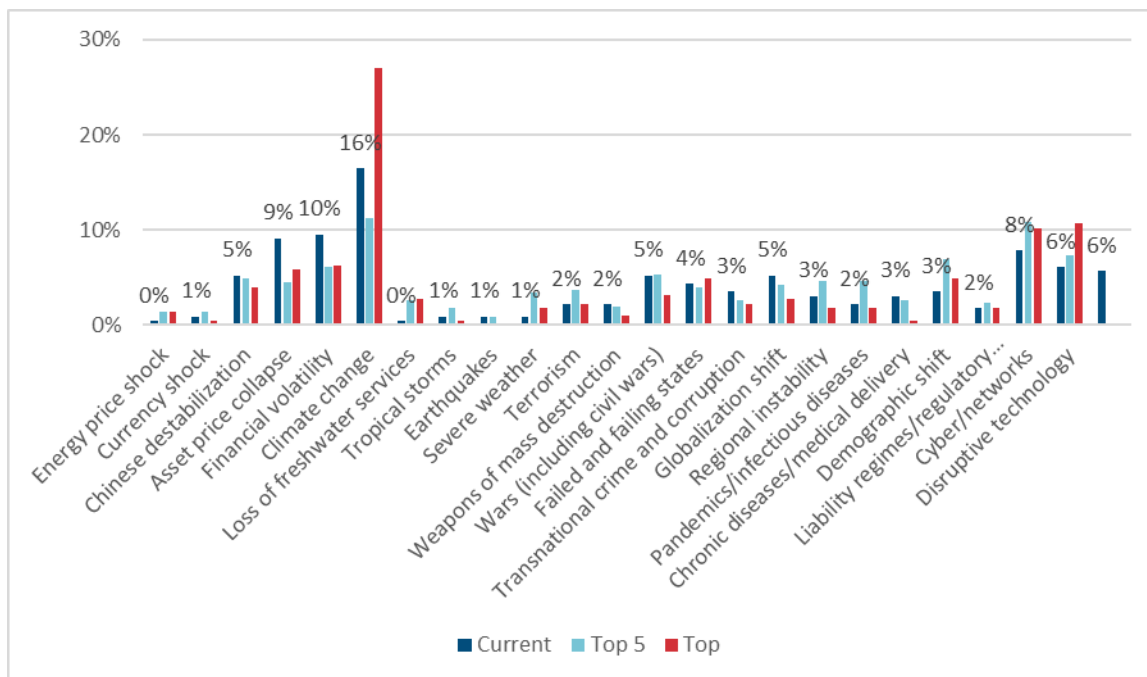
4.5.3 Risk Combinations

Normal trading risks can be managed using proxies like price volatility, but solvency risk differs as many of the risk metrics break down when they encounter a plausible or extreme risk. When risk combinations occur, it becomes more important to manage leverage and liquidity risk. Clustering of events looks at either a combination of multiple risks or the same risk occurring more frequently than it would if the frequency was spread out based on likelihood (e.g., a 4% likelihood risk is expected to occur on average every 25 years, but occurs both this year and again next year). These risks often have low correlations with each other, so are not typically considered in the same deterministic scenario. Risk managers should consider combinations of risk and look at which ones threaten solvency if they occur at about the same time.

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, Economic and Environmental categories are the most frequent response categories, with Economic risks increasing after falling for six consecutive years. Figure 36 provides a graphical representation of the results that follow.

1. 30%/30%/35%   Geopolitical (2019/2018/2017)
2. 23%/22%/23%   Economic
3. 20%/21%/15%   Environmental
4. 15%/15%/17%   Technological
5. 12%/12%/11%   Societal

Relative to the mean over the history of the survey, *Climate change* exceeded it the most in the current survey at 6%, and *Financial volatility* fell short the most at 5%.

Figure 36: Most Impactful Risk Combinations, by Risk Category

% of Responses Selected from Category in Given Year
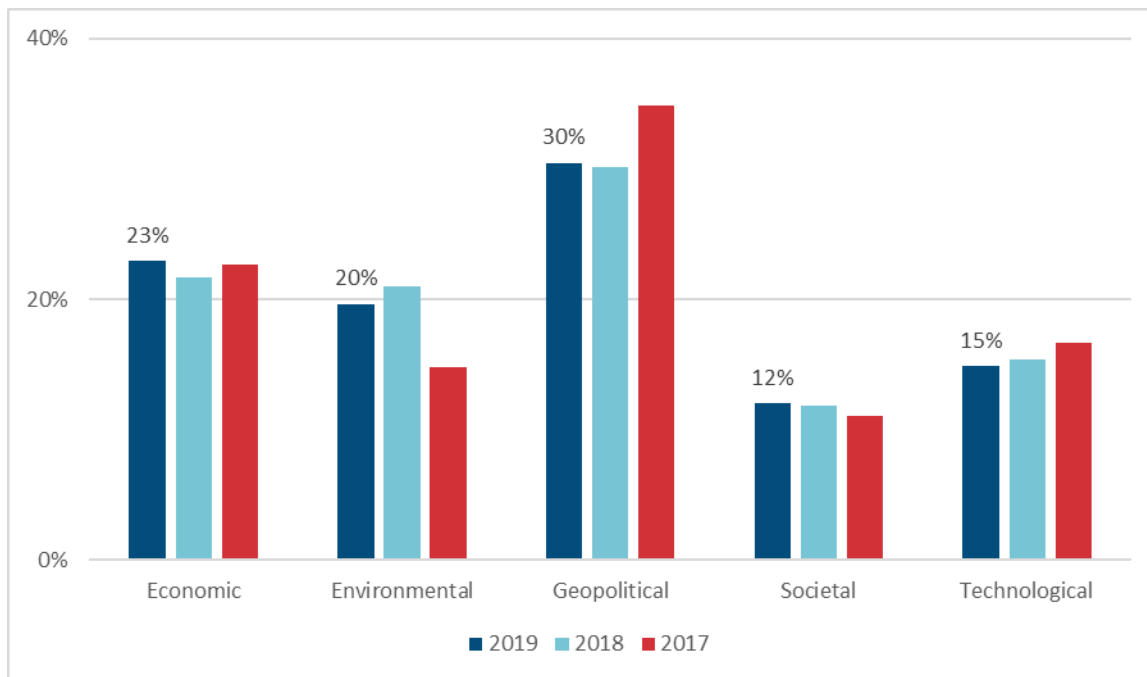
The individual risks most often selected for combinations were *Climate change*, *Cyber/network infrastructure* and *Financial volatility*.

1. 12%/11%/7%   *Climate change*
2. 8%/9%/10%   *Cyber/networks*
3. 7%/8%/8%   *Financial volatility*
4. 7%/7%/6%   *Disruptive technology*
5. 6%/7%/7%   *Asset price collapse*

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 630 responses were as follows:

1. 7%/9%/7%, No. 1 in previous survey
   Cyber/networks
   Disruptive technology

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

3. 3%/4%, No. 4
   Climate change
   Loss of freshwater services

4. 3%/6%/6%, No. 2
   Asset price collapse
   Financial volatility

5. 3%/2%, No. 10
   Wars (including civil wars)
   Failed and failing states

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

16%/16%	Geopolitical–Geopolitical
12%/11%	Economic–Geopolitical
11%/13%	Environmental–Environmental
11%/11%	Economic–Economic
7%/9%	Technological–Technological
7%/7%	Geopolitical–Technological
6%/4%	Environmental–Geopolitical
6%/7%	Environmental–Societal
5%/3%	Economic–Environmental
5%/3%	Economic–Technological
4%/3%	Societal–Societal
4%/4%	Economic–Societal
4%/5%	Geopolitical–Societal
3%/2%	Societal–Technological
2%/1%	Environmental–Technological

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 as the top current risk is high), Geopolitical (frequency of selection for top emerging risk is low), Societal (selection of top five emerging risks is high), and Environmental and Technological (selection of top emerging risk is high).

Figure 37: Selection of Risks in Category, by Question

% of Responses Selected from Category for Given Question
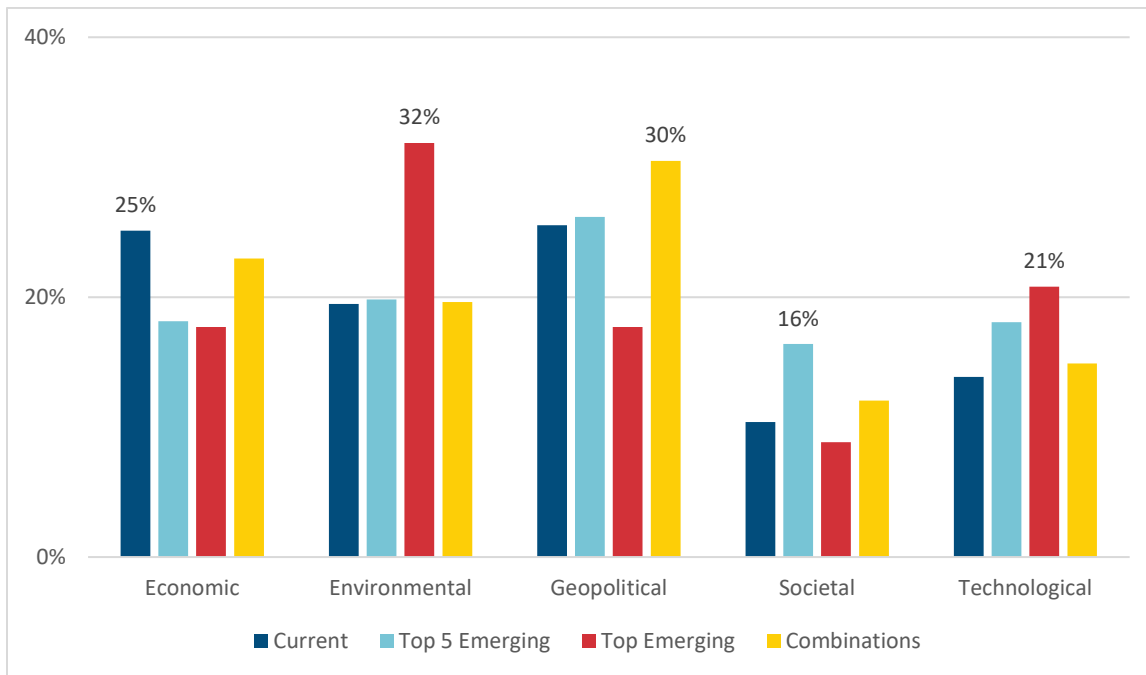
Risk by risk, there is much more variation, as shown in Figure 38.

Figure 38: Selection of Risk, by Question

% of Responses to Given Question
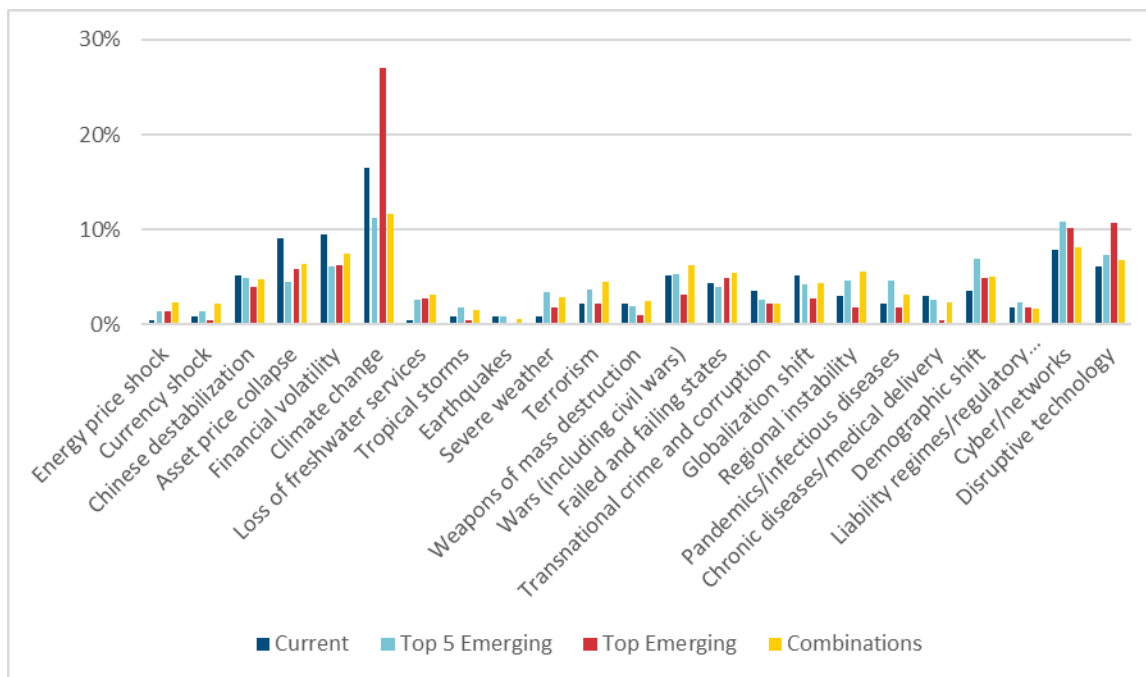
The following risks were most often selected as the top current risk (relative to the other questions):

- *Chinese destabilization*
- *Asset price collapse*
- *Financial volatility*
- *Natural catastrophe: earthquakes*
- *Transnational crime and corruption*
- *Globalization shift*
- *Chronic diseases/medical delivery*

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

- *Natural catastrophe: tropical storms*
- *Natural catastrophe: severe weather*
- *Pandemics/infectious diseases*
- *Demographic shift*
- *Liability regimes/regulatory framework*
- *Cyber/networks*

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

- *Climate change*
- *Disruptive technology*

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

- *Energy price shock*
- *Currency shock*
- *Loss of freshwater services*
- *Terrorism*
- *Weapons of mass destruction*
- *Wars (including civil wars)*
- *Failed and failing states*
- *Regional instability*

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

Figure 39: Cumulative Distribution of Risk Combinations Selected
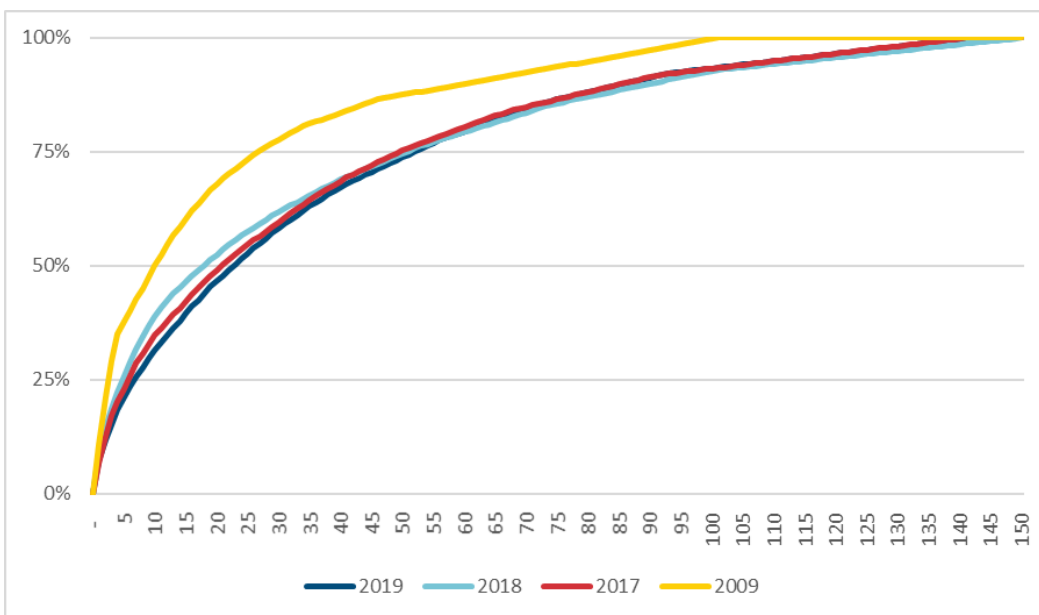
Figure 40 shows the number of combinations selected each year, with data listed cumulatively and the first quartile representing the most frequent responses. The past several surveys suggest a trend toward broader consideration of risks, especially in the third- and fourth-quartile results. More than half of the possible two-risk combinations were again selected. This will be an interesting chart to review in future iterations of the survey as the 2020 pandemic has combined with other risks to be a year to remember. Will future respondents focus on just a few risks, as they did in 2009, or did so many risk events occur that a broad distribution will be the result?

Figure 40: Number of Risk Combinations Selected, by Year
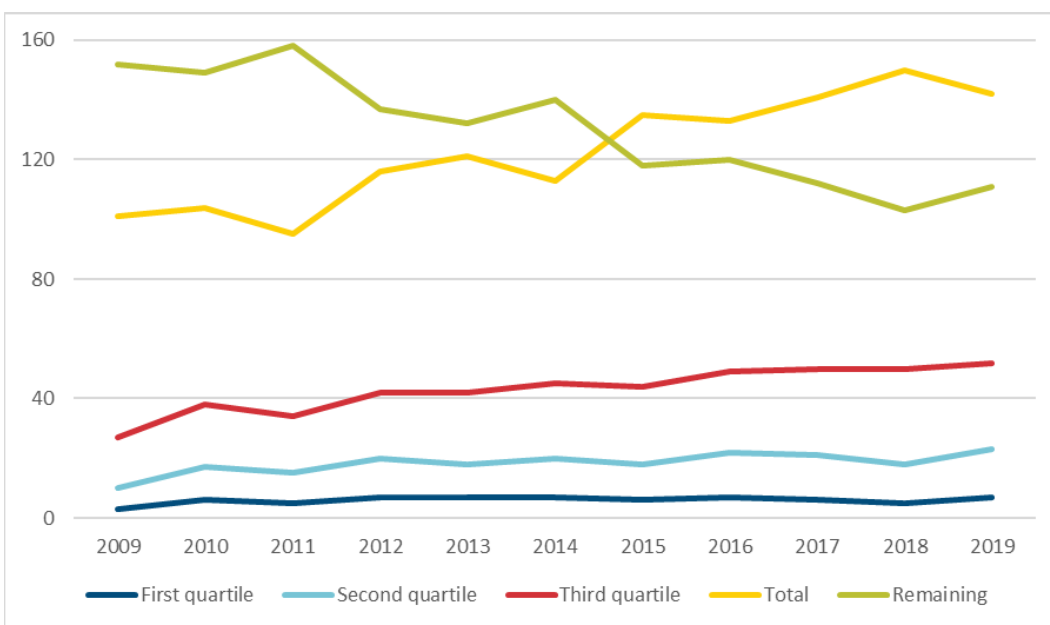
The broad representation may be an indicator of the current risk environment, with each quartile being considered against the extreme example of 2009 and then averaged across the three quartile results. Shown in Figure 41, this year's risk concentration ratio of 46% is the lowest rate seen in the survey.[7] This can be interpreted as if 2019 was a "calm" year.

Figure 41: Risk Concentration Ratio

Base 2009 = 100%
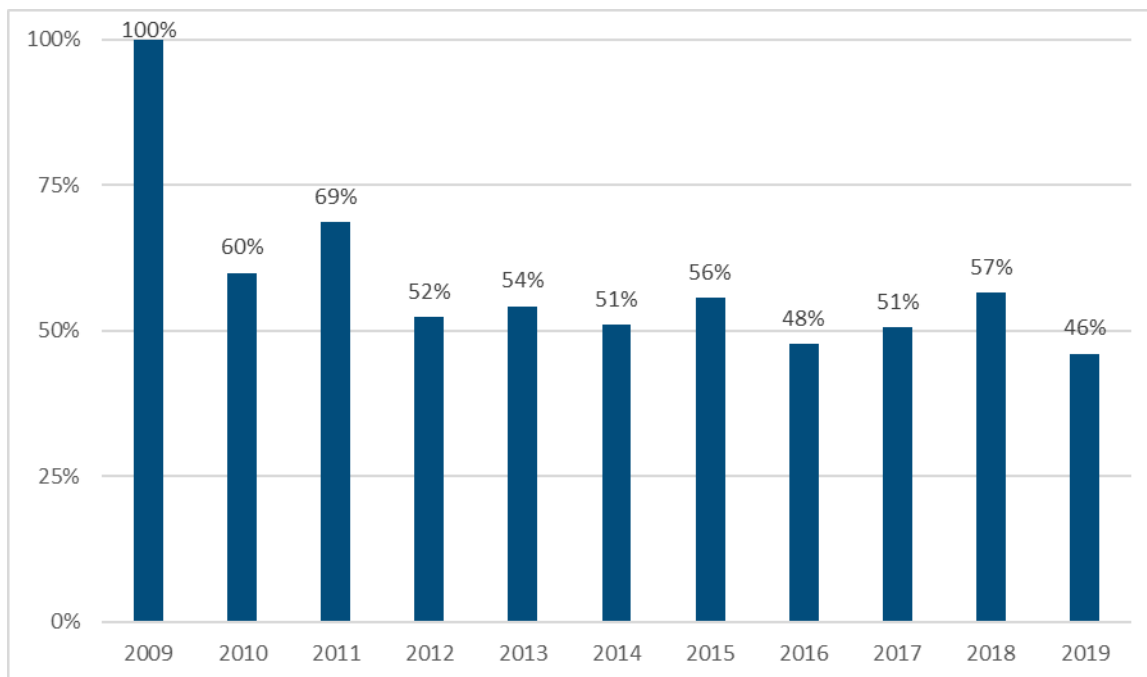
4.5.4 Undervalued Risks

This survey includes a rotating question allowing a choice of up to three risks that fit specified criteria. In this survey, respondents were asked, "Which THREE emerging risks do you believe are 'undervalued' and deserve more attention over the next 20 years?" Figures 42 through 44 show the results from this question by risk, as a comparison with the question about top-five emerging risks, and comparing risks against the top emerging risk. While *Climate change* (11%) finished first, the rest of the top five included *Demographic shift*, *Pandemics/infectious diseases*, *Cyber/networks* and *Loss of freshwater services*. Each risk received at least 1%.

There are similarities and differences between risks considered undervalued and those in the top five emerging risks. The top five in the top five emerging risks were *Climate change* (1 in undervalued ranking), *Cyber/networks* (4), *Disruptive technology* (6), *Demographic shift* (2) and *Financial volatility* (16).

[7] 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. A lower number shows broader results, while 100% would recreate the 2009 survey. This generates a relative concentration ratio.

Figure 42: Undervalued Risks

% of Responses
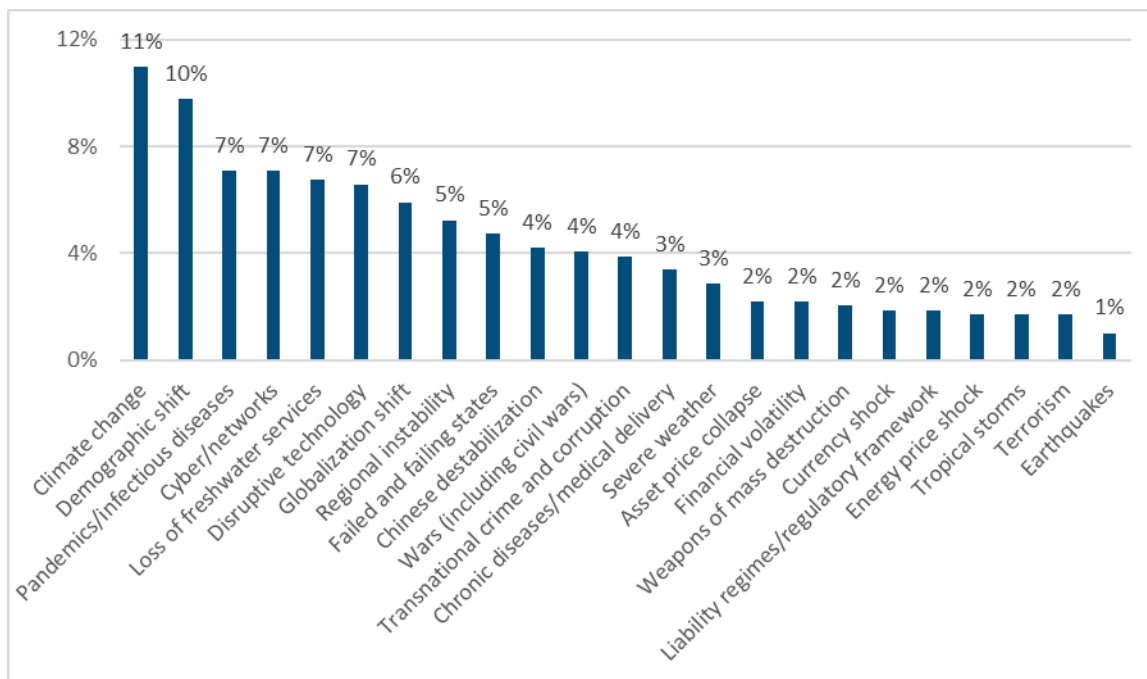
The Societal category was chosen relatively more frequently as an undervalued risk than as top current or top five emerging risk, and the Economic category was less likely to be chosen. Many of the economic risks would be expected to average out, or mean revert, over a 20-year time period, while societal risks tend to trend monotonically, so this is not surprising.

Figure 43: Undervalued Risk Categories Compared with Current and Top 5 Emerging Risks

% of Responses
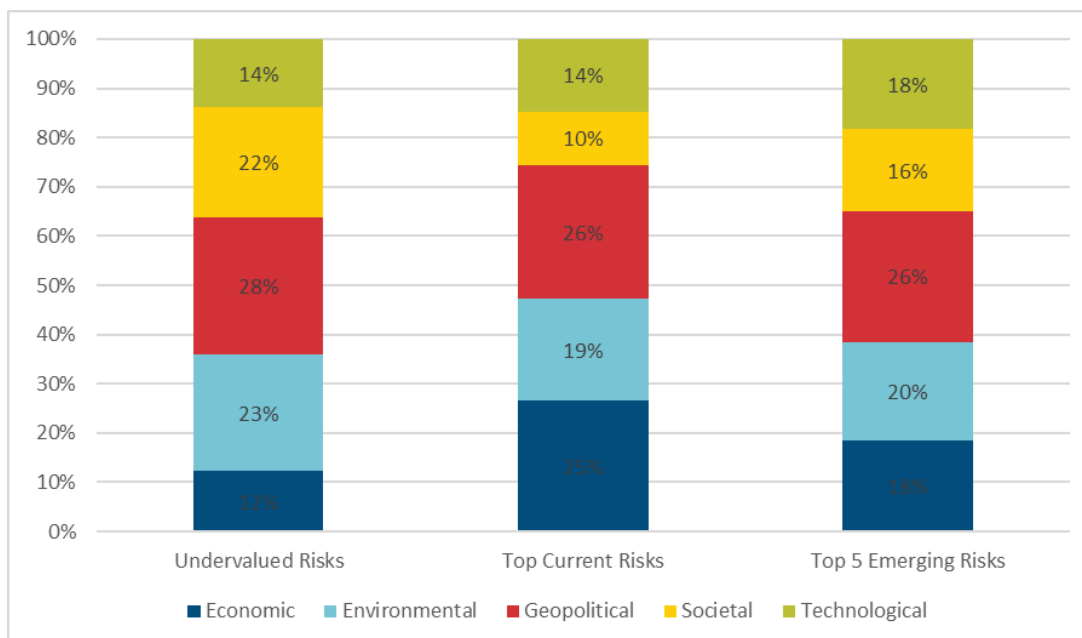
When compared with responses to the question about the top emerging risk, risks identified as being undervalued tended to be more frequently in the Geopolitical and Societal categories and less often in the Economic category.

Figure 44: Undervalued Risks Compared with Top Emerging Risk

% of Responses
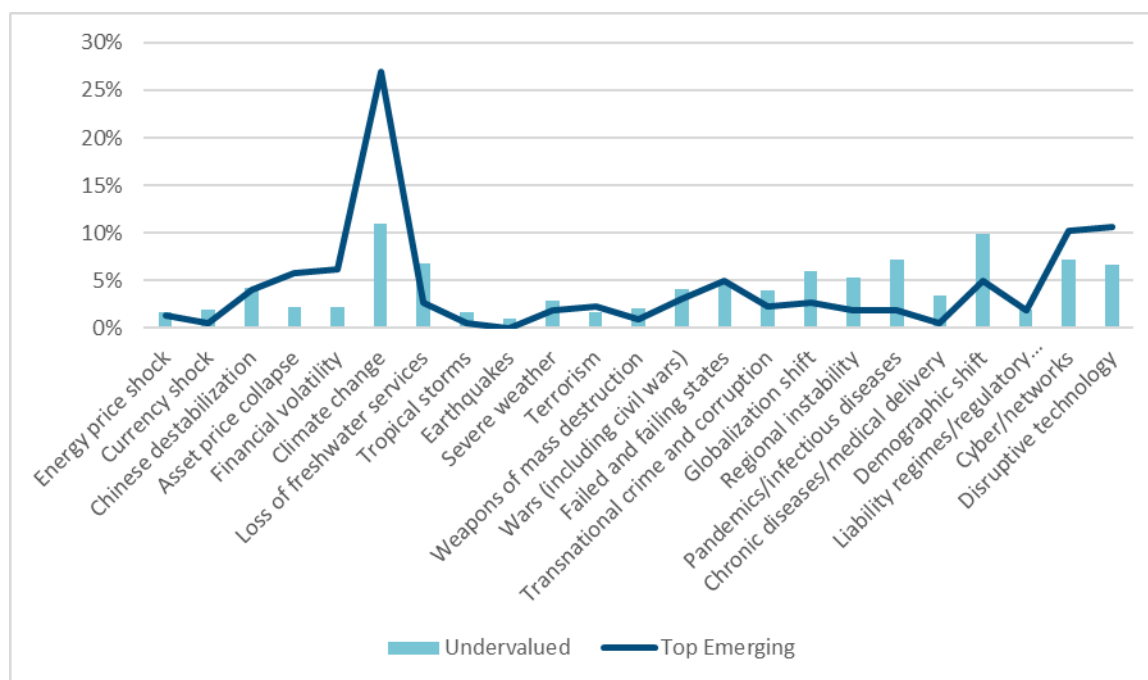
4.5.5 Additional Risks

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 in future survey iterations to incorporate risk nuances. Here are some of the typical suggestions:[8]

- *Socialist and far left political agendas*
- *Collision with asteroid or comet*
- *Protectionism/nationalism*
- *Opioid (Drug) Crisis*
- *Increased income inequality*
- *Prolonged low/negative interest rates*
- *Societal Risks: Increased allergies, the immune system is no longer strong, as we no longer eat healthy things*
- *Aging infrastructure*
- *Demographic shift should be split into (a) migration; and (b) problems of an aging population. The former is creating political strains while the latter is a growing threat to public finances.*
- *Food security*
- *Widening social rifts*

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

- *Brexit*
- *Loss of biodiversity*

While responses like an asteroid 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 concerns about mortality/longevity risk. These could be incorporated into *Demographic shift* and *Chronic diseases/medical systems* 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.* Risks like biodiversity loss and food security could be identified with *Climate change*.

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., initial cluster of influenza cases in a hospital) indicating that an emerging risk is more likely to materialize. This allows responsive actions to be taken earlier than they might be otherwise.

Trending indicators like 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 higher unemployment rate would drive expectations of lower collected taxes. A leading indicator could be an event that becomes a Boolean operator, acting as an on/off indicator. An example might be enaction of a single-payer health care system in the U.S., with new equilibriums achieved over time for labor and tax rates.

The survey asked about the use of leading indicators that provide a firm with actionable information. As shown in Figure 45, 47% of respondents said they formally identify emerging risks, higher than recent surveys.

Figure 45: Whether Respondents Formally Identify Emerging Risks

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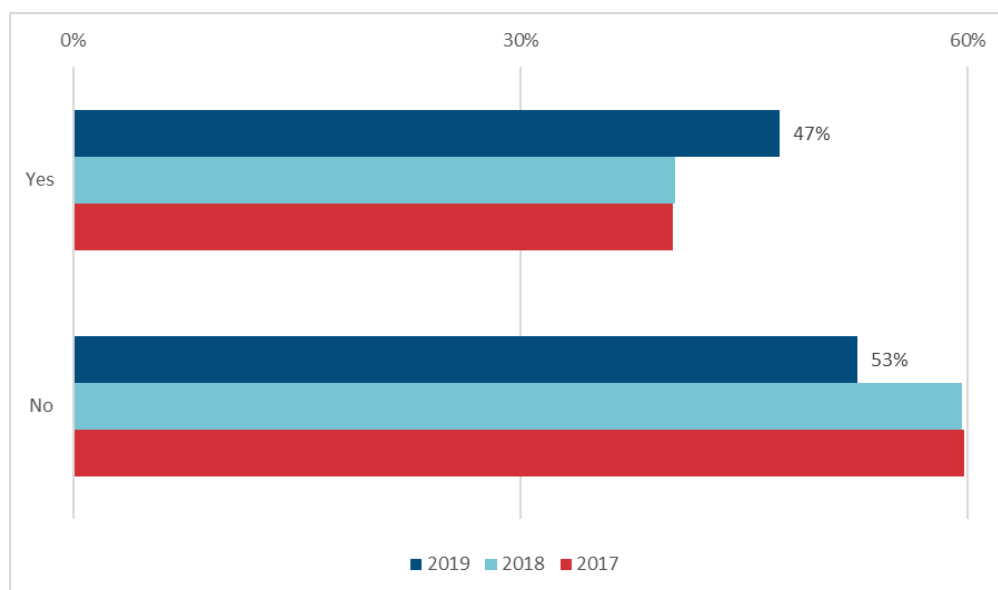
For respondents who reported having a formal process (those without one moved directly to the next section), the survey asked about measuring, monitoring and mitigating an emerging risk once it has been identified. Figure 46 shows that nearly all respondents said they do this for some or all of their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

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

% of Responses in Given Year
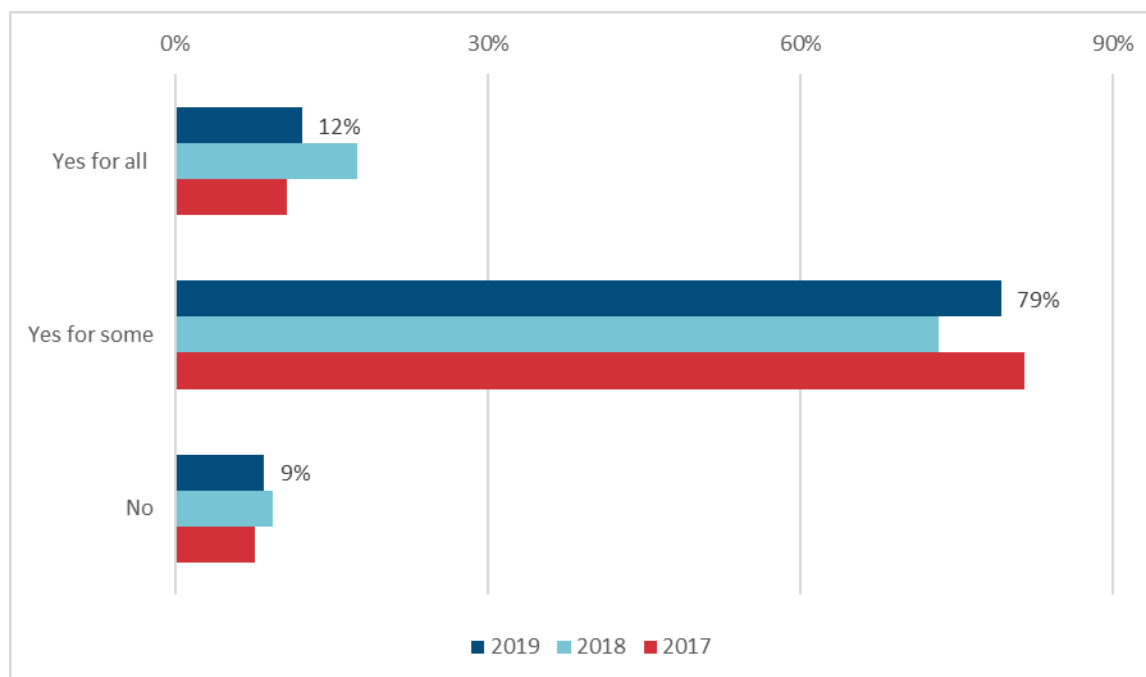
Most of the comments about actual processes used talked about respondents' activities to measure, monitor and mitigate the risk. This shows that progress is being made, as more leading indicators are listed and proactive steps taken as a result. Here are examples of processes in place:

- *New risks are logged, assessed, placed on an emerging risk/opportunities dashboard and appropriate actions are taken – note that an appropriate action may be to 'watch and wait'.*
- *For cyber risk we use indicators such as number of attacks on similar organisations.*
- *We have an emerging risk register and for some items on the list we do a qualitative analysis of the impacts of the risk.*
- *Research articles (industry and global) to stay abreast of impacts of top 5 emerging risks. Monitor and report on emerging risks to the Enterprise Risk Committee on a regular basis.*

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, 49% of respondents noted that they had leading indicators for some or all identified emerging risks, a decrease from 63% in the prior survey. These results show that some 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
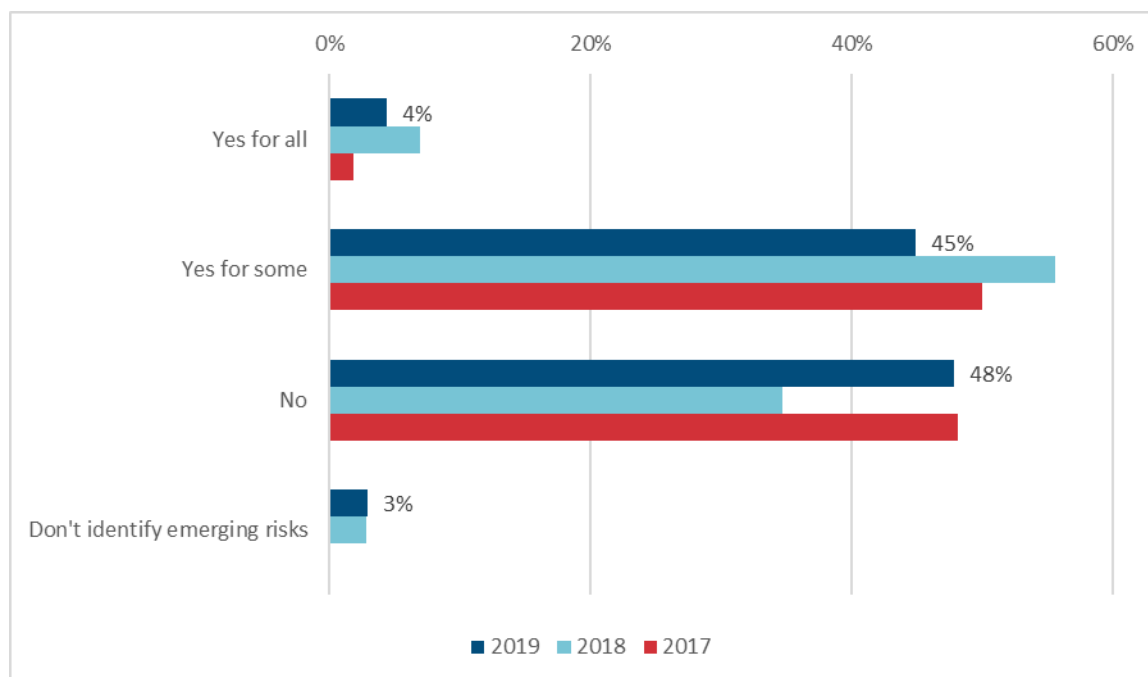
The specific examples shared about leading indicators being collected and monitored are interesting. The broader group of respondents allows the survey to include additional practices (e.g., only recently has the survey been sent to health and pension practitioners). Here are a few of the responses:

- *I measure various demographic shifts over time and corresponding disease prevalence per demographic subgroup.*
- *For IT cyber risk – we look at number of attempted hacks, regions, internal/external threat.*
- *The growing impact of financial volatility from the risks of climate change*
- *Pandemic – WHO tracking of cases*
- *For extreme market risks we will track interest rates, credit spreads, asset indices etc.*
- *We are monitoring glacial melt via press reports and satellite photos measuring the number of hectares covered by the major glaciers in the Alps, Rockies, Greenland, Himalayas. This is a proxy for water availability and temperature fluctuations.*

The survey asked whether these leading indicators include criteria that would lead to action to mitigate or accept the risk. Over four-fifths (82%) 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
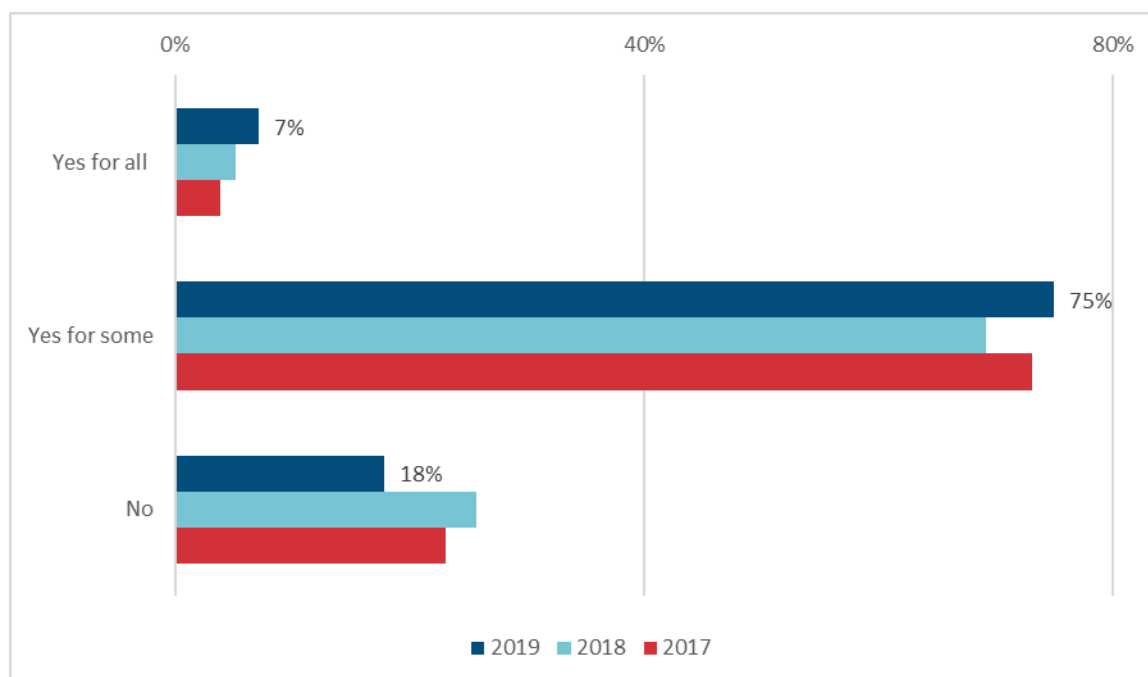
When respondents were asked for examples, they shared some specific actions and triggers. Some good examples are as follows:

- *When I observe an unusual uptick in, for example, a certain disease prevalence or medical procedure use rate, I warn senior management regarding the implications.*
- *Unique on a case by case basis generally. We consider them tipping points.*
- *When financial outcomes are not as expected, we start scenario testing to see what other outcomes might be likely.*
- *We use our risk appetite framework (RAF) which contains clear trigger points for actions.*

4.7 SECTION C: METHODOLOGY

This section solicits input on the overall health of ERM. Several open-ended questions complement the emerging-risk trends asked about in Section A. Each risk management program is unique. 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 comments found in Appendix II. They suggest possible future development paths of an ERM process for those at various levels of maturity.

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 (3%) said it has had a negative effect, and a majority (54%) responded that the effect has been positive. The high number of *Neutral* or *Not sure* responses is also telling, as ERM continues to evolve toward company-specific levels consistent with unique governance goals and company risk culture.

Figure 49: Effect of ERM in Respondent's Company/Industry

% of responses in Given Year
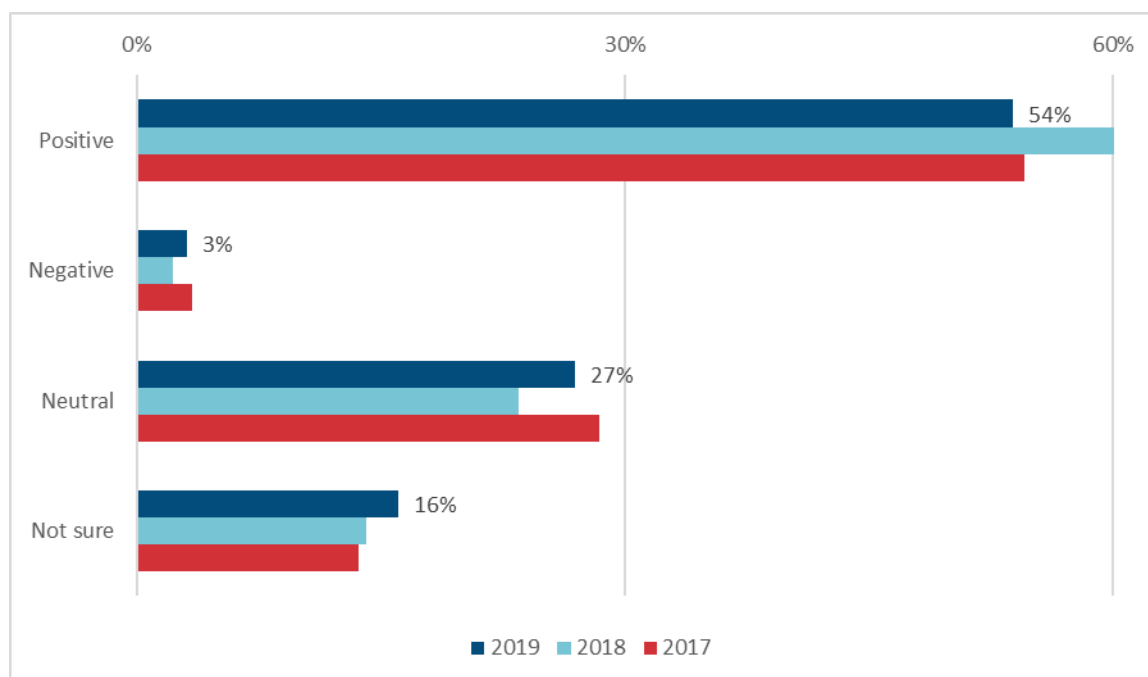
An open-ended question asked respondents to share an example from the past year where another company used ERM in a positive way. Most of the comments considered the ERM process. The comments included the following, with many showcasing how ERM interacts with strategic planning:

- *ERM has been used in Israel to prevent terrorist attacks.*
- *I think Amazon is watching the risks and moving to alleviate the risk. They have opened new distribution centers, so when online orders are taxed, they are already in that state.*
- *Tesla through expansion of production footprint to counter trade wars*
- *Looking at climate change and considering shortening the pricing time horizon*
- *Firm with large fleet exposure justified increased technology in its vehicles*

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 show a continued move toward *Not sure* responses (50%). Splitting the comments out by how the question was answered provides additional clarification. A company's unique risk culture often drives the role of ERM. This question has many well-thought-out responses. Readers are encouraged to read all of them in Appendix II.

Figure 50: Whether ERM Improves Returns Relative to Risk

% of Responses in Given Year
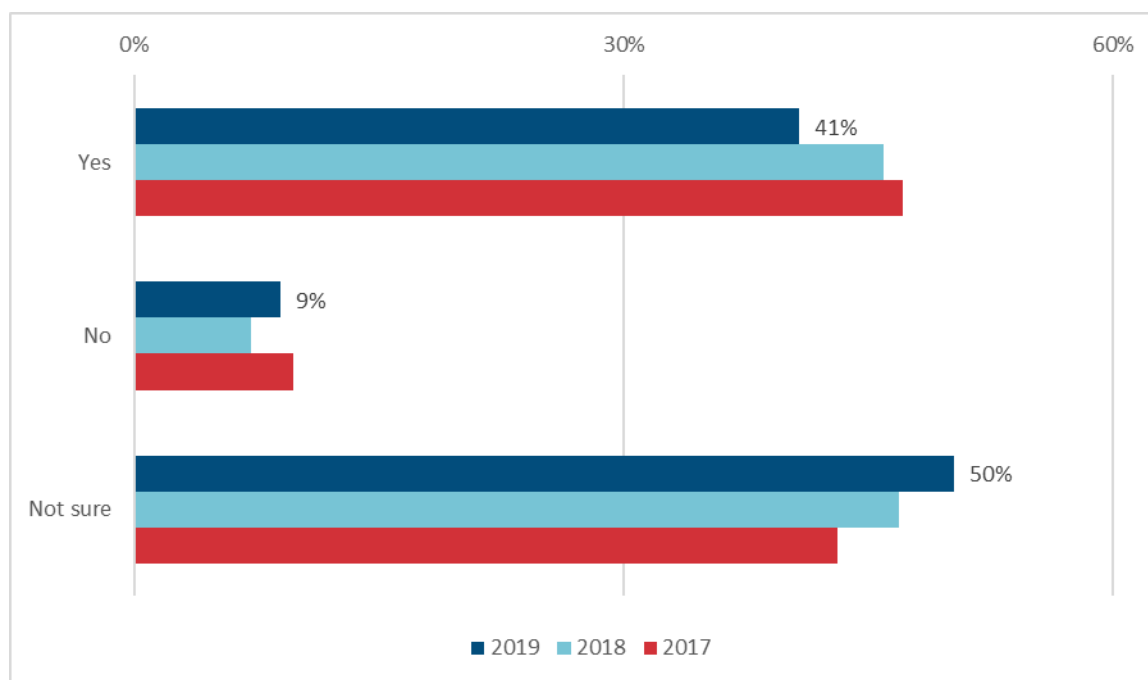
Among those stating that ERM does improve returns relative to risk, comments included improved strategy and proactive risk mitigation:

- *Strategizing is a lot more effective when we have a better understanding of our risk exposure.*
- *Company rating (AM Best/S&P) gets better*
- *Mitigating risk does not have to be expensive to be effective.*
- *Some risks and reactions are prepared for, and even when a different risk or response avails itself, ERM strategy provides a road map to follow.*

Respondents who said ERM does not improve returns relative to risk were extremely direct about their misgivings. Comments included the following:

- *ERM is generally "window-dressing" and takes resources away from other important initiatives.*
- *That's not what it's for.*
- *ERM is impossible to predict; and any implementation in advance won't help because it's unlikely to predict the actual crisis that might occur.*
- *ERM is too broad to be effective. Largely a fad with a mixed, if not unsuccessful track record. The core techniques of risk management, prospective review, and trying to look at operational exposures are valuable but are really useful when performed in a focused risk management program.*

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

- *Measurement is difficult.*
- *If current risks remain stable, efforts to monitor show little return.*
- *It is difficult to measure how we improve since it could be the result from many factors.*
- *ERM on its own does not work unless it translates into actions that improve. There are dependencies on the company culture, the context in which ERM operates.*
- *Results are dependent on the actions of management, which may have a 'risk-taker' or 'risk-adverse' culture. So, I can see situations where it can reduce variability by having a plan for risks but also situations where it may not. Thus the 'not-sure' answer.*
- *Too much emphasis on risk identification & mitigation has the potential to lead to paralysis. The objective should be how to take reasonable risk given potential for rewards.*
- *Very dependent on how ERM is implemented. If it becomes a checkbox or an after-the-fact review it becomes simply another bureaucratic impediment rather than a holistic, strategic view of the enterprise.*

Two new open-ended questions were asked this year. The first asked about risks or practices that were considered systemic, that spread throughout a group or system with limited ability to hedge once the risk is accepted. Responses included climate, health, technological, financial and geopolitical. The following shares a few examples:

- *Data issues and mortality deterioration*
- *Chronic disease impact on LTC experience*
- *The tendency to continue to look only internally at risks and processes*
- *Partial Alzheimer "cure" that requires facility care and prolongs life*
- *Climate change*
- *Mortality risk*
- *Cyber/cloud*
- *Overreliance on capital markets/financial derivatives to transfer risk*
- *Instability of politics*
- *Low interest rate risk*
- *Regulatory risk*
- *Earthquake risk in Canada with pooling amongst the industry, major event could trigger insolvency of the entire industry*
- *Longevity risk*
- *Demographic changes*
- *Pandemics*
- *Any product that claims to hedge a risk like stock returns, where they all move in the same direction*

Respondents were also asked about low-probability events that they worry about. Many worried about pandemics, nuclear war, a long-term low-interest-rate environment and earthquakes. The following are examples of their responses:

- *Systemic shock impairing the functioning of the global financial market system, terrorist activities leading to mass casualty*
- *Detonation of nuclear device, simultaneous massive global cyber attack*
- *The one(s) I am not aware of today*
- *Conversion of a democracy society to a dictatorship*
- *Market events (e.g. equity crash), large data breaches*
- *Sudden (over 1–5 years) feedback loop disruptions in our climate that cause world destabilization due to loss of plants/animals*

- *U.S. civil war*
- *Loss of the power grid in the US*
- *Coronal mass ejections*
- *Earthquakes*
- *Pandemic event raised from global warming effect*
- *Cyber threats*
- *A loss of liquidity in our financial system. Also, very long-term low rates affecting the ability of insurers and pension plans to honor guarantees, such as a beefed up Japanese scenario or perhaps what we're seeing in Europe*
- *War*
- *Drug-resistant bacteria*
- *Violent climate events (hurricanes, wildfires); maybe not low probability anymore*

4.8 SECTION D: CURRENT TOPICS

More than a decade after the event, the 13th survey in this series continues to reflect on the period since the global financial crisis. The Current Topics section reflects this, showing changing expectations. It will be interesting to see results from this section in future surveys as the 2020 risk events seem to be never-ending.

Asked their expectations about the global economy in 2020, respondents were less positive than respondents the previous year, with 55% having a moderate and 28% a good outlook, as shown in Figure 51. At its highest level since 2015, 13% (up from 6%) had poor expectations. As can be seen in Figure 52, combined good and strong expectations were steady.

Figure 51: Expectations for the Global Economy

% of Responses in Given Year
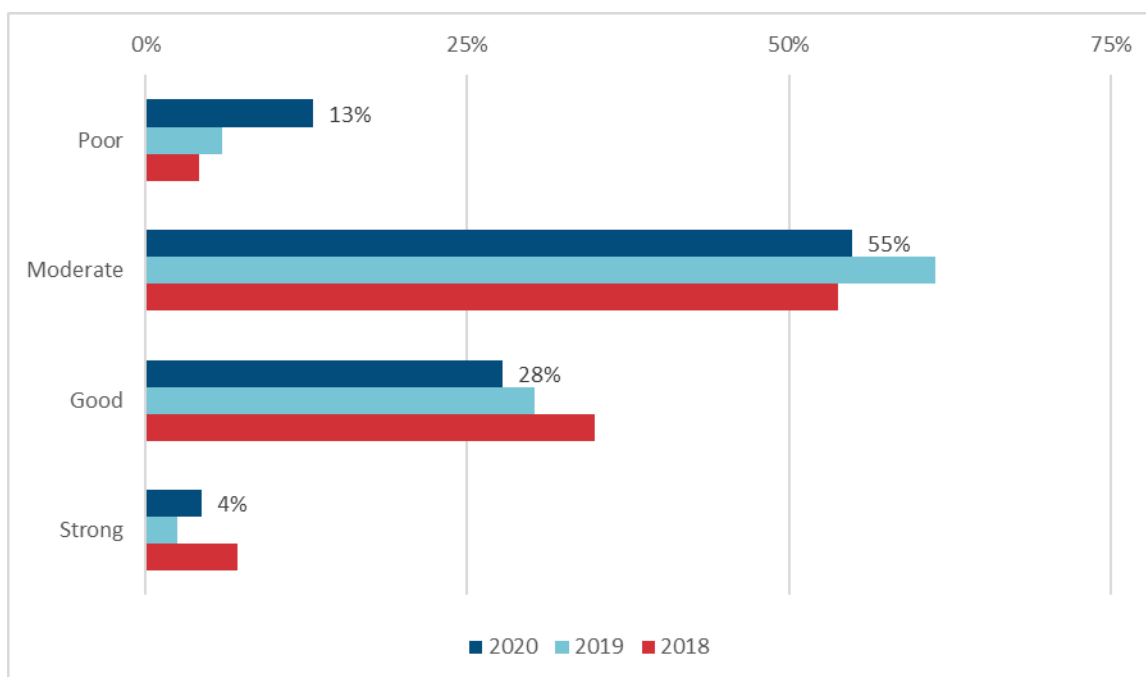
Figure 52: Combined Good and Strong Economic Expectations, 2009–2019

% of Responses in Given Year
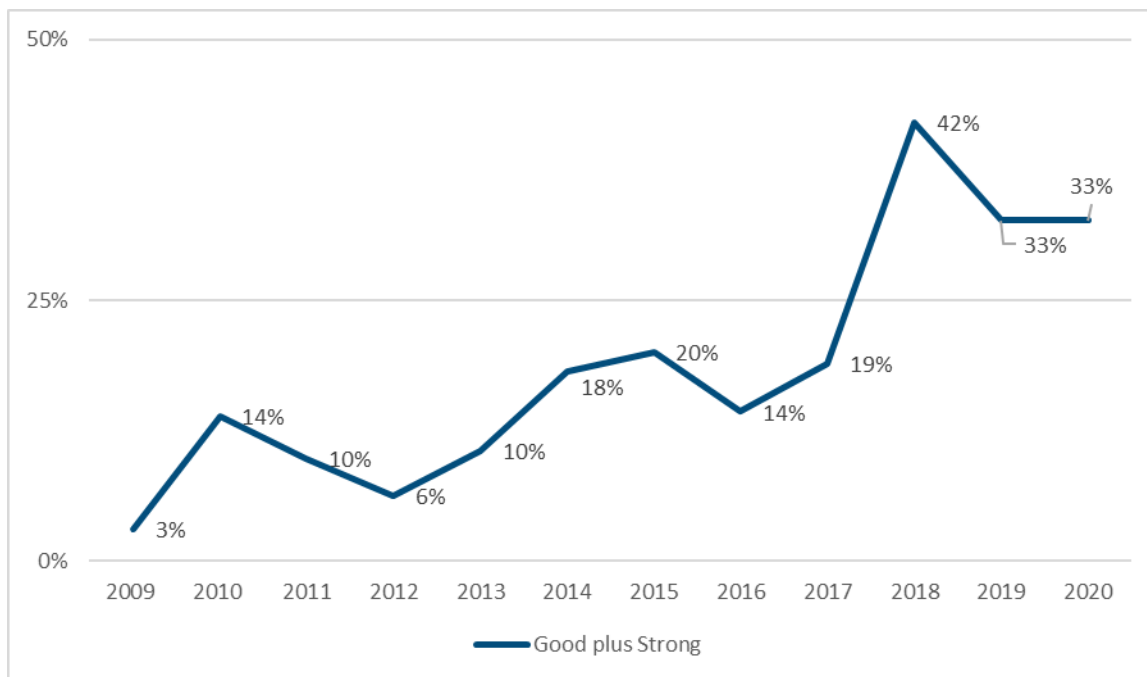
Concerning the level of ERM activity, most risk managers (57%) reported a stable environment in 2019, as shown in Figure 53.

Figure 53: Perceived Level of ERM Activity

% of Responses in Given Year
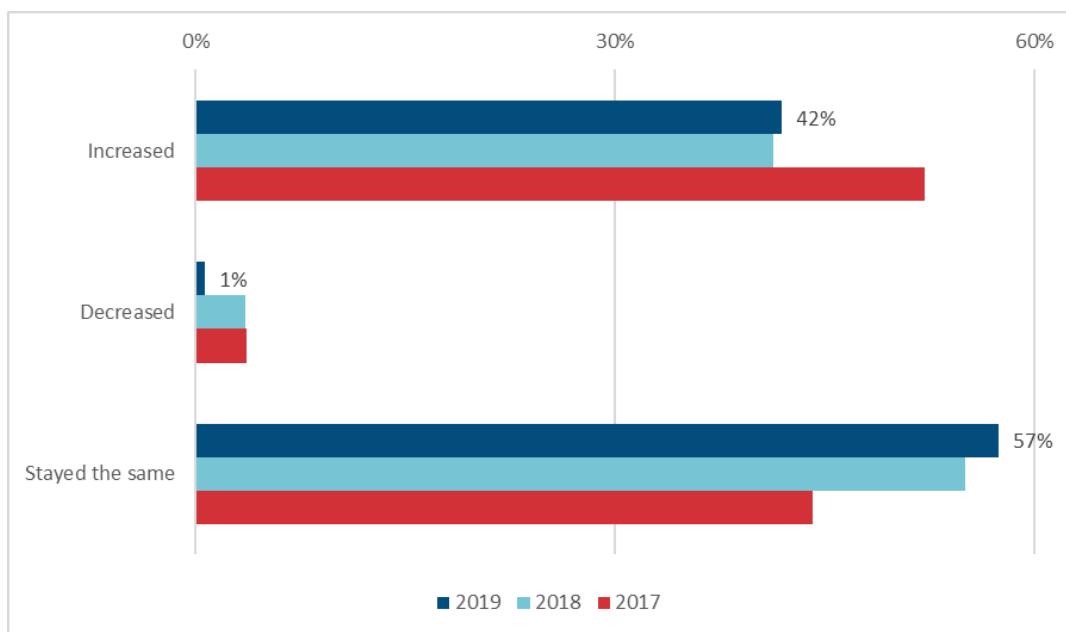
Higher ERM activity led to internal staff growth for only 21% of the respondents in 2019, as shown in Figure 54. We seem to be in an era where ERM is considered a cost center with a goal to reduce its size, at least until the next crisis or regulatory modeling requirement.

Figure 54: ERM Internal Staff Growth

% of Responses in Given Year
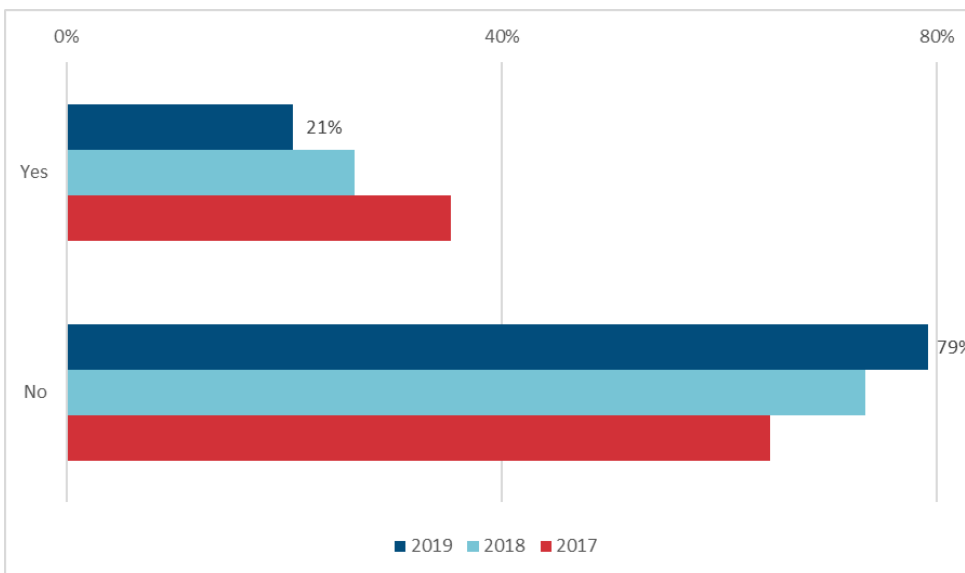
ERM activity is expected to increase for only 39% of the respondents in 2020, as shown in Figure 55.

Figure 55: ERM Activity Growth 2020

% of Responses in Given Year
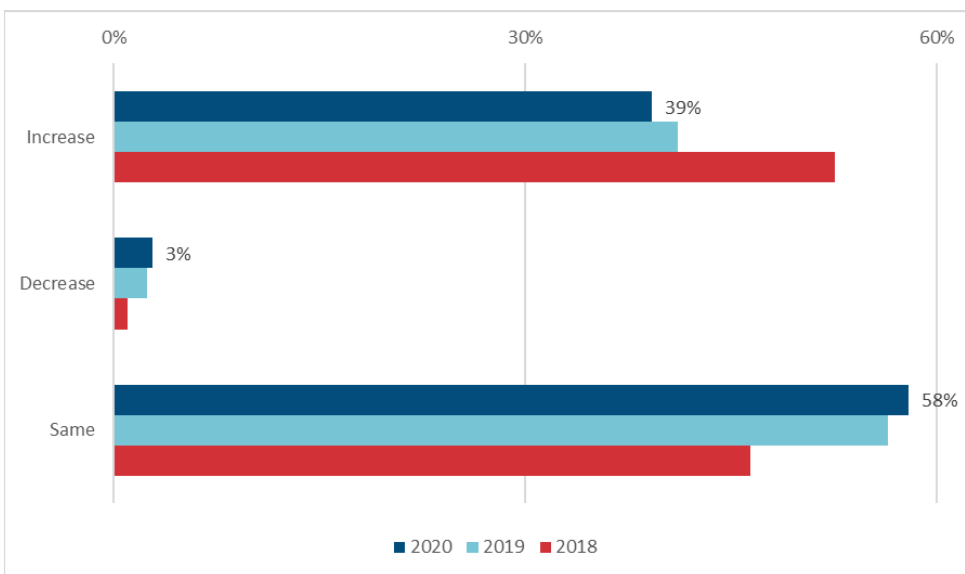
Respondents indicated that levels of funding for ERM are expected to be stable in 2020. Figure 56 shows that only 23% expect funding to increase for the upcoming year.

Figure 56: Anticipated Levels of ERM Funding in 2020

% of Responses to Given Question
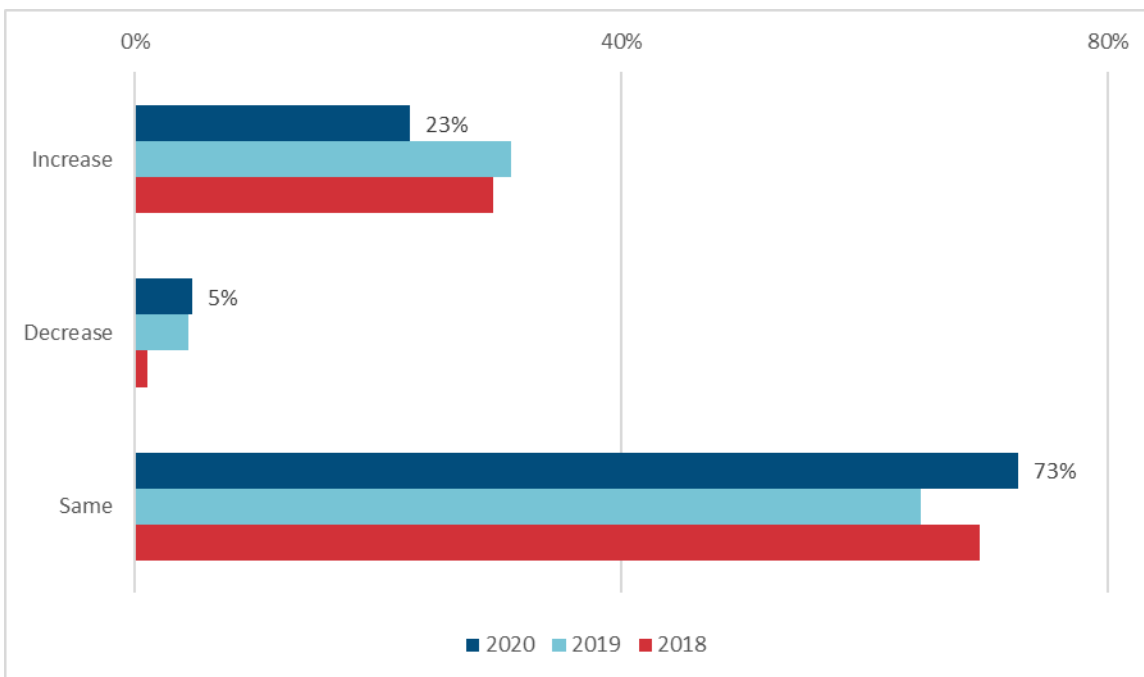
In Figure 57, respondents show that activity levels are expected to increase in 2020 more than funding.

Figure 57: Anticipated Levels of ERM Activity and Funding in 2019

% of Responses to Given Question
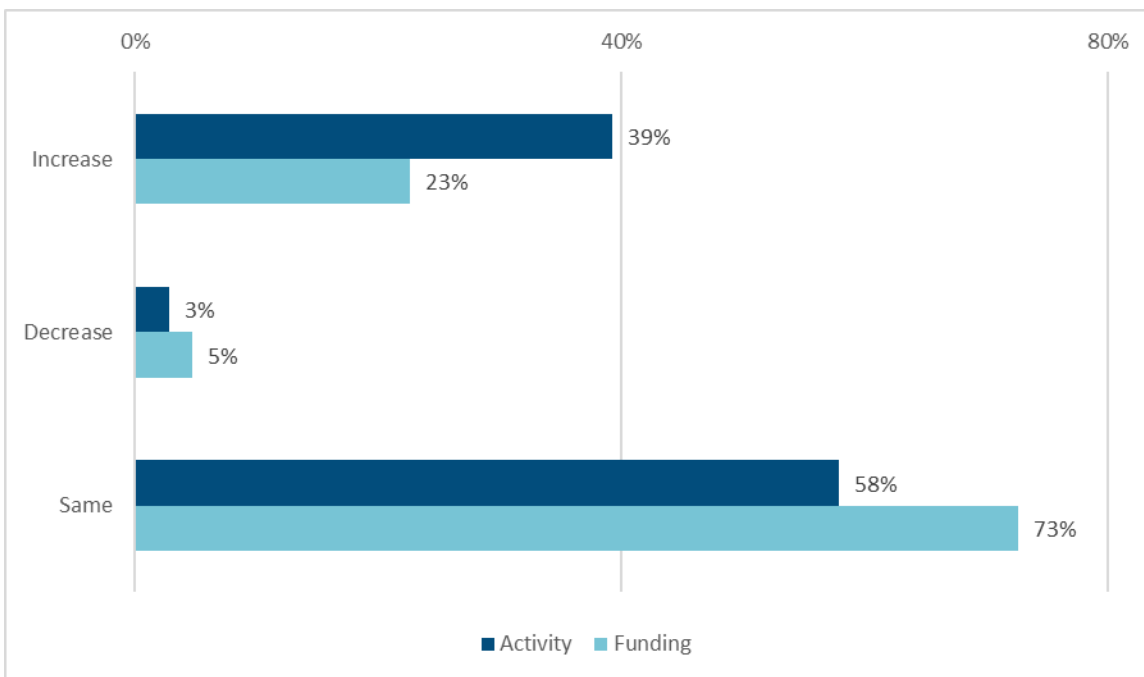
In an effort to determine what types of technological activities were being added, the survey asked what types of *Cyber/networks* and *Disruptive technology* scenarios were analyzed. Some of the interesting comments included the following:

- *Phishing Malware*
- *Customer privacy issues*
- *More hacks as more information goes to "the cloud"*
- *Loss of power leading to need for data backups*
- *Extortion, Denial of Service, and Data Breach*
- *Change in the market: customers will leave traditional insurers for new insurtechs with more information sharing and less data protection (privacy).*
- *New competitors such Amazon or Google to compete against big insurers*
- *Disruptive technology scenarios include new ways to deliver care (telemedicine, crowdsourcing, etc.), and innovations in the healthcare sphere.*

The survey asked how the ERM team is used when a strategic opportunity is presented to a firm. As illustrated in Figure 58, while 96% of respondents said they can either say no to a strategic opportunity and/or have input, a limited few still have no input.

Figure 58: Use of ERM Team for a Strategic Opportunity

% of Respondents in Given Year
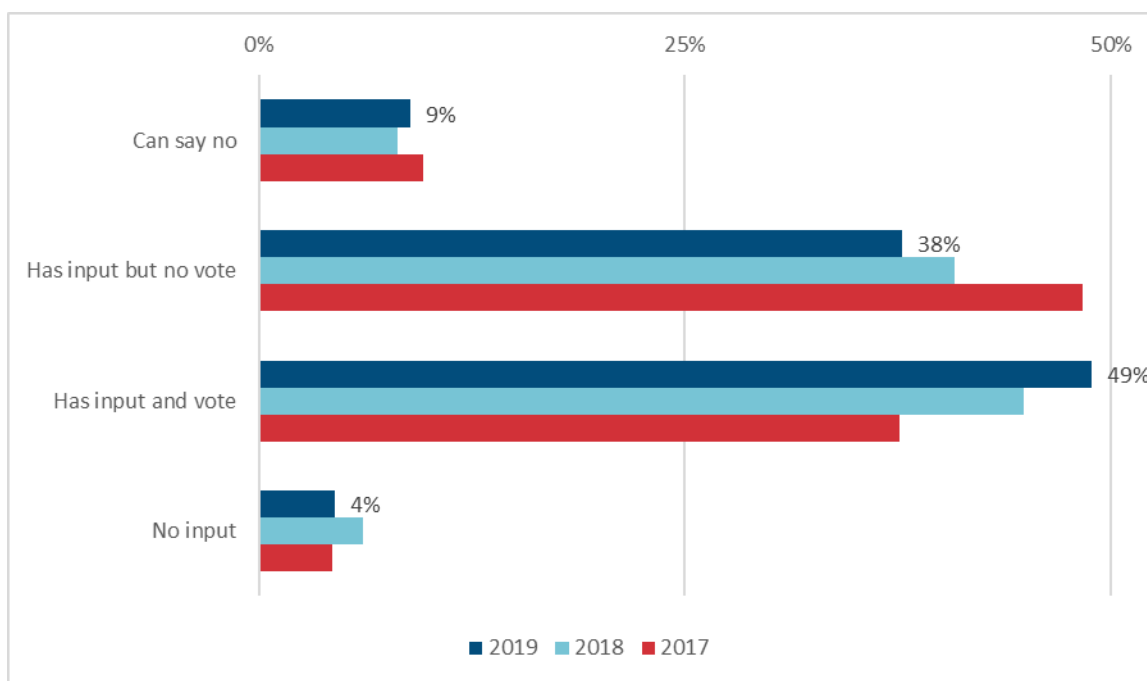
Respondents were asked to share examples of the ERM department being recognized following a risk event, in either a positive or negative way. Many of the examples spoke of scenario planning that was developed by the ERM unit. A few examples were specific and provide guidance to risk teams of where successes and failures might be recognized.

- *Correctly identified that California wildfire risk was something that needed to be reduced*
- *Our CRO blamed the actuaries for not anticipating an assumption change on a recently purchased block of business. This assumption change led to a significant increase in reserves and infusion of capital. The CRO was so focused on operational risks that he forgot to consider the insurance risks.*
- *Usually ERM function doesn't get credit for risks that don't happen, but in fact they are often responsible for avoiding those risks.*
- *Positively – correctly predicting staff retention risk as very high*
- *We recently sold off insurance wing. This was decision motivated by ERM function as the insurance business was too risky and demanded too much capital.*

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 included asset class opportunities as well as waiting until excesses had worked off. Here are some specific examples:

- *Bargain asset purchases during a downturn*
- *Capital and regulatory arbitrage*
- *I am very pessimistic about market prospects given the wide range of geopolitical threats faced.*
- *We look at potential acquisitions of smaller competitors.*

Respondents were asked if they had identified bubbles. Only one indicated concern with the general concept. Debt of various kinds, shadow banks and localized real estate markets were suggested.

- *I don't know what that means.*
- *China shadow banking system*
- *Just about everything financial is in a bubble: bonds, stocks, derivatives.*
- *Asset over-valuation for fossil fuel industries*
- *The whole world seems to be going crazy around marijuana (medical use or otherwise).*
- *Real state in Bogota*
- *Cryptocurrencies*

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 low interest rates, pandemics and illiquid assets.

- *Pandemic*
- *Cyber threats – use industry stats*
- *Cost of Care for Long Term Care; scenario analysis*
- *Increasing natural catastrophes – use of more sophisticated AI predictive modelling*
- *Non-liquid assets in unit-linked contracts*
- *Climate change e.g., coastal sea level rise – avoid commercial mortgages and property ownership in areas likely to flood permanently*

4.9 SECTION E: DEMOGRAPHICS

Each year, the *Survey of Emerging Risks* is distributed using targeted emails and social media. For this survey, 40% reported filling out the survey in the past. One of the sponsors, the JRMS, was well represented in the survey, with 78% of respondents holding a credential from the SOA, 8% from the CAS and 14% from the CIA (see Figure 59). Other groups strongly represented were CFA charter holders (7%),

those holding the FIA credential from the Institute of Actuaries (5%) and those with a master's degree in business administration (7%). Many respondents held multiple credentials.

Figure 59: Credentials Held by Respondents

% of Responses in Given Year
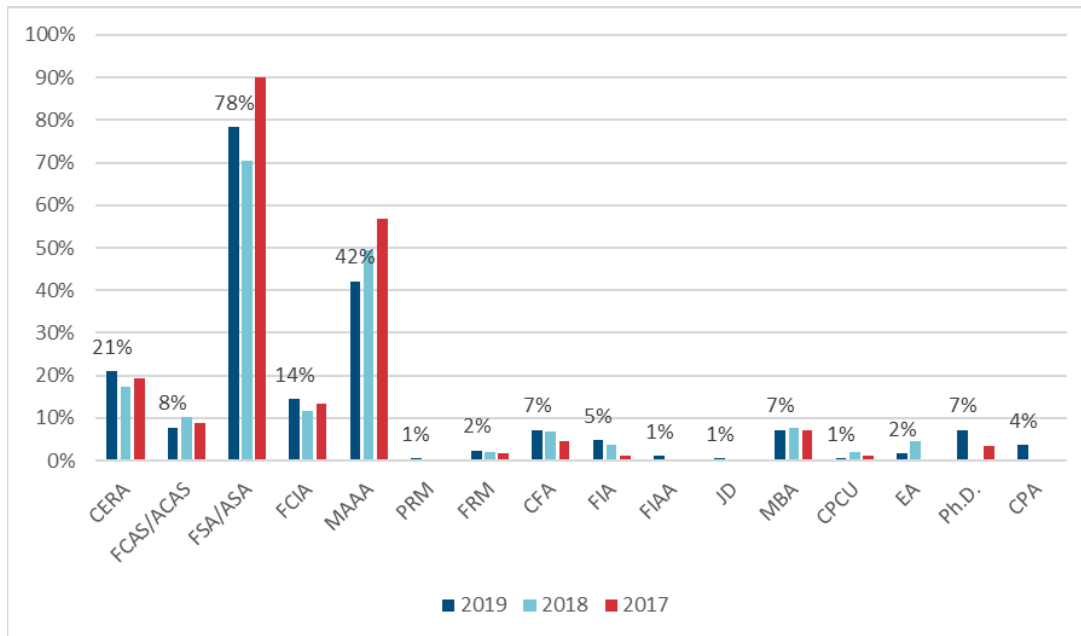
This year's survey was completed by more experienced practitioners, with only 22% having less than 3 years of experience as risk managers (see Figure 60). The researcher is again indebted to respondents who share their experiences. Most respondents work at an insurer/reinsurer (52%) or consulting firm (27%).

Figure 60: Respondents' Risk Management Experience

% of Responses in Given Year
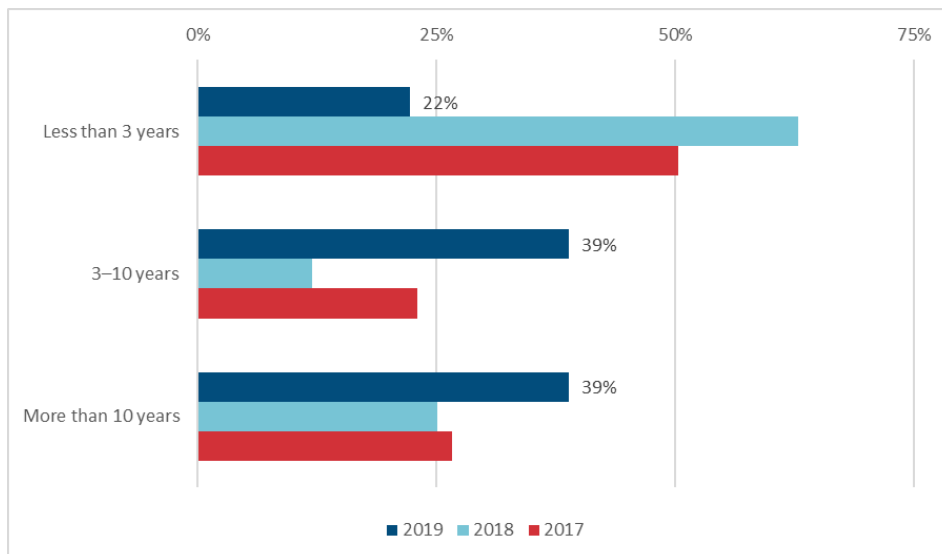
The survey was sent directly to all JRMS, INARM and IAA AFIR-ERM members, some targeted social media groups on LinkedIn and Twitter, and to the members of several SOA sections.

The survey continued to be dominated by North Americans (79%), with a significant minority coming from Europe (8%) and Asia (3%). This year, surveys were also completed by risk managers in the Middle Eastern, South American, Caribbean/Bermuda, Australia/Pacific and African regions.

As illustrated in Figure 61, the primary areas of practice were life insurance (36%), health (16%), pensions (14%), property/casualty (12%) and risk management (11%).

Figure 61: Respondents' Practice Areas

% of Responses in Given Year
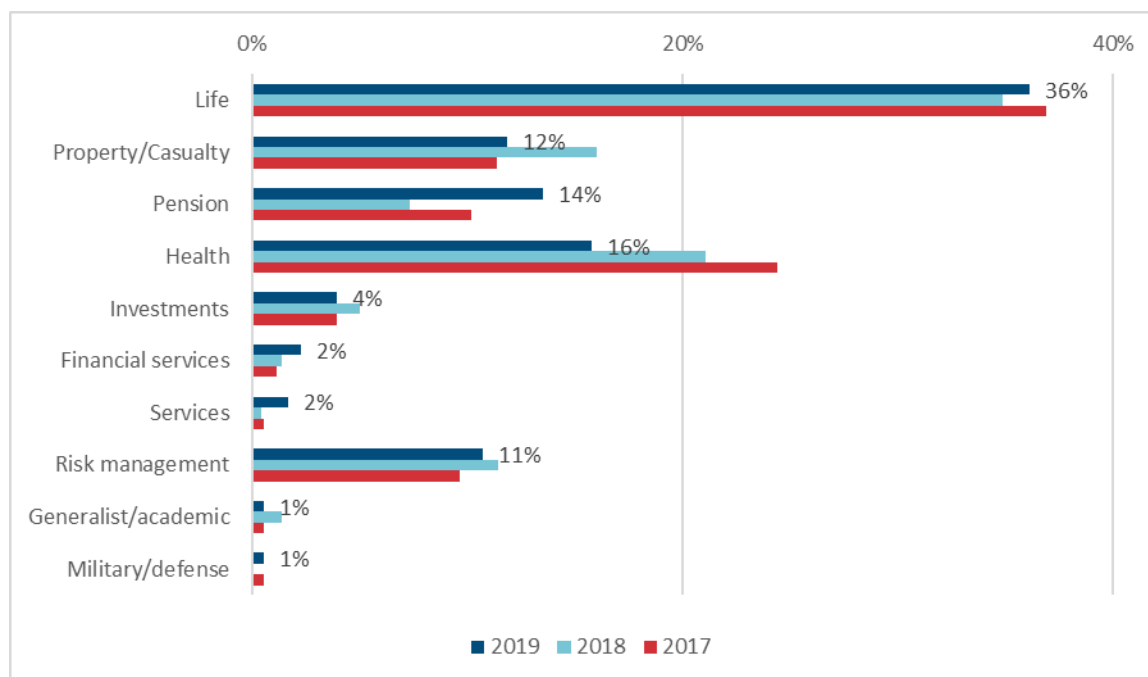
A final survey question asked for sources respondents use to scan for emerging risks. While you are encouraged to read all of the responses for personal interest, many respondents shared news services, the *Wall Street Journal*, magazines (e.g., *The Economist*, *Insurance ERM*, *National Geographic*), PESTLE (political, economic, social, technological, legal, environmental) analysis, reinsurer and consultant publications, rating-agency reports, seminars, blogs, government agencies, professional actuarial organizations (e.g., the CAS, SOA and CIA), the WEF, the Global Risk Institute, the CDC and WHO, and the CRO Forum. This survey was referenced by several respondents as a good source, meeting the hopes of the researcher.

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 IAA publicized the survey, and hopefully this partnership can continue and lead to other cross-networking opportunities. Here are specific suggestions made by the researcher, POG and respondents:

- *Risks to consider: food insecurity*
- *For Figure showing risk combinations selected 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.*
- *Combinations table in Appendix II should be larger, perhaps rotated to a full page*
- *Globalization shift – mention trade wars and populism in definition*
- *Currency shock – definition should refer to central banks*
- *Failing states – widening social rifts?*
- *Note in email that anyone can fill out the first section and if you aren't comfortable with the other parts just forward to the demographics section and submit*
- *Section C Question 5 – define systemic*
- *Section C Question 5 – ask how COVID has changed its scenarios built around technology*

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 a description of the current 23 risks used by the *Survey of Emerging 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, demographics, 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, ecosystem biodiversity (e.g., insects, shell fish) 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—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.
- Wars (including civil wars)—Wars erupt between or within countries.
- 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. Political uncertainty. 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/medical delivery—Diseases such as obesity, diabetes and cardiovascular become widespread. Material changes to medical delivery.
- 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 increases in the spread and size of litigiousness and speed of regulatory revisions.

Technological Risks

- Cyber/networks—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.
- Disruptive 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 risk definitions 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 the Economic to Societal category and renamed it *Demographic shift*; updated trend data to make it consistent going forward
- Added *Financial volatility—price instability of core products such as commodities, energy or currency* to the 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." Comments in 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

2019—Changes to the names of five risks and update to the definitions of six risks

- Changed definition of *Chinese destabilization* to include demographics
- Changed definition of *Climate change* to include ecosystem biodiversity (e.g., insects, shell fish)
- Changed name of *Natural catastrophe: severe weather (except tropical storms)* to *Natural catastrophe: severe weather*
- Changed name and definition of *Interstate and civil wars* to clarify that all wars were included. The risk is now called *Wars (including civil wars)*
- Definition of *Globalization shift* adds "Political uncertainty."
- Updates name and definition of *Chronic diseases* to incorporate medical delivery (e.g., change to single-payer system)
- Changed definition of *Liability regimes/regulatory framework* to include increases in the spread and size of litigiousness

- Changed name of *Cyber/network infrastructure* to *Cyber/networks*, but definition is unchanged
- Changed name of *Technology* to *Disruptive technology* due to suggestions in prior survey

Appendix II: 13th Survey Results (Compiled Fall 2019)

This appendix includes the survey as well as the responses. There were 232 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 for recurring questions 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 five 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.

****

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
End of September	Fall 2011	1,131.42	78.93	1.34
	Fall 2012	1,440.67	92.18	1.29
End of September	Fall 2013	1,681.55	102.36	1.35
End of September	Fall 2014	1,972.29	91.17	1.26
End of October	Fall 2015	2,079.36	46.60	1.10
End of October	Fall 2016	2,126.15	46.83	1.10
End of October	Fall 2017	2,575.26	54.36	1.16
End of October	Fall 2018	2,711.74	65.31	1.14
End of October	Fall 2019	2,976.74	54.09	1.09

Sources:
S&P 500 https://fred.stlouisfed.org/series/SP500
Oil price ($ per barrel) www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D
EUR/USD 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 soon followed. Today's survey reflects a doubling of the S&P 500, much lower prices for oil and a stronger dollar.

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 regularly updated its list, despite a stated time horizon of 10 years, and recent reports include 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 as described in Appendix I.

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

232 total responses

- 37 responses   (16%)   Financial impact on the world economy
- 41 responses   (18%)   Disruption to the world economy
- 50 responses   (22%)   Financial impact on me personally or my firm/industry
- 20 responses   (9%)   Disruption to me personally or my firm/industry
- 20 responses   (9%)   Financial impact on lives, habitat and safety
- 59 responses   (25%)   Disruption to lives, habitat and safety
- 5 responses   (2%)   Other
    - *Financial and reputational impacts on my firm/industry*
    - *Global climate change*
    - *All of the above*
    - *Disruption to habitat and economy, affecting our safety*
    - *Unbalance effect on one or more categories*

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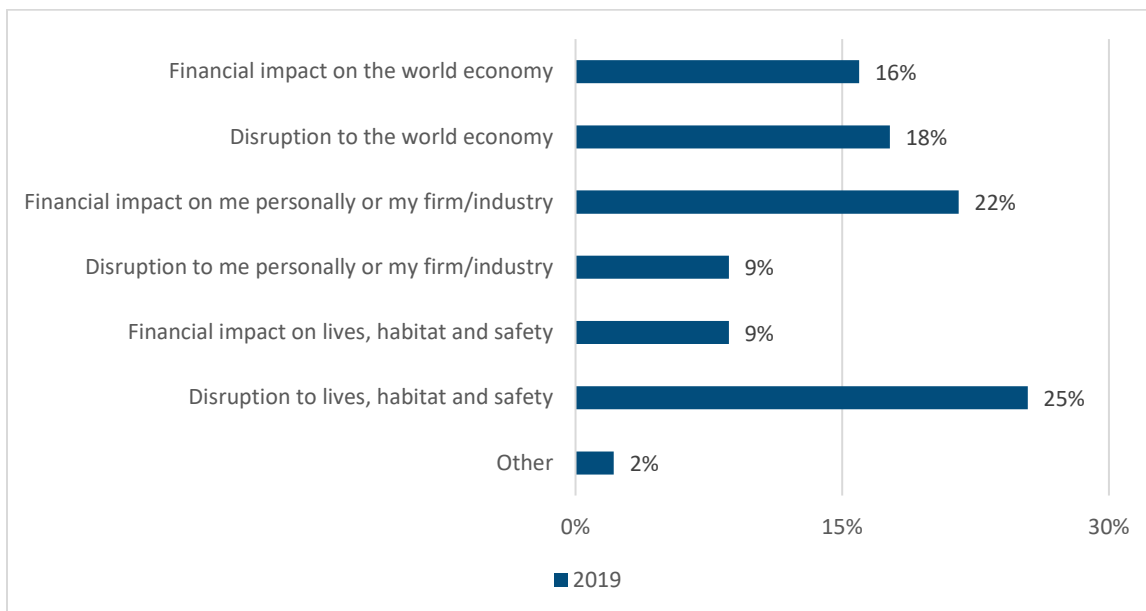
Question 2. What is the risk that currently has the greatest impact? (Please select one.)

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.)

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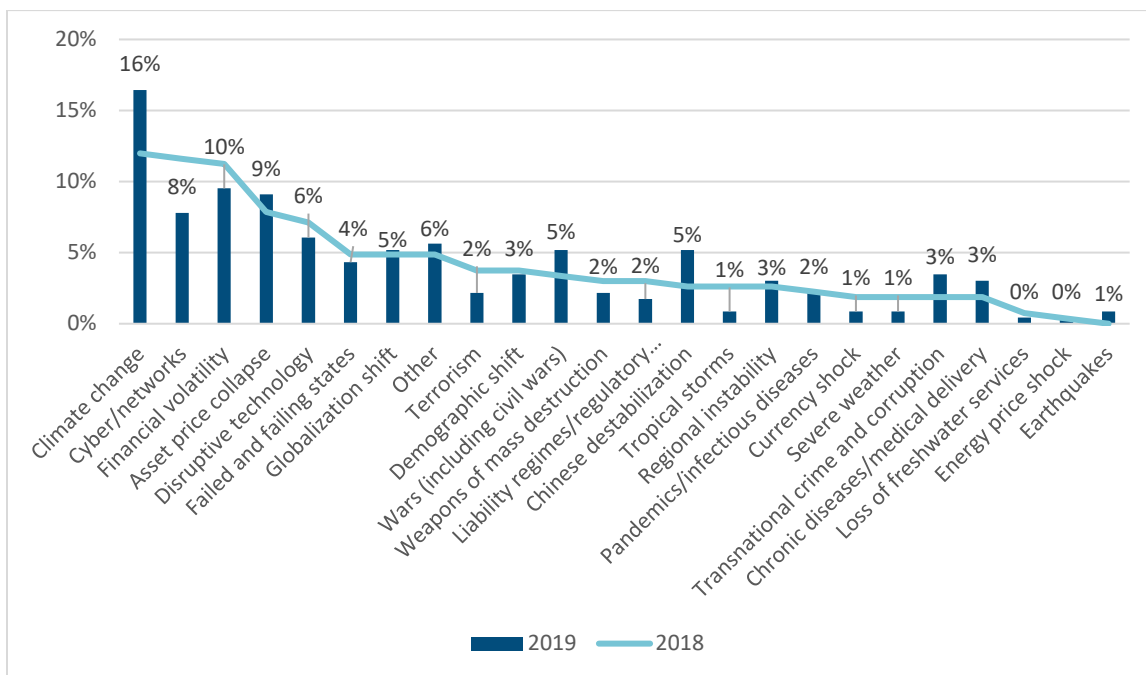
In the following tables of responses, when previous results were above 2%, **boldface** is used to indicate a five percentage point increase or doubling, and *italics* indicate a five percentage point decrease or halving. The leading responses are numbered 1 through 5 to the left of the terms for those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

231 total responses

In the detail shown in this appendix, the amount in parentheses are shown with the most recent to the far left and as you move to the right the responses for previous surveys are shared.

Economic—58 responses (25%/24%/22%/27%/33% in 2019/2018/2017/2016/2015)

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

Environmental—45 responses (19%/17%/16%/13%/15%)

• 38 responses	(16%/12%/11%/10%/8%)	1	Climate change
• 1 response	(0%/1%/1%/1%/2%)		Loss of freshwater services
• *2 responses*	*(1%/3%/2%/0%/1%)*		*Natural catastrophe: tropical storms*
• 2 responses	(1%/0%/1%/0%/1%)		Natural catastrophe: earthquakes
• 2 responses	(1%/2%/0%/1%/3%)		Natural catastrophe: severe weather

Geopolitical—59 responses (26%/24%/33%/29%/19%)

• *5 responses*	*(2%/4%/6%/6%/6%)*		*Terrorism*
• 5 responses	(2%/3%/6%/4%/2%)		Weapons of mass destruction
• 12 responses	(5%/3%/6%/4%/4%)		Wars (including civil wars)
• 10 responses	(4%/5%/4%/5%/2%)		Failed and failing states
• 8 responses	(3%/2%/2%/1%/0%)		Transnational crime and corruption
• 12 responses	(5%/5%/4%/8%/1%)		Globalization shift
• 7 responses	(3%/3%/5%/0%/4%)		Regional instability

Societal—24 responses (10%/11%/10%/9%/12%)

- • 5 responses   (2%/2%/3%/4%/3%)   Pandemics/infectious diseases

- • 7 responses   (3%/2%/1%/0%/0%)   Chronic diseases/medical delivery

- • 8 responses   (3%/4%/2%/2%/3%)   Demographic shift

- • 4 responses   (2%/3%/4%/3%/5%)   Liability regimes/regulatory framework

Technological—32 responses (14%/19%/18%/15%/18%)

- • 18 responses   (8%/12%/13%/11%/15%)   4   Cyber/networks

- • 14 responses   (6%/7%/6%/4%/3%)   5   Disruptive technology

Other—13 responses (6%/5%/1%/7%/3%)

- *Socialist and far left political agendas*
- *Populism*
- *Populism and failing democracies*
- *Trade Wars*
- *Central Banking*
- *Combination of cyber linked to nation sponsored terrorism/actors couple with changing globalization*
- *Government regulation (political changes)*
- *Ignorance of the population with the ability to impact global decisions*
- *China/US relations (incl Hong Kong), Brexit – ie political instability*
- *Global population growth*
- *Geopolitical risks from income inequality and societal polarization*
- *US political instability*
- *Rise of right wing nationalism in liberal democracies*

Current Risk with Greatest Impact
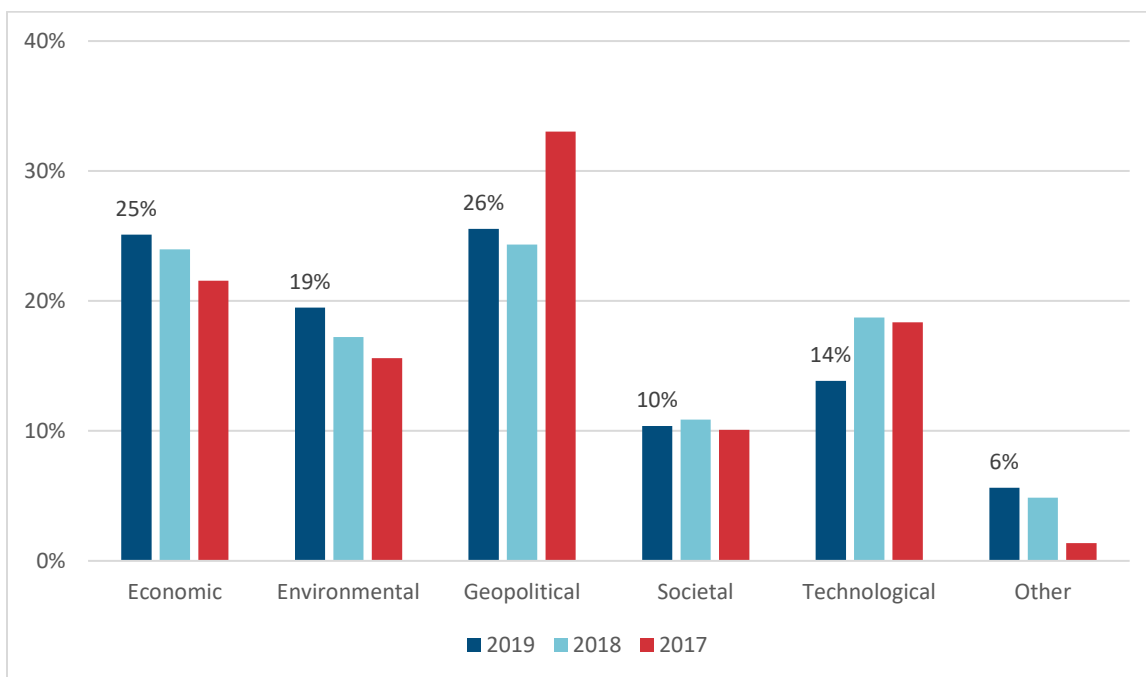
The categories of risks having the current greatest impact were:

- Economic   25%/24%/22%/27%/33% in 2019/2018/2017/2016/2015
- Environmental   19%/17%/16%/13%/15%
- Geopolitical   26%/24%/33%/29%/19%
- Societal   10%/11%/10%/9%/12%
- Technological   14%/19%/18%/15%/18%
- Other   6%/5%/1%/7%/3%

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.

1,074 total responses from 226 surveys

Average of 4.75 risks selected per survey (4.68 in prior survey)

Divisor in percentages for major categories is 1,074; for individual risks, it is 226. 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: 2 surveys (1%)
- 2: 4 surveys (2%)
- 3: 6 surveys (3%)
- 4: 24 surveys (11%)
- 5: 190 surveys (84%)

Emerging Risks by Category (Up to Five Risks Chosen per Survey)
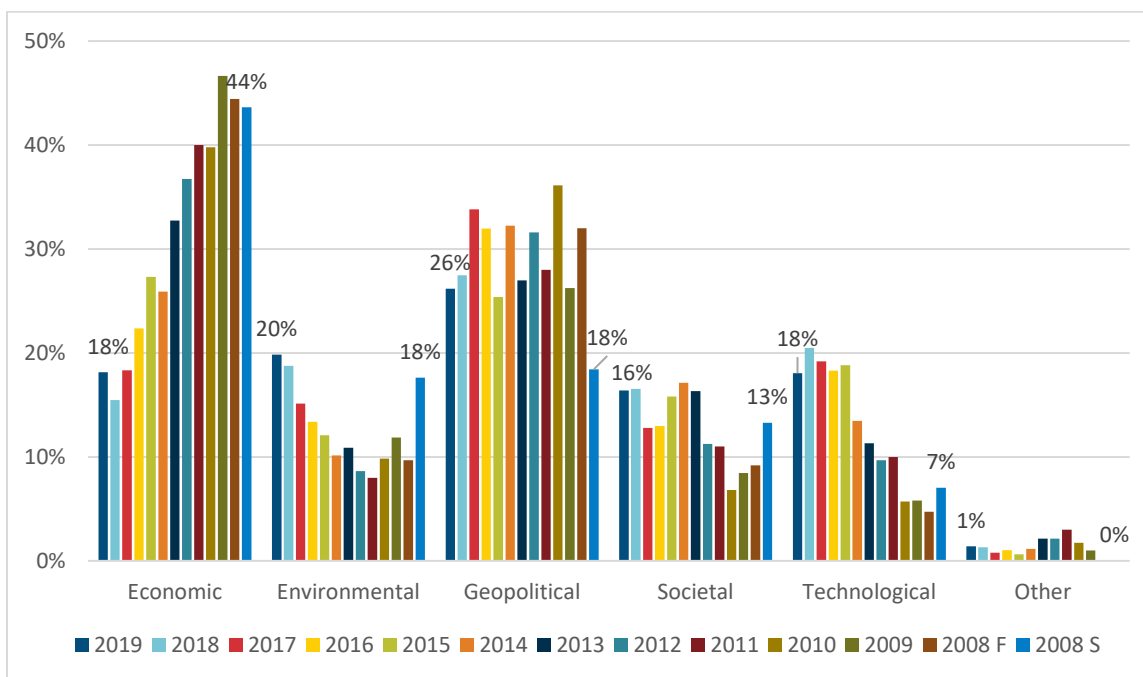
Economic—195 responses (18%/15%/18%/22%/27%/26%/33%/37%/40%/40%/47%/44%/44% in November 2019, November 2018, November 2017, November 2016, November 2015, October 2014, October 2013, October 2012, October 2011, October 2010, December 2009, November 2008, April 2008, usually listed as 2019/2018/2017/2016/2015/2014/2013/2012/2011/2010/2009/F2008/S2008)

• 15 responses	(7%/6%/5%/10%/14%/13%/7%/31%/32%/40%/45%)		Energy price shock
• 15 responses	(7%/7%/7%/10%/14%/7%/27%/26%/25%/49%/66%)		Currency shock
• 52 responses	**(23%/15%/16%/17%/25%/27%/28%/31%/32%/41%/33%)**		**Chinese destabilization**
• 48 responses	(21%/19%/30%/26%/31%/31%/30%/24%/22%/31%/49%)		Asset price collapse
• 65 responses	(29%/27%/29%/43%/45%/44%/59%/62%/68%)	5	Financial volatility

Environmental—213 responses (20%/19%/15%/13%/12%/10%/11%/9%/8%/10%/12%/10%/18%)

• 121 responses	**(54%/49%/29%/28%/26%/19%/16%/20%/14%/25%/27%)**	1	Climate change
• 28 responses	(12%/13%/11%/9%/8%/8%/9%/11%/6%/9%/10%)		Loss of freshwater services
• 19 responses	(8%/8%/16%/8%/6%/5%/8%/6%/5%/4%/8%)		Natural catastrophe: tropical storms

| • 9 responses | (4%/6%/6%/9%/7%/5%/6%/2%/6%/5%/7%) | | Natural catastrophe: earthquakes |
| • 36 responses | (16%/12%/10%/9%/10%/11%/11%/1%/4%/2%/5%) | | Natural catastrophe: severe weather |

Geopolitical—281 responses (26%/27%/34%/32%/25%/32%/27%/32%/28%/36%/26%/32%/18%)

• *39 responses*	*(17%/23%/41%/39%/37%/41%/27%/28%/20%/43%/30%)*		*Terrorism*
• 20 responses	(9%/13%/21%/9%/8%/9%/5%/14%/9%/18%/14%)		Weapons of mass destruction
• **57 responses**	**(25%/18%/19%/16%/19%/19%/13%/14%/10%/10%/9%)**		**Wars (including civil wars)**
• *42 responses*	*(19%/25%/14%/21%/18%/28%/29%/33%/42%/38%/18%)*		*Failed and failing states*
• 28 responses	(12%/12%/14%/10%/5%/10%/8%/5%/3%/12%/7%)		Transnational crime and corruption
• 45 responses	(20%/20%/20%/30%/6%/8%/13%/13%/11%/25%/18%)		Globalization shift
• 50 responses	(22%/18%/31%/26%/26%/37%/29%/42%/32%/25%/28%)		Regional instability

Societal—176 responses (16%/17%/13%/13%/16%/17%/16%/11%/11%/7%/8%/9%/13%)

• 50 responses	(22%/25%/14%/16%/17%/30%/19%/12%/13%/22%/30%)		Pandemics/ infectious diseases
• 27 responses	(12%/8%/8%/6%/8%/5%/3%/3%/2%/4%/4%)		Chronic diseases/ medical delivery
• 74 responses	(33%/32%/23%/24%/26%/23%/30%/30%/30%/26%/27%)	4	Demographic shift
• 25 responses	(11%/12%/16%/15%/24%/22%/23%/8%/7%/6%/6%)		Liability regimes/ regulatory framework

Technological—194 responses (18%/20%/19%/18%/19%/14%/11%/10%/10%/6%/6%/5%/7%)

| • *116 responses* | *(51%/56%/53%/53%/65%/58%/47%/40%/38%/23%/21%)* | 2 | *Cyber/networks* |

• *78 responses*   *(35%/40%/38%/34%/24%/5%/5%/6%/5%/4%/7%)*   *3*   *Disruptive technology*

Other—15 responses (7%/1%/6%/1%/1%/1%/1%/2%/2%/3%/2%/1%/4%/4%)

- *Socialist and far left political agendas*
- *Cyber terrorism*
- *Shift to cryptocurrency undermines governments' ability to execute monetary policy*
- *Trade Wars*
- *Autonomous vehicles*
- *Governmental influences*
- *Speed of Technology and the inability to foresee consequences*
- *Changes in global market sentiment*
- *Risks to food chain (e.g., swine fever)*
- *Mismanagement*
- *Growing burden of aging populations (pensions, healthcare)*
- *Income inequality*
- *Chinese nationalism*
- *Collapse of the Central Banking System*

Another way to review this data is as a percentage of the total responses. For example, *Climate change* had 121 responses in this survey. In the previous analysis just shared, 121/226 = 54%. In the following tables, we will look at 121/1,074 = 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.[9]

Results are presented with the average across all 13 surveys first, then listing each result starting with the most recent survey.

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

• *5%—1%/1%/1%/2%/3%/3%/2%/6%/7%/9%/10%/8%/13%*   *Energy price shock*

• *5%—1%/1%/1%/2%/3%/1%/6%/5%/6%/10%/14%/10%/9%*   *Currency shock*

• *6%—5%/3%/3%/4%/5%/6%/6%/7%/7%/9%/7%/6%/9%*   *Chinese destabilization*

• *7%—4%/4%/6%/5%/6%/7%/7%/5%/5%/6%/10%/14%/5%*   *Asset price collapse*

• *10%—6%/6%/6%/9%/9%/9%/13%/13%/15%*   *Financial volatility*

Environmental (13%—20%/19%/15%/13%/12%/10%/11%/9%/8%/10%/12%/9%/17%)

• 6%—11%/11%/6%/6%/6%/4%/4%/4%/3%/5%/6%/5%/9%   Climate change

• 2%—3%/3%/2%/2%/2%/2%/2%/2%/1%/2%/2%/2%/3%   Loss of freshwater services

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

- 2%—2%/2%/3%/2%/1%/1%/2%/1%/1%/1%/2%/1%/2%

  Natural catastrophe: tropical storms

- 1%—1%/1%/1%/2%/1%/1%/1%/0%/1%/1%/1%/1%/2%

  Natural catastrophe: earthquakes

- **2%—3%/3%/2%/2%/2%/2%/2%/0%/1%/0%/1%/0%/1%**

  Natural catastrophe: severe weather

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

- *6%—4%/5%/9%/8%/8%/9%/6%/6%/4%/9%/6%/6%/4%*

  Terrorism

- *3%—2%/3%/4%/2%/2%/2%/1%/3%/2%/4%/3%/3%/4%*

  Weapons of mass destruction

- **3%—5%/4%/4%/3%/4%/4%/3%/3%/2%/2%/2%/2%/3%**

  Wars (including civil wars)

- *5%—4%/5%/3%/4%/4%/6%/6%/7%/9%/8%/4%/6%/2%*

  Failed and failing states

- **2%—3%/2%/3%/2%/1%/2%/2%/1%/1%/3%/2%/2%/2%**

  Transnational crime and corruption

- 4%—4%/4%/4%/6%/1%/2%/3%/3%/2%/5%/4%/5%/2%

  Globalization shift

- *6%—5%/4%/7%/5%/6%/8%/6%/9%/7%/5%/6%/7%/1%*

  Regional instability

Societal (15%—16%/17%/13%/13%/16%/17%/16%/11%/11%/7%/8%/9%/12%)

- 5%—5%/5%/3%/3%/4%/6%/4%/3%/3%/5%/6%/7%/8%

  Pandemics/infectious diseases

- **1%—3%/2%/2%/1%/2%/1%/1%/1%/2%/1%/1%/1%/2%**

  Chronic diseases/medical delivery

- **6%—7%/7%/5%/5%/6%/5%/6%/6%/7%/6%/6%/5%/6%**

  Demographic shift

- *3%—2%/3%/3%/3%/5%/5%/5%/2%/2%/1%/1%/1%/2%*

  Liability regimes/regulatory framework

Technological (12%—18%/20%/19%/18%/19%/13%/11%/10%/10%/6%/5%/4%/7%)

- **9%—11%/12%/11%/11%/14%/12%/10%/8%/8%/5%/4%/3%/5%**

  Cyber/networks

- **4%—7%/9%/8%/7%/5%/1%/1%/1%/1%/1%/1%/1%/2%**

  Disruptive technology

Emerging Risk Trends – Economic (% of Total)

Bar chart showing Emerging Risk Trends – Economic (% of Total) for 2019, 2018, 2017:
- Energy price shock: 2019 = 1%
- Currency shock: 2019 = 1%
- Chinese destabilization: 2019 = 5%
- Asset price collapse: 2019 = 4%
- Financial volatility: 2019 = 6%

Legend: 2019, 2018, 2017

Emerging Risk Trends – Environmental (% of Total)

Bar chart showing Emerging Risk Trends – Environmental (% of Total) for 2019, 2018, 2017:
- Climate change: 2019 = 11%
- Loss of freshwater services: 2019 = 3%
- Tropical storms: 2019 = 2%
- Earthquakes: 2019 = 1%
- Severe weather: 2019 = 3%

Legend: 2019, 2018, 2017

Emerging Risk Trends – Geopolitical (% of Total)

Bar chart showing percentages for 2019, 2018, 2017:

- Terrorism: 4%
- Weapons of mass destruction: 2%
- Wars (including civil wars): 5%
- Failed and failing states: 4%
- Transnational crime and corruption: 3%
- Globalization shift: 4%
- Regional instability: 5%

Legend: ■ 2019 ■ 2018 ■ 2017

Emerging Risk Trends – Societal (% of Total)

Bar chart showing percentages for 2019, 2018, 2017:

- Pandemics/infectious diseases: 5%
- Chronic diseases/medical delivery: 3%
- Demographic shift: 7%
- Liability regimes/regulatory framework: 2%

Legend: ■ 2019 ■ 2018 ■ 2017

Emerging Risk Trends – Technological (% of Total)

Cyber/networks — 11%

Disruptive technology — 7%
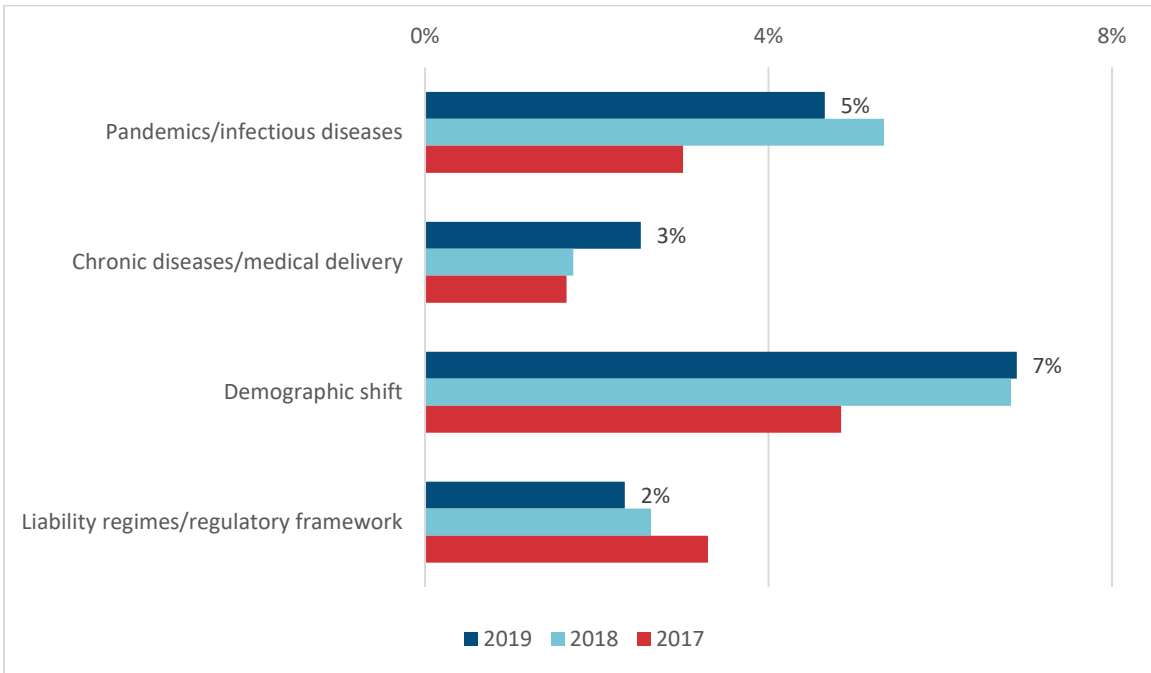
Legend: 2019 · 2018 · 2017
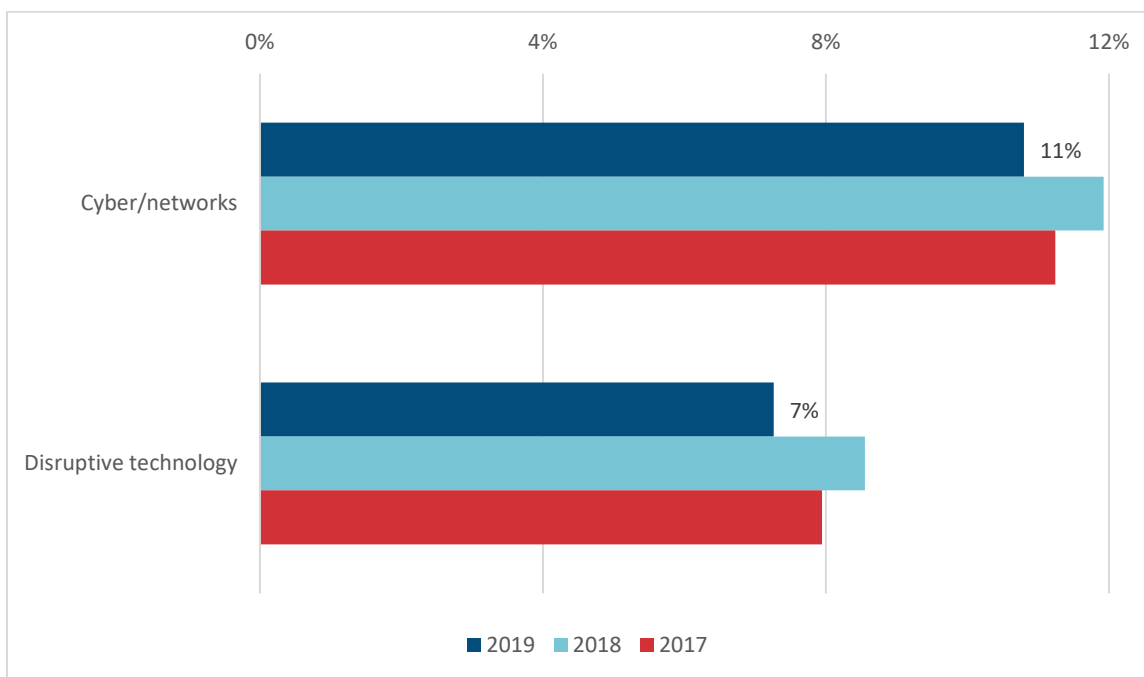
Top Five Emerging Risks as Percentage of Total (Not by Number of Surveys)	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	F 2008	S 2008	Average
1 Energy price shock	1%	1%	1%	2%	3%	3%	2%	6%	7%	9%	10%	8%	13%	5%
2 Currency shock	1%	1%	1%	2%	3%	1%	6%	5%	6%	10%	14%	10%	9%	5%
3 Chinese destabilization	5%	3%	3%	4%	5%	6%	6%	7%	7%	9%	7%	6%	9%	6%
4 Asset price collapse	4%	4%	6%	5%	6%	7%	7%	5%	5%	6%	10%	14%	5%	7%
5 Financial volatility	6%	6%	6%	9%	9%	9%	13%	13%	15%					10%
6 Climate change	11%	11%	6%	6%	6%	4%	4%	4%	3%	5%	6%	5%	9%	6%
7 Loss of freshwater services	3%	3%	2%	2%	2%	2%	2%	2%	1%	2%	2%	2%	3%	2%
8 Tropical storms	2%	2%	3%	2%	1%	1%	2%	1%	1%	1%	2%	1%	2%	2%
9 Earthquakes	1%	1%	1%	2%	1%	1%	1%	0%	1%	1%	1%	1%	2%	1%
10 Severe weather	3%	3%	2%	2%	2%	2%	2%	0%	1%	0%	1%	0%	1%	2%
11 Terrorism	4%	5%	9%	8%	8%	9%	6%	6%	4%	9%	6%	6%	4%	6%
12 Weapons of mass destruction	2%	3%	4%	2%	2%	2%	1%	3%	2%	4%	3%	3%	4%	3%
13 Wars (including civil wars)	5%	4%	4%	3%	4%	4%	3%	3%	2%	2%	2%	2%	3%	3%
14 Failed and failing states	4%	5%	3%	4%	4%	6%	6%	7%	9%	8%	4%	6%	2%	5%
15 Transnational crime and corruption	3%	2%	3%	2%	1%	2%	2%	1%	1%	3%	2%	2%	2%	2%
16 Globalization shift	4%	4%	4%	6%	1%	2%	3%	3%	2%	5%	4%	5%	2%	4%
17 Regional instability	5%	4%	7%	5%	6%	8%	6%	9%	7%	5%	6%	7%	1%	6%
18 Pandemics/infectious diseases	5%	5%	3%	6%	6%	4%	4%	3%	3%	5%	6%	7%	8%	5%
19 Chronic diseases/medical delivery	3%	2%	2%	1%	2%	1%	1%	1%	2%	1%	1%	1%	2%	1%
20 Demographic shift	7%	7%	5%	5%	6%	5%	6%	6%	7%	6%	6%	5%	6%	6%
21 Liability regimes/regulatory framework	2%	3%	3%	3%	5%	5%	5%	2%	2%	1%	1%	1%	2%	3%
22 Cyber/networks	11%	12%	11%	11%	14%	12%	10%	8%	8%	5%	4%	3%	5%	9%
23 Disruptive technology	7%	9%	8%	7%	5%	1%	1%	1%	1%	1%	1%	1%	2%	4%
24 Other	1%	1%	1%	1%	1%	1%	2%	2%	3%	2%	1%	4%	4%	2%

Top Emerging Risks (Choose Up to Five)
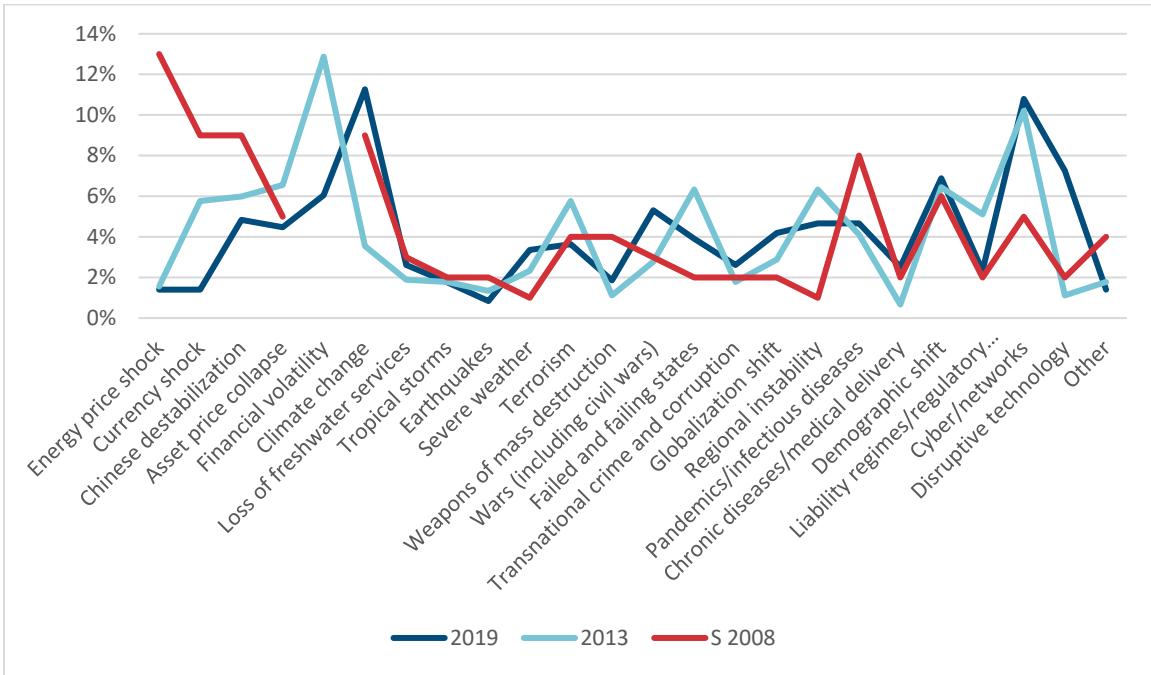
What follows are two versions of the same chart, with the first one sorted based on the prior survey's results. The data labels in the first chart reflect 2019 results.

Year-Over-Year Emerging Risks (Up to Five Risks Chosen per Survey)
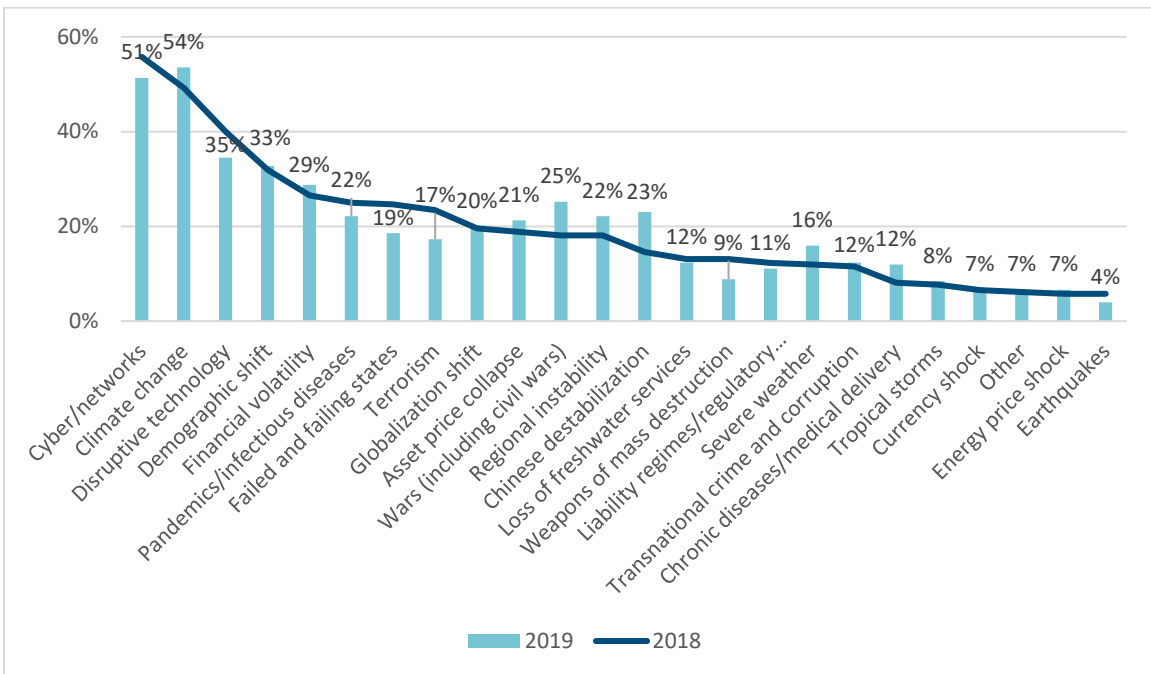
Year-Over-Year Emerging Risks (Up to Five Risks Chosen per Survey)
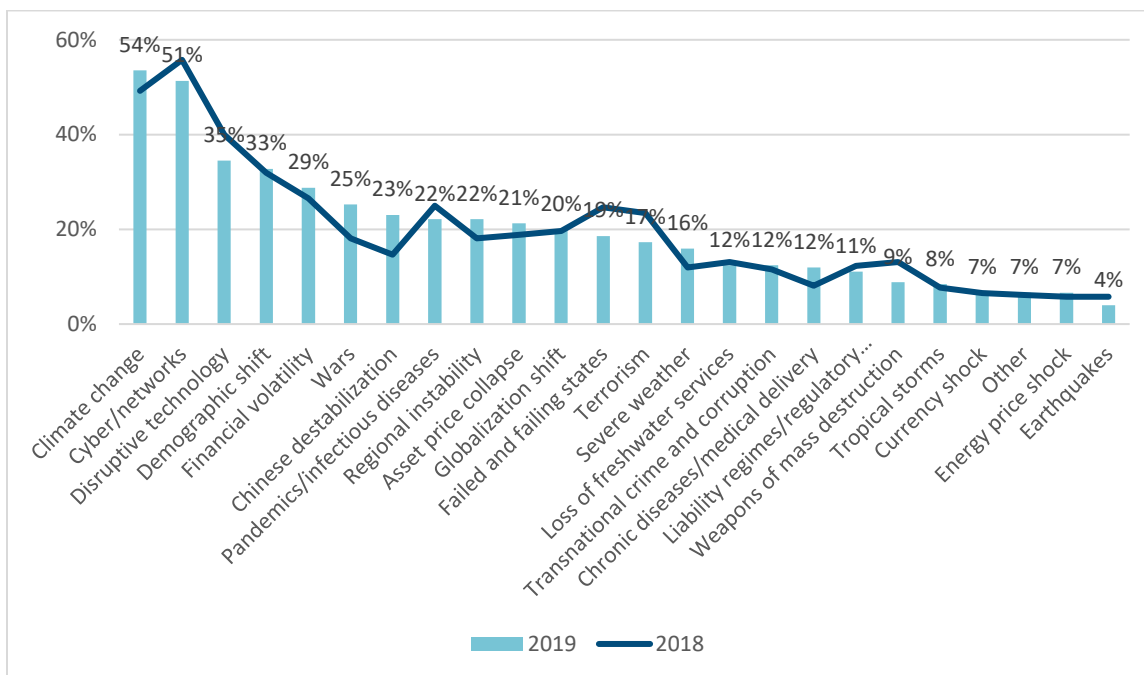
<mark>Question 2.</mark> Out of these five, what one emerging risk would you rank number one as having the greatest impact?

226 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—40 responses (18%/13%/20%/27%/30%/31%/44%/54%/56%/48%/63%/65%)

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

Environmental—72 responses (32%/26%/9%/8%/8%/5%/6%/6%/4%/7%/12%/4%)

• 61 responses	(27%/22%/7%/6%/6%/3%/4%/5%)	1	Climate change
• 6 responses	(3%/2%/0%/0%/0%/0%/0%/0%)		Loss of freshwater services
• 1 response	(0%/1%/0%/0%/0%/1%/0%/1%)		Natural catastrophe: tropical

storms

• 0 responses	(0%/0%/0%/0%/0%/0%/0%/0%)	Natural catastrophe: earthquakes
• 4 responses	(2%/1%/0%/1%/1%/1%/0%)	Natural catastrophe: severe weather

Geopolitical—40 responses (18%/18%/32%/29%/22%/31%/17%/23%/22%/28%/14%/18%)

• 5 responses	(2%/2%/9%/3%/6%/8%/4%/1%)	Terrorism
• 2 responses	(1%/1%/2%/3%/2%/2%/1%/1%)	Weapons of mass destruction
• 7 responses	(3%/3%/4%/4%/4%/3%/2%/3%)	Wars (including civil wars)
• 11 responses	(5%/3%/4%/4%/3%/8%/4%/8%)	Failed and failing states
• 5 responses	(2%/2%/1%/1%/0%/0%/1%/0%)	Transnational crime and corruption
• 6 responses	(3%/4%/4%/10%/0%/2%/1%/3%)	Globalization shift
• 4 responses	(2%/3%/7%/3%/6%/8%/4%/7%)	Regional instability

Societal—20 responses (9%/12%/11%/8%/10%/16%/13%/6%/5%/4%/2%/2%)

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

Technological—47 responses (21%/28%/26%/24%/28%/15%/15%/8%/8%/9%/6%/6%)

• 23 responses	(10%/15%/16%/17%/23%/14%/14%/7%)	3	Cyber/networks
• 24 responses	(11%/13%/10%/7%/5%/1%/1%/1%)	2	Disruptive technology

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

- *Socialist and far left political agendas*
- *Autonomous vehicles*
- *Governmental influences*
- *Mismanagement*
- *Income inequality*
- *Collapse of the Central Banking System*

Top Emerging Risks by Category – Single Greatest Impact
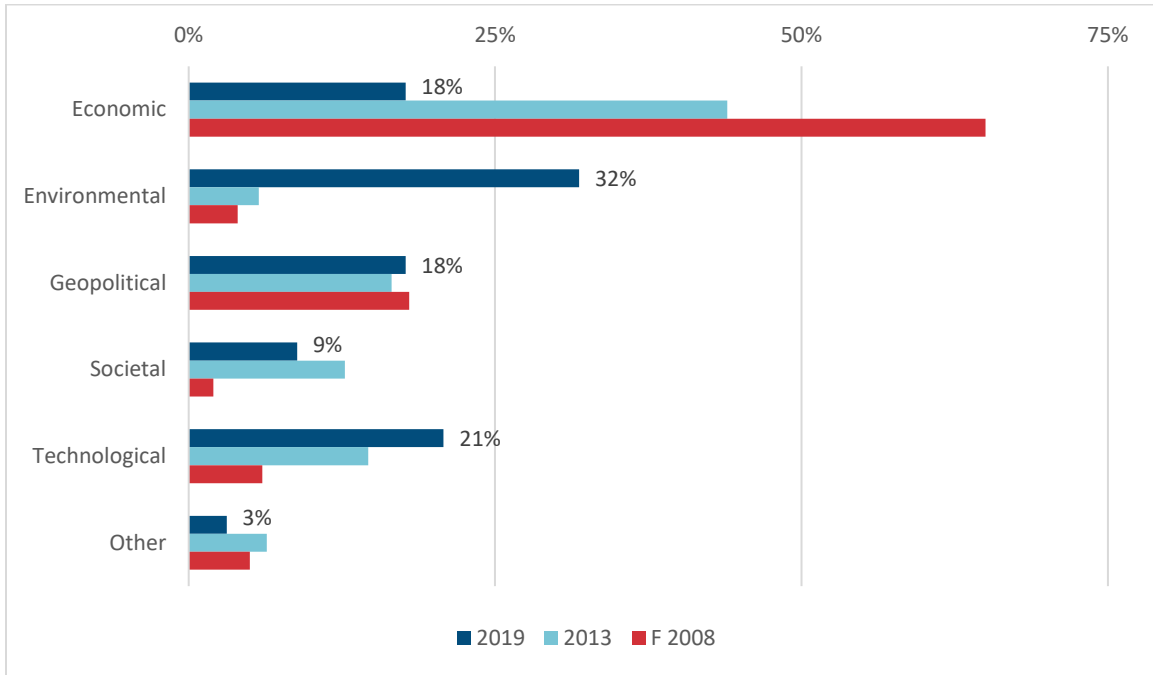
Category Comparison Across Three Questions

Top Emerging Risks – Economic (% of Total)

Legend: ■ 2019 ■ 2018 ■ 2017

- Energy price shock: 1%
- Currency shock: 0%
- Chinese destabilization: 4%
- Asset price collapse: 6%
- Financial volatility: 6%

Top Emerging Risks – Environmental (% of Total)

Legend: ■ 2019 ■ 2018 ■ 2017

- Climate change: 27%
- Loss of freshwater services: 3%
- Tropical storms: 0%
- Earthquakes: 0%
- Severe weather: 2%

Top Emerging Risks – Geopolitical (% of Total)

Legend: ■ 2019 ■ 2018 ■ 2017

- Terrorism: 2%
- Weapons of mass destruction: 1%
- Wars (including civil wars): 3%
- Failed and failing states: 5%
- Transnational crime and corruption: 2%
- Globalization shift: 3%
- Regional instability: 2%

Top Emerging Risks – Societal (% of Total)

Legend: ■ 2019 ■ 2018 ■ 2017

- Pandemics/infectious diseases: 2%
- Chronic diseases/medical delivery: 0%
- Demographic shift: 5%
- Liability regimes/regulatory framework: 2%

Top Emerging Risks – Technological (% of Total)

Legend: ■ 2019 ■ 2018 ■ 2017

Cyber/networks: 10%
Disruptive technology: 11%

Emerging Risks

Values: 1%, 1%, 5%, 4%, 6%, 11%, 3%, 2%, 1%, 3%, 4%, 2%, 5%, 4%, 3%, 4%, 5%, 5%, 3%, 7%, 2%, 11%, 7%

Legend: ■ Top 5 Emerging — Top Emerging

Risk Comparison Across Three Questions

<mark>**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.</mark>

Two-risk combinations—**630 total responses (mean across all surveys is listed first)**

Economic 34% average (23%/22%/23%/28%/33%/35%/40%/46%/48%/45%/53%/49%)

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

Environmental 13% average (20%/21%/15%/12%/12%/10%/11%/9%/7%/11%/13%/9%)

- 6-(12%/11%/7%/5%/4%/4%/4%/4%)   1   Climate change
- 2-(3%/3%/2%/2%/2%/2%/2%/2%)   Loss of freshwater services

- 2-(2%/3%/3%/2%/2%/1%/2%/1%)   Natural catastrophe: tropical storms

- 1-(0.5%/1%/1%/1%/1%/0.4%/0.2%/1%)   Natural catastrophe: earthquakes

- 2-(3%/3%/3%/2%/2%/2%/3%/1%)   Natural catastrophe: severe weather

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

- 7-(5%/5%/8%/9%/8%/9%/6%/6%)   Terrorism

- 3-(2%/3%/4%/2%/2%/2%/4%/4%)   Weapons of mass destruction

- 4-(6%/4%/4%/4%/4%/4%/4%/4%)   Wars (including civil wars)

- 6-(5%/6%/5%/5%/5%/7%/6%/8%)   Failed and failing states

- 2-(2%/3%/3%/3%/2%/2%/4%/1%)   Transnational crime and corruption

- 4-(4%/4%/5%/6%/1%/3%/3%/3%)   Globalization shift

- 6-(6%/5%/7%/6%/5%/7%/6%/7%)   Regional instability

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

- 3-(3%/4%/3%/3%/3%/4%/2%/2%)   Pandemics/infectious diseases

- 1-(2%/2%/2%/1%/1%/1%/0.4%/1%)   Chronic diseases/medical delivery

- 4-(5%/4%/3%/4%/3%/4%/3%/3%)   Demographic shift

- 2-(2%/1%/3%/2%/3%/3%4%/1%)   Liability regimes/regulatory framework

Technological 11% average (15%/15%/17%/15%/17%/8%/9%/5%/7%/4%/3%/2%)

- 7-(8%/9%/10%/10%/12%/7%/7%/5%)   2   Cyber/networks

- 3-(7%/7%/6%/5%/5%/1%/1%/1%)   4   Disruptive technology

Risk Combinations
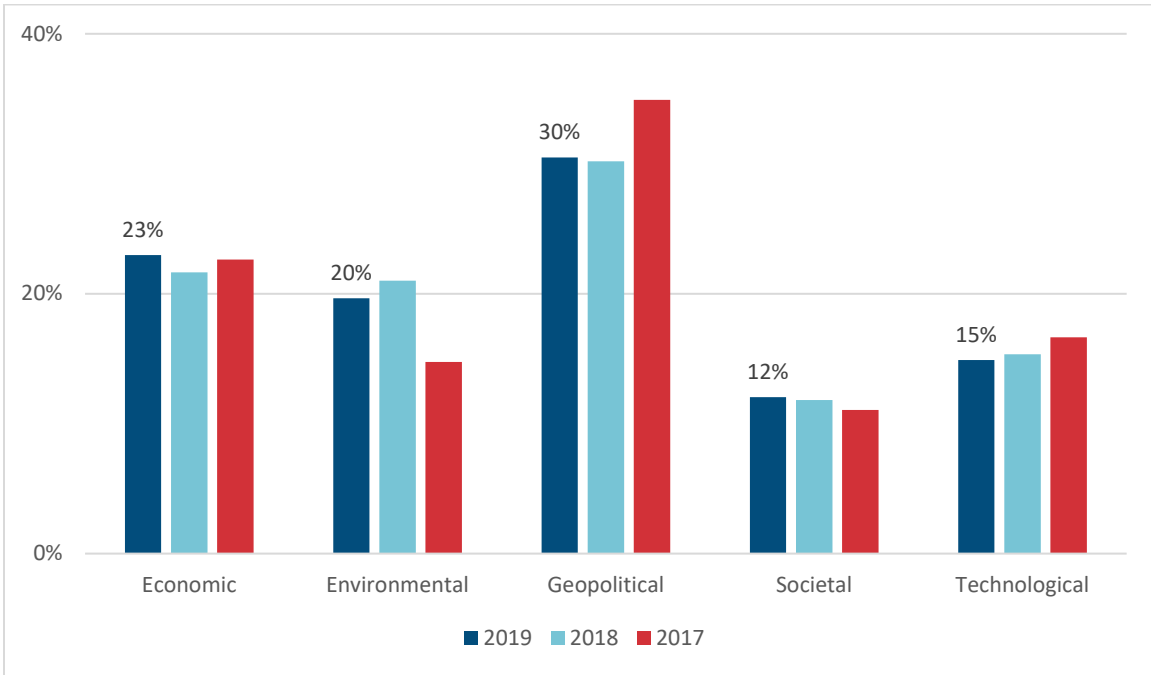
Category Comparison Across Four Questions

Risk Comparison Across Four Questions

Legend: ■ Current ■ Top 5 Emerging ■ Top Emerging ■ Combinations
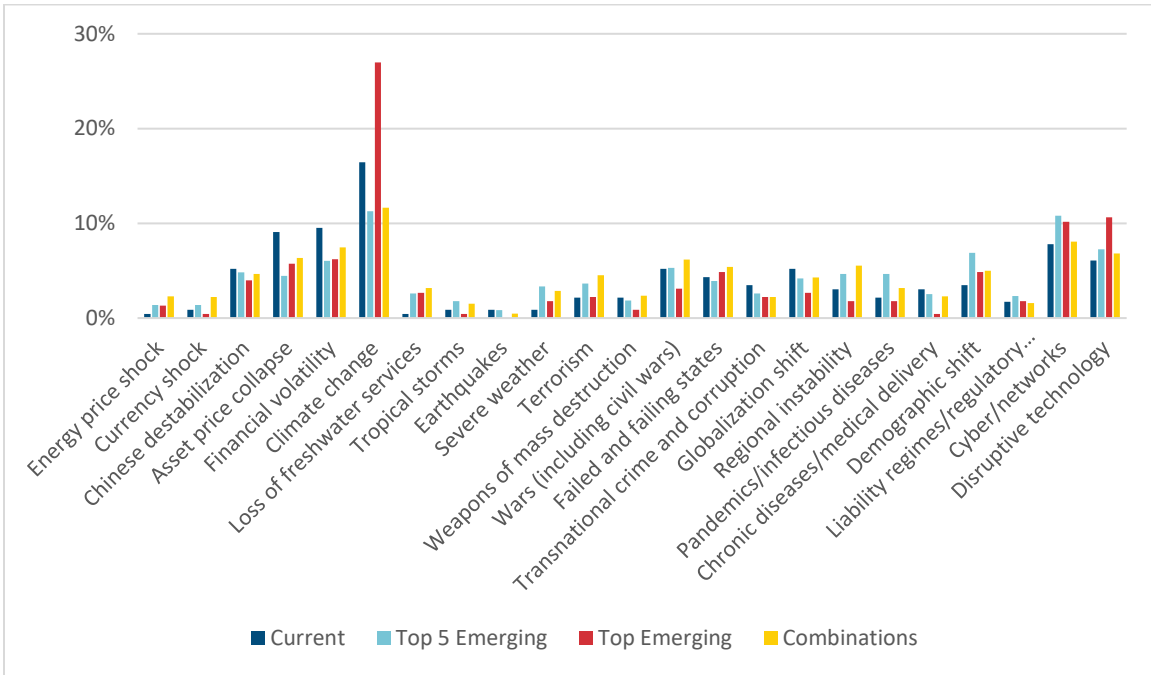
Comparison Across Four Questions	Current	Top 5	Top	Combos
	2019	2019	2019	2019
Energy price shock	0.4%	1.4%	1.3%	2.3%
Currency shock	0.9%	1.4%	0.4%	2.2%
Chinese destabilization	5.2%	4.8%	4.0%	4.7%
Asset price collapse	9.1%	4.5%	5.8%	6.3%
Financial volatility	9.5%	6.1%	6.2%	7.4%
Climate change	16.5%	11.3%	27.0%	11.6%
Loss of freshwater services	0.4%	2.6%	2.7%	3.2%
Tropical storms	0.9%	1.8%	0.4%	1.5%
Earthquakes	0.9%	0.8%	0.0%	0.5%
Severe weather	0.9%	3.4%	1.8%	2.9%
Terrorism	2.2%	3.6%	2.2%	4.5%
Weapons of mass destruction	2.2%	1.9%	0.9%	2.4%
Wars (including civil wars)	5.2%	5.3%	3.1%	6.2%
Failed and failing states	4.3%	3.9%	4.9%	5.4%
Transnational crime and corruption	3.5%	2.6%	2.2%	2.2%
Globalization shift	5.2%	4.2%	2.7%	4.3%
Regional instability	3.0%	4.7%	1.8%	5.5%
Pandemics/infectious diseases	2.2%	4.7%	1.8%	3.2%
Chronic diseases/medical delivery	3.0%	2.5%	0.4%	2.3%
Demographic shift	3.5%	6.9%	4.9%	5.0%
Liability regimes/regulatory framework	1.7%	2.3%	1.8%	1.6%
Cyber/networks	7.8%	10.8%	10.2%	8.1%
Disruptive technology	6.1%	7.3%	10.6%	6.8%
Other	5.6%	1.4%	3.1%	

Combinations

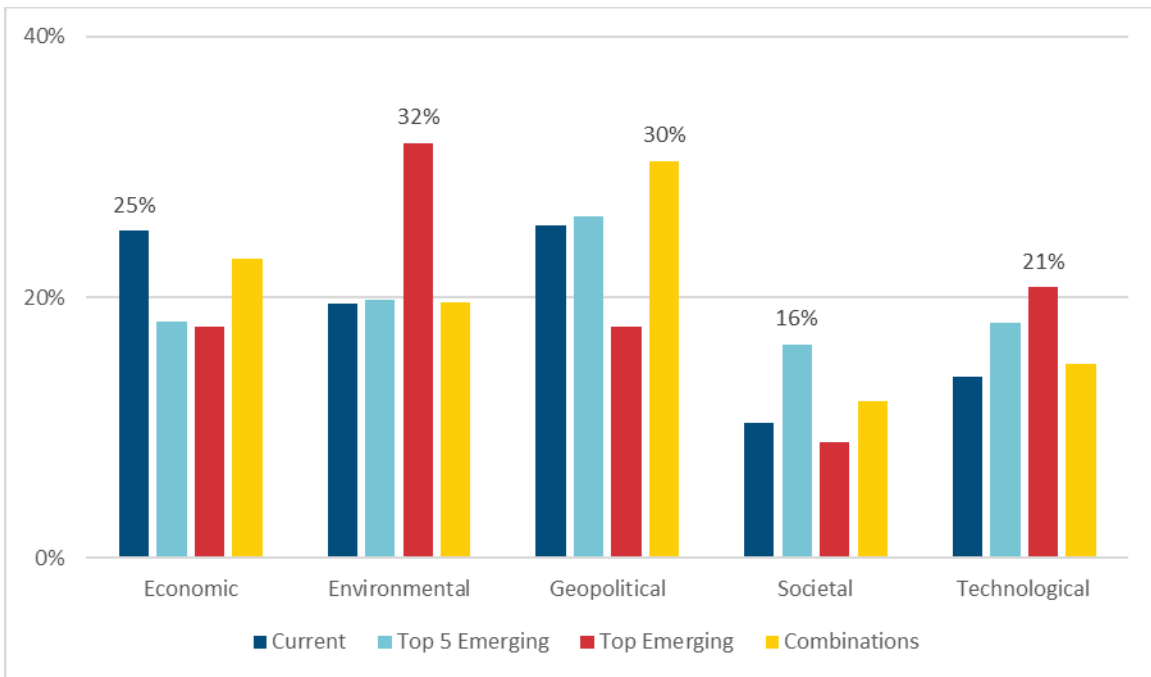| Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
1		1	1	3	4	10	0	0	0	0	1	0	0	0	0	1	6	0	0	0	1	0	1	1
2			3	12	5	0	0	0	0	0	1	0	0	2	0	0	0	1	0	0	0	1	2	2
3				10	8	1	0	0	0	1	0	0	4	3	4	9	6	0	0	1	6	1		3
4					20	4	0	0	2	0	0	1	4	5	0	4	1	3	1	3	2	3	2	4
5						10	0	0	0	2	1	0	0	3	0	8	10	2	0	4	4	8	5	5
6						22	14	0	0	29	0	0	9	3	2	4	9	11	3	6	1	7	2	6
7							0	0	0	0	0	0	3	1	0	1	2	6	1	4	0	0	0	7
8								1	1		0	0	0	0	0	0	1	1	0	1	0	0	0	8
9									0		0	0	1	0	0	0	0	0	1	0	1	0	0	9
10											0	0	0	0	1	1	0	0	0	0	0	0	1	10
11											14	10	7	1	2	3	0	0	3	0	11	3		11
12												6	3	1	0	2	1	0	0	0	1	1		12
13													18	2	5	7	0	0	2	0	4	2		13
14														7	2	8	1	0	2	1	1	0		14
15															0	1	0	0	1	0	7	1		15
16																4	0	0	5	2	3	3		16
17																	2	0	4	0	3	1		17
18																		7	4	0	0	1		18
19																			13	0	0	3		19
20																				1	1	7		20
21																					1	5		21
22																						49		22
23																								23

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

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

Cyber/networks

Disruptive technology

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

Climate change

Natural catastrophe: severe weather

22 responses (3%/4%), No. 4

Climate change

Loss of freshwater services

20 responses (3%/6%/6%/4%/7%), No. 2

Asset price collapse

Financial volatility

18 responses (3%/2%), No. 10

Wars (including civil wars)

Failed and failing states

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

Climate change

Natural catastrophe: tropical storms

14 responses (2%/2%/3%/3%), No. 9

Terrorism

Weapons of mass destruction

13 responses (2%), Not rated in previous survey

Chronic diseases/medical delivery

Demographics

12 responses (2%), Not rated in previous survey

Currency shock

Asset price collapse

11 responses (2%/3%/5%/6%/9%), No. 7

Terrorism

Cyber/networks

11 responses (2%/3%), No. 8

Climate change

Pandemics/infectious diseases

Combinations by Category		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Economic	Economic	34%	42%	29%	29%	29%	24%	19%	21%	14%	13%	11%	11%
Economic	Environmental	2%	3%	5%	3%	3%	2%	2%	2%	2%	2%	3%	5%
Economic	Geopolitical	22%	16%	21%	24%	21%	18%	15%	10%	15%	10%	11%	12%
Economic	Societal	2%	3%	2%	6%	6%	7%	9%	7%	6%	4%	4%	4%
Economic	Technological	1%	1%	3%	4%	3%	4%	4%	5%	4%	4%	3%	5%
Environmental	Environmental	7%	9%	7%	4%	6%	7%	7%	8%	8%	9%	13%	11%
Environmental	Geopolitical	2%	2%	3%	2%	2%	4%	2%	3%	3%	4%	4%	6%
Environmental	Societal	5%	3%	2%	2%	1%	2%	1%	3%	4%	4%	7%	6%
Environmental	Technological	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%	2%
Geopolitical	Geopolitical	16%	14%	20%	14%	18%	15%	19%	15%	19%	20%	16%	16%
Geopolitical	Societal	4%	2%	2%	1%	2%	4%	7%	2%	2%	4%	5%	4%
Geopolitical	Technological	1%	2%	3%	7%	4%	9%	8%	12%	11%	13%	7%	7%
Societal	Societal	2%	1%	2%	1%	2%	2%	2%	3%	3%	4%	3%	4%
Societal	Technological	1%	0%	1%	0%	1%	1%	2%	3%	4%	2%	2%	3%
Technological	Technological	0%	1%	0%	1%	1%	2%	1%	7%	5%	7%	9%	7%

Ed. Note: the combinations question was added in the second iteration of the survey in fall 2008.

Cumulative Distribution of Combinations (253 total possible)
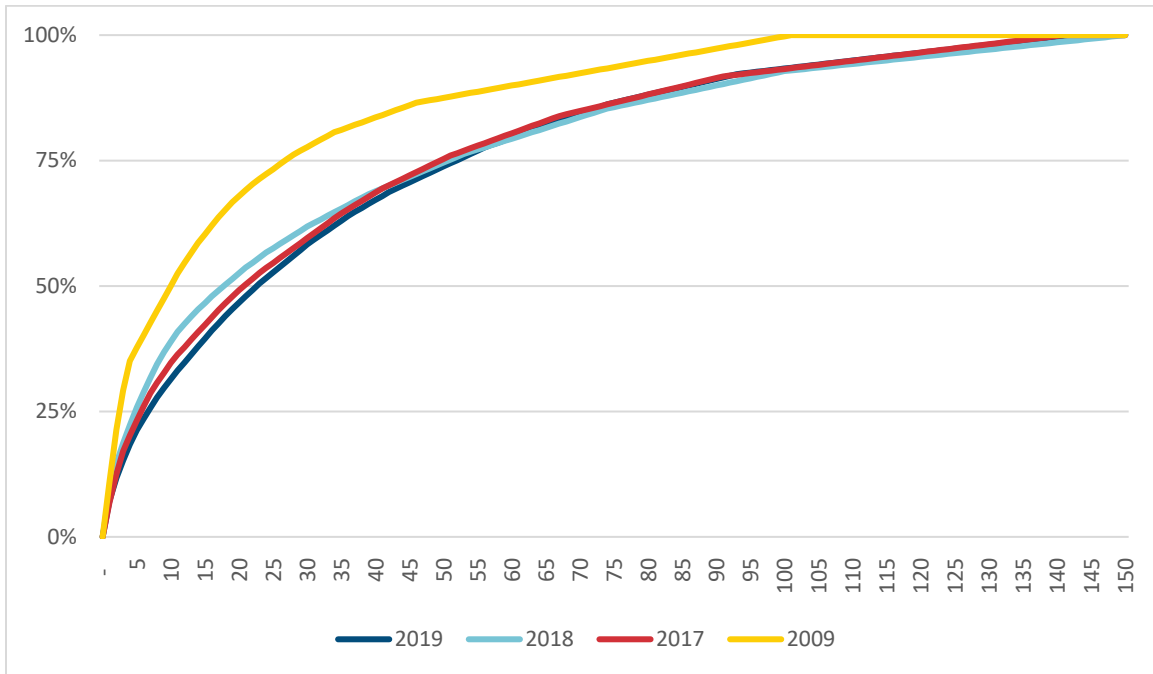
Risk Combinations
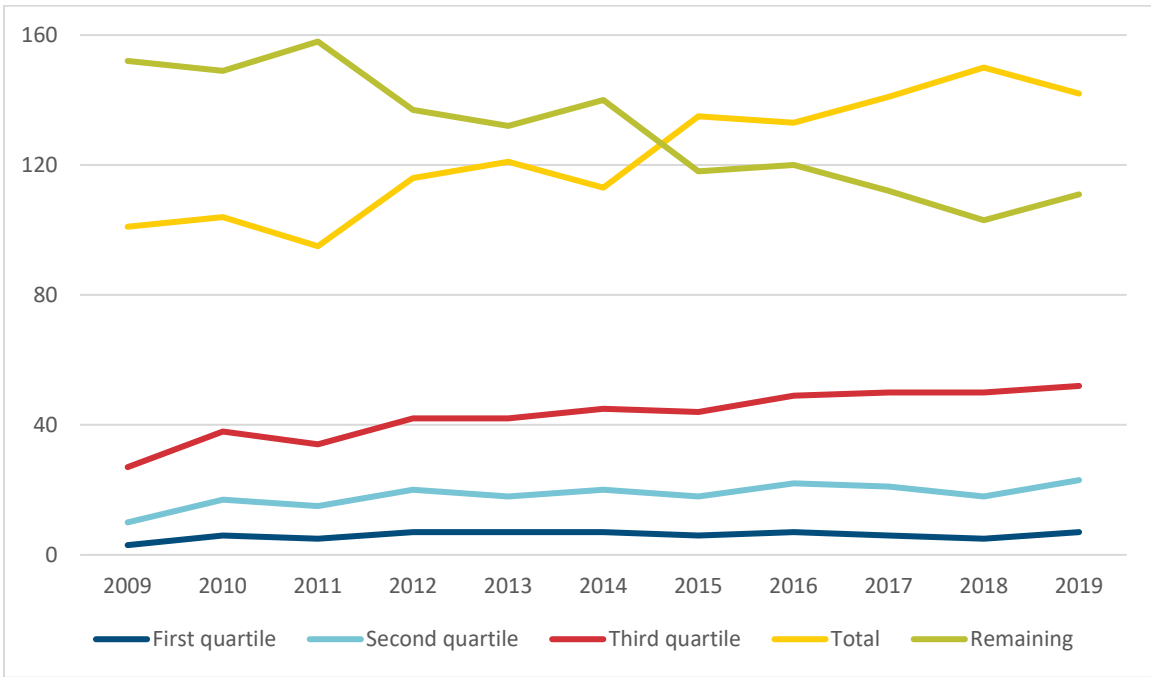
Risk Concentration Ratio (Base 2009 = 100%)
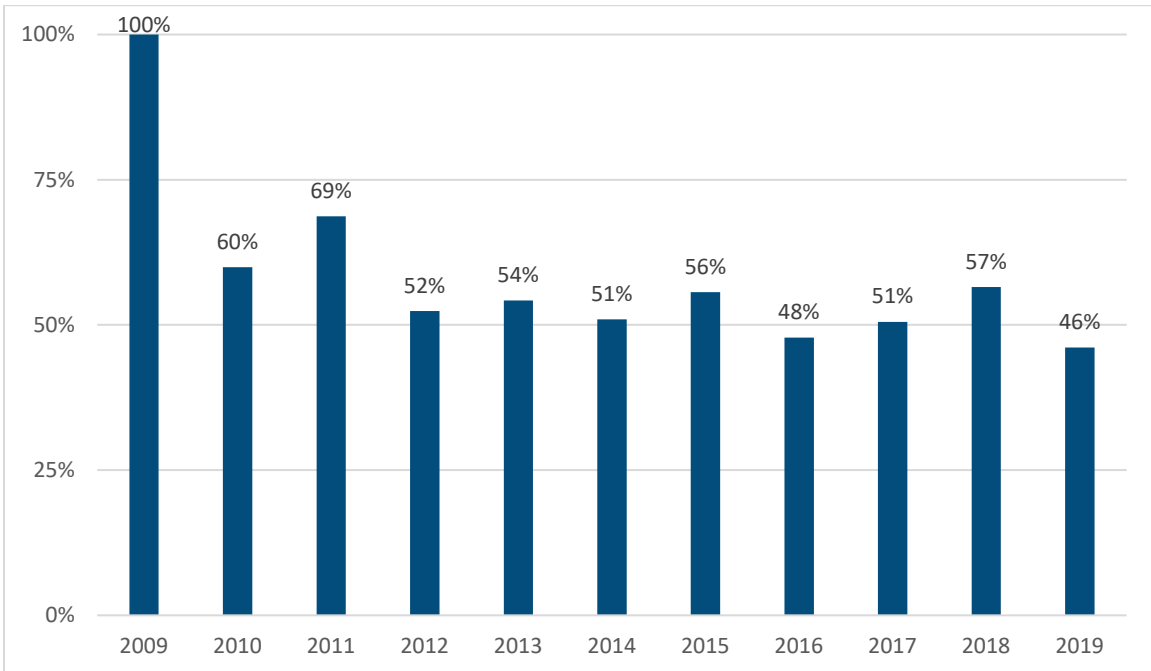
Each year a specialty question is asked. Traditionally the question has not been repeated in future surveys, but some may cycle through periodically.

Question 6. Which THREE emerging risks do you believe are "undervalued" and deserve more attention over the next 20 years? (Please select no more than three.)

206 respondents chose at least one risk, for a total of 592 responses (average of 2.87 risks selected per survey)

Economic—12%

- 2%   Energy price shock

- 2%   Currency shock

- 4%   Chinese destabilization

- 2%   Asset price collapse

- 2%   Financial volatility

Environmental—23%

- 11%   1   Climate change

- 7%   5   Loss of freshwater services

- 2%   Natural catastrophe: tropical storms

- 1%   Natural catastrophe: earthquakes

- 3%   Natural catastrophe: severe weather

Geopolitical—28%

- 2%   Terrorism

- 2%   Weapons of mass destruction

- 4%   Wars (including civil wars)

- 5%   Failed and failing states

- 4%   Transnational crime and corruption

- 6%   Globalization shift

- 5%   Regional instability

Societal—22%

- 7%   3T   Pandemics/infectious diseases

- 3%   Chronic diseases/medical delivery

- 10%   2   Demographic shift

- 2%   Liability regimes/regulatory framework

Technological—14%

• 7%   3T   Cyber/networks

• 7%   Disruptive technology

Other—1%

- *Attacks on religious freedom*
- *Policy*
- *Opioids, e-cigarette, solar storm*
- *Growing wealth gap*
- *Governmental/political impacts*
- *Sovereign Downgrade and Default – explicit or otherwise (latter including inflation or withholding taxes)*
- *Collapse of the Central Banking System*

Undervalued Risks
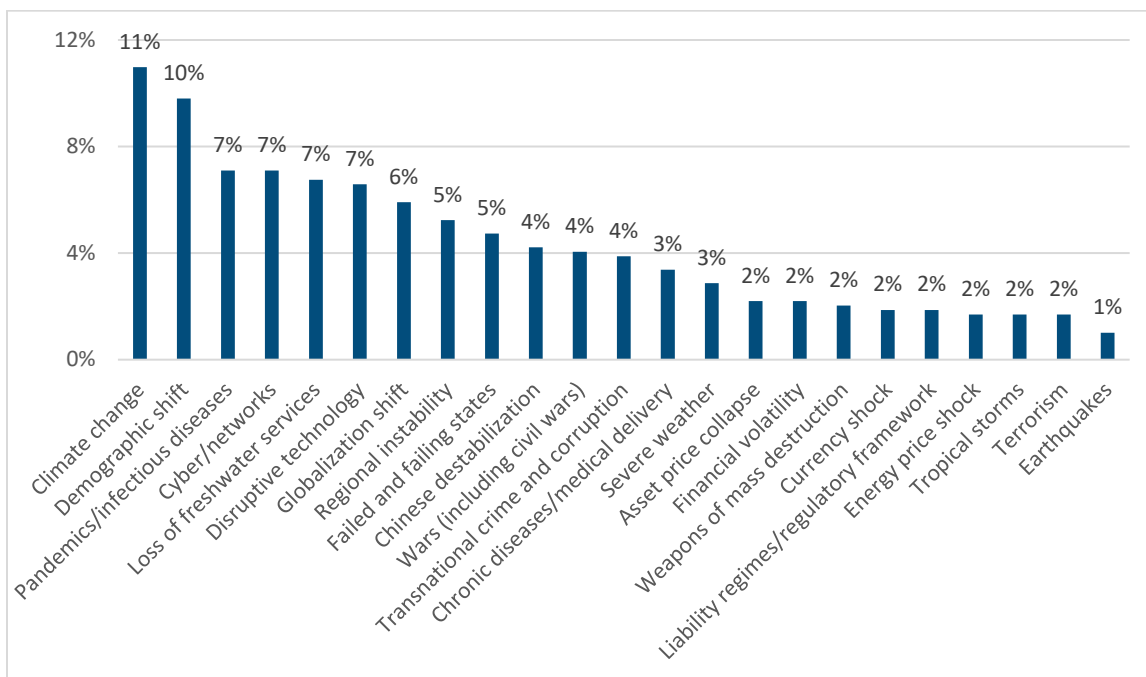
Undervalued Categories
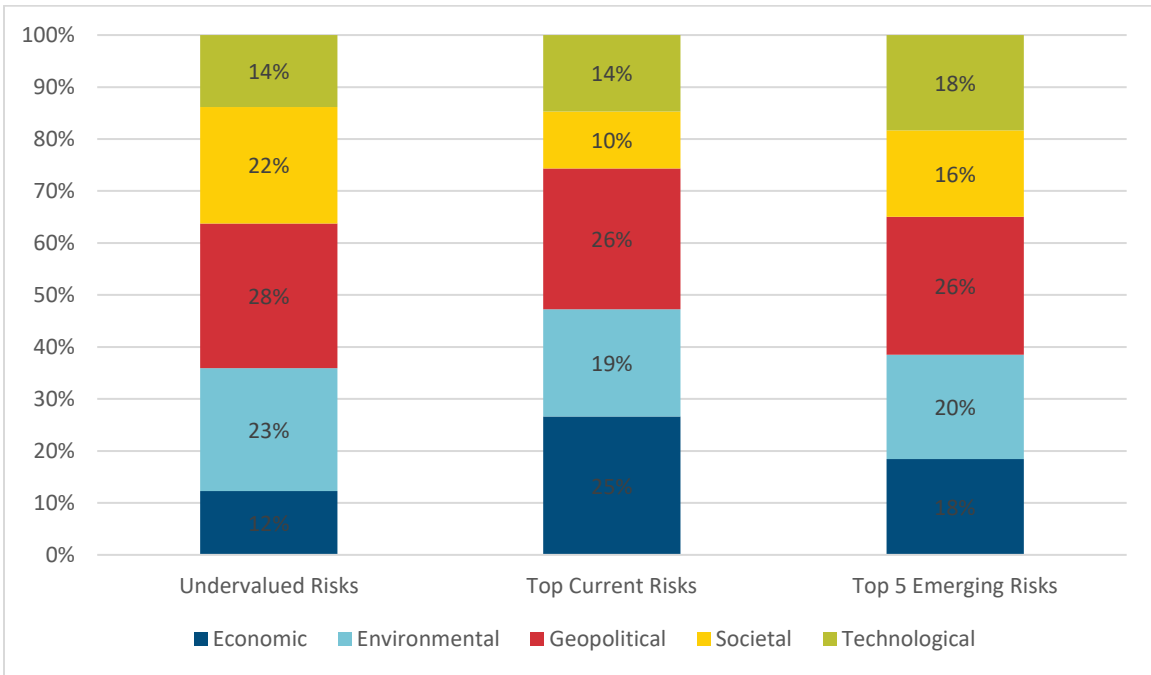
Undervalued Risks Compared Against Top Emerging Risk
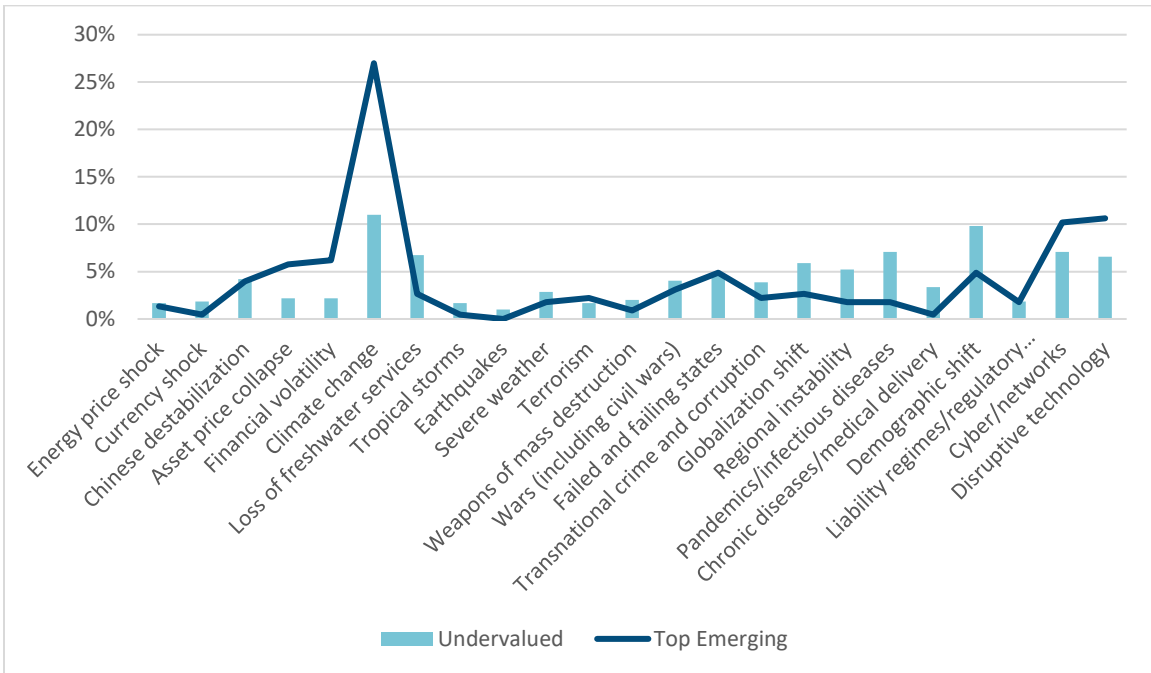
No list of risks is ever complete. Are there additional emerging risks you feel are significant that should be considered for future surveys?

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

- *Use of Social media to destabilize regimes*
- *Socialist and far left political agendas*
- *Economic Inequality*
- *Intolerance due to increased immigration*
- *Collision with asteroid or comet*
- *Low growth/productivity*
- *Protectionism/nationalism*
- *Cyber Terrorism*
- *Cryptocurrency undermines governments' ability to manage monetary policy*
- *Breakdown in rule of law in the US*
- *Populism*
- *Coronal mass ejections*
- *Opioid (Drug) Crisis*
- *Political Correctness Idiocy*
- *Breakdown of American Democracy*
- *Shift in demography*
- *Increasing reliance on third parties and related to that the increasing degree of connectivity*
- *Cyber War*
- *Consumer Service Preference Shift*
- *Increased income inequality*
- *Political polarization*
- *Backlash from data-driven economies/consumers prioritizing privacy*
- *Macrobiotic resistance*
- *Decline in physical health/emotional health of population*
- *Global pension crisis*
- *Disruptive technology*
- *Loss of common sense or ability to think critically, a societal risk that schools are no longer teaching children to think for themselves*
- *Overpopulation*
- *Political risk*
- *Worsening of overall health due to obesity and resulting diabetes*
- *Prolonged low/negative interest rates*
- *Informational liquidity risks*
- *Euro–Dollar volatility*
- *Anti-vaccination movement*
- *Populism and its influence in the world*
- *Air quality in cities*
- *Societal Risks: Increased allergies, the immune system is no longer strong, as we no longer eat healthy things*
- *Government Over-regulation*
- *Income inequality*
- *Growing wealth gap*
- *Restrictions on underwriting, especially in light of genetic testing*

- *Monetary system failure*
- *Instability of US Political system – whipsawing views*
- *Demographic Equity*
- *Rise of totalitarianism*
- *Bee colony collapse*
- *Political unrest in the US*
- *POLITICAL RISK*
- *Education*
- *State of mental health*
- *Geopolitical risks*
- *Global trade*
- *Political polarization in the US*
- *Widespread famine*
- *Educational Degradation*
- *Societal risk – disruptive technology leads to much longer lives*
- *Geo/political risk*
- *Exponential rates of change*
- *Disinformation on social and traditional media*
- *Replacement birth rate*
- *Chinese political ambition clashing with US's view*
- *Illegal immigration changing country demographics (see Nordic states)*
- *Aging infrastructure*
- *No suggestion*
- *Blackout on a large scale (not terrorism related)*
- *Lifestyle drugs*
- *Mismanagement*
- *Demographic shift should be split into (a) migration; and (b) problems of an aging population. The former is creating political strains while the latter is a growing threat to public finances.*
- *Unsustainable Population Increases*
- *Interest increase*
- *US isolationism*
- *Colonialism*
- *Rise of Dictatorial Leaders*
- *Long period of deflation or very low inflation*
- *Asteroid Impact*
- *No single source of truth leading to widespread mistrust/misinformation*
- *Technological risk*
- *Infrastructure failure*
- *Income inequality*
- *Skills shortages due to retirement and technology advances*
- *Food security*
- *Lifestyle developments*
- *Demographic shift*
- ***Widening social rifts. Perhaps is capture[d] under failing states but I think would get more votes with this title***
- *Domestic Political Change – change in political parties could have impact on policies (regulations)*
- *Monopolies*
- *Lack of education*
- *Collapse of the Central Banking System*
- *Social pathologies*

- *Widening of wealth gap between countries/individuals*

Option 2

- *Rise of nationalism*
- *Attacks on free speech and religious freedom*
- *Political Instability*
- *Increased nationalization and isolationism*
- *Global crop failure due to volcanos or meteorites*
- *Ice age due to low solar activity*
- *Access to Chinese Markets*
- *Negative Interest Rates in EU*
- *Social unrest*
- *Reshaping of global alliances*
- *Social and Governance impact on Companies (more information leakage thanks to social networks)*
- *Brain diseases related to dopamine addictions (gamification, social media, social credit rating systems/surveillance states) causing sleep deprivation and attention deficit*
- *Expanding wealth difference between ultra wealthy and rest leading to civil unrest*
- *Food supply crisis*
- *Electrical grid failure*
- *Societal Risks: increased poverty especially among young people*
- *Socialism*
- *Methods of Policing*
- *Disruption in Earth's magnetic field/increased solar flare activity*
- *Too many people on earth*
- *Rise of socialism in the US*
- *FOOD AVAILABILITY*
- *Fertility*
- *Financial market bubbles*
- *Societal Polarization*
- *Geopolitical risk – collapse of a large, well-developed state (China, Russia, US, etc.)*
- *Brexit*
- *Nationalism/protectionism (reversing globalization trends)*
- *Family formation*
- *Ongoing political return to populism leading to escalation of tensions and war*
- *Illegal immigration leading to instability/terrorism/pandemics/more "refugees"*
- *Fragility of power grid*
- *No suggestion*
- *Aging population*
- *Widespread Behavioral Health Conditions*
- *Lack of innovation*
- *Sovereign and Agency default and downgrade – as the problems of an aging population mount, governments may seek to reduce their obligations through fair means or foul. Aside from inflation, there may be a threat of de facto cut in coupons by means of withholding taxes.*
- *Reallocation from equities to bonds due to aging*
- *Lack of diversity*
- *Societal breakdown between haves and have-nots*
- *Poor distribution of wealth across the world*
- *Societal polarization*
- *Loss of biodiversity*
- *Fake News*

- *Lack of food*
- *Global Food Shortage*

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.

- 47%/40%/40%   Yes
- 53%/60%/60%   No

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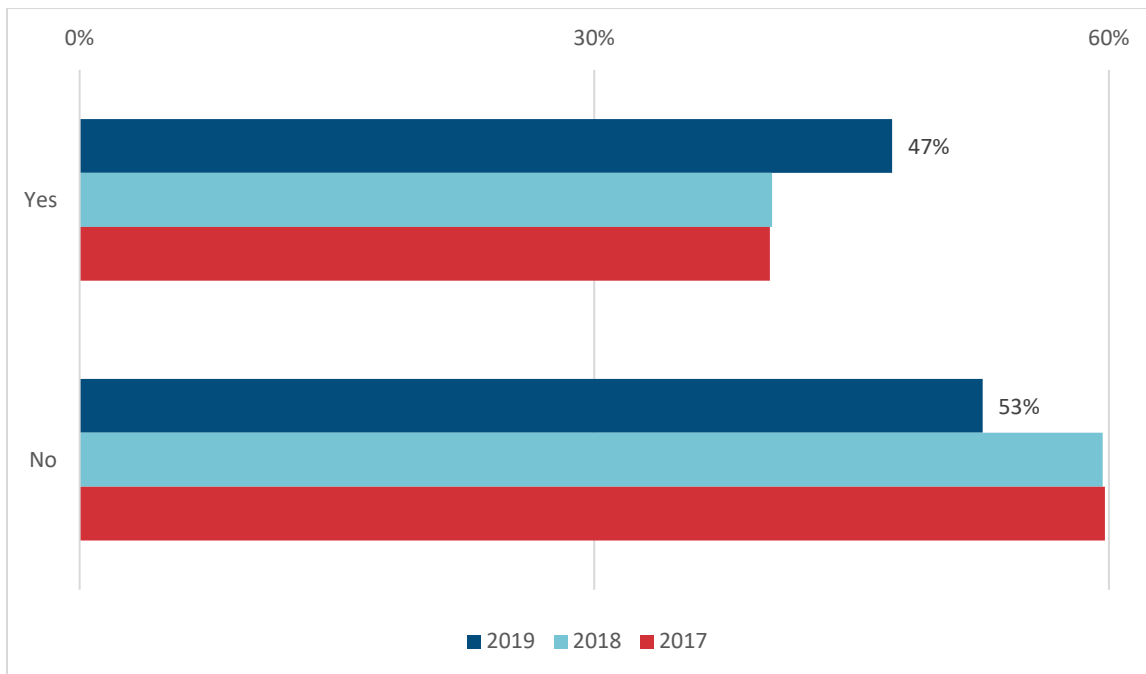
Question 2. Once an emerging risk is identified, do you have a process to measure, monitor and/or mitigate the risk?

- 12%/17%/11%/17%   Yes for all
- 79%/73%/82%/79%   Yes for some
- 9%/9%/8%/4%   No

Process to Measure/Monitor/Mitigate
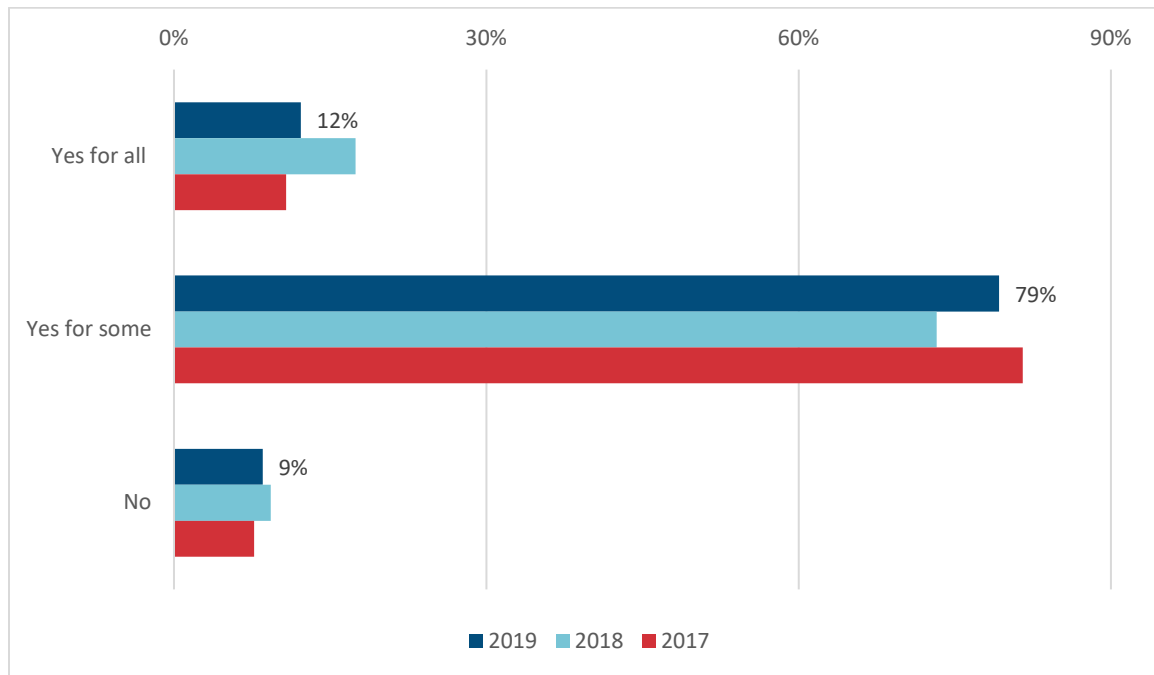
Question 3. If yes, please provide examples.

From those who responded *Yes for all*:

- *Technology shifts, cyber threats*
- *Opioids*
- *Expert and working groups for each topic*
- *Cyber risks in IT, regulatory risks in states*
- *The me too movement generated potential E&O and D&O issues for various organizations. We identified the overall potential and likelihood of litigation and or change in management of insureds.*
- *Introduction of national health care, introduction of open banking*

From those who responded *Yes for some*:

- *Crisis simulations, qualitative analysis of emerging risks*
- *Tracking chronic disease on LTC risks*
- *Quarterly committee to review list of emerging risks*
- *For example, I monitor new and on-going model risk. I also monitor risk of scenarios of what might happen if anyone on my team left the company.*
- *Demographic changes*
- *Medical costs*
- *Low interest rates through ALM strategy*
- *Business Continuation Plan in light of nature disaster*
- *We link the risk to work we are doing that would reduce the impact – alternatively, if not of an immediate impact, we note it in our reporting and monitor trends.*
- *Regular monitoring of key developments and reporting to the Board on its implications for the Company*

- *Continued monitoring of climate risk and how it affects catastrophe exposure. Which has led my company to reduce its exposure in certain markets*
- *Blockchain/cryptocurrency technologies and potential implications for our firm/industry*
- *Daily monitoring, reading news, talking to "experts" on the subject (people from the region or global analysts)*
- *Action Plan, Accountability and Deadline*
- *Financial/production reports to track impacts to existing products or assets*
- *Country risk and economic policy in Argentina*
- *Autonomous vehicle, opioids, cyber attack to critical infrastructure, populism, solar storm*
- *Experience studies, assumption review/update processes, regular risk reporting*
- *LTC changes in claim dynamics*
- *Implications to our services if certain market events prevail globally*
- *CLIMATE CHANGE ON EXPECTED RETURN ON ASSET*
- *Increase incidence of disability due to chronic illness or mental health; we implemented early intervention assistance that targets mental health. Rise of Drug costs – implement case management; looking at increase in diabetes – still no solution there implemented*
- *Try to evaluate the impacts of IFRS 17 the impacts to key trend of product*
- *Climate change will impact not only policyholders of a LICo, but also the investments we hold to cover the liability cash flows. We monitor and adjust our portfolio as our models show impact. We also monitor our hiring practices, and try to manage risks associated with demographic shift and technology improvements. (Partly why we are outsourcing to India – new technology in emerging Asian markets has leapfrogged our legacy systems maintenance needs.)*
- *Cyber risk – program to measure the frequency and severity – so that we can get insurance on it*
- *Follow the trend, adjust products, adjust prices*
- *Company is currently investing efforts and processes in monitoring and measuring chronic condition risks and prevalence in our insured/covered populations*
- *Realistic disaster scenario development, AI based tools*
- *New risks are logged, assessed, placed on an emerging risk/opportunities dashboard and appropriate actions are taken – note that an appropriate action may be to 'watch and wait'.*
- *I am working in the power energy business. Lot of attention to long-term power prices/inflation/currency/interest*
- *Suppliers not able to deliver*
- *For cyber risk we use indicators such as number of attacks on similar organisations*
- *Electricity issues in Africa sustainable solution to be implemented*
- *Assemble data, compare risk level, review relevant economic reports. Develop model*
- *We have an emerging risk register and for some items on the list we do a qualitative analysis of the impacts of the risk.*
- *We are in the risk protection business and therefore we maintain a list of the risk likely to disrupt our customers including source and mitigants. Example of sea level rises and the likely impact on cities and customer communities*
- *Expert judgement in terms of identification and assessment*
- *Our research team prepares ESG analysis for our Fixed income and equity investments, for Climate Change we have our environmental factors monitor, such as CO2 emissions, water/energy usage, waste management and others. We gather all the information published by the company in order to measure those risks and affect the valuation. If the company is not very ESG, we would probably not invest in it.*
- *Tracking and depth in analysis*
- *Expanded monitoring of web traffic on issues of identified interest*
- *Research articles (industry and global) to stay abreast of impacts of top 5 emerging risks. Monitor and report on emerging risks to the Enterprise Risk Committee on a regular basis*

- *Advocating for political change, advocating for private/public partnerships to address the risk, employing new technology to address the risk*
- *Cyber exposure*

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.

- 4%/7%/2%   Yes for all
- 45%/56%/50%   Yes for some
- 48%/35%/48%   No
- 3%/3%/0%   We do not formally identify emerging risks

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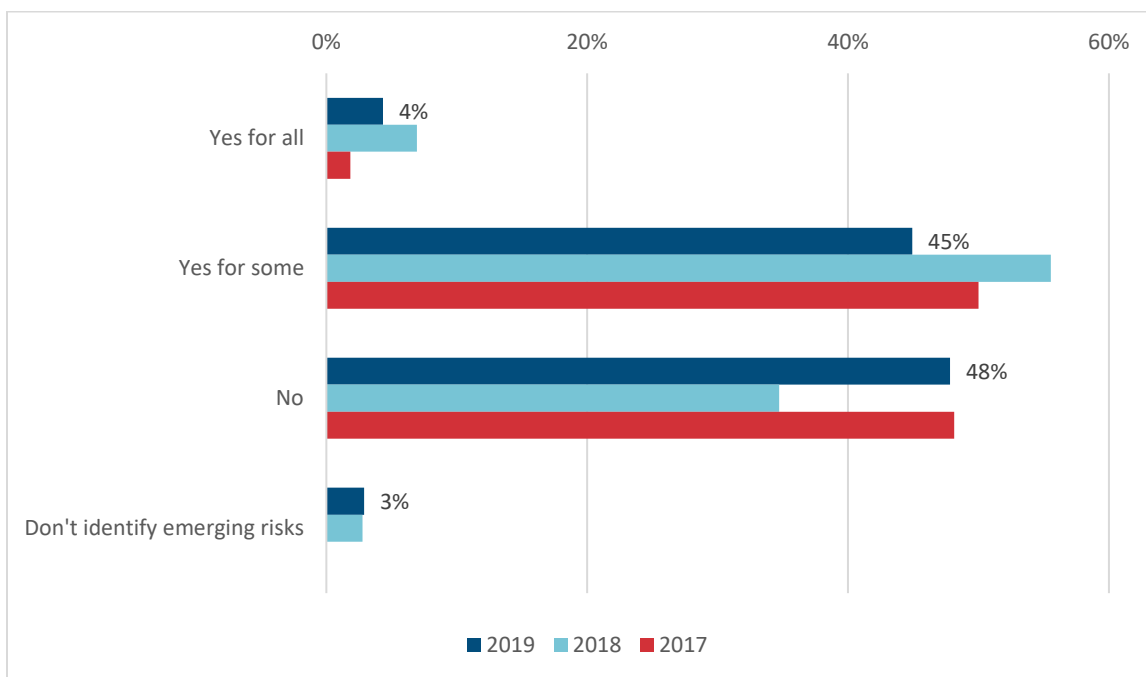
Question 5. If yes, please provide examples of these methods, including the specific emerging risk and leading indicators.

- *I measure various demographic shifts over time and corresponding disease prevalence per demographic subgroup.*
- *Monitoring Newspapers and Private Journals, as well as the Internet News Channels available*
- *Rely on long term weather forecast*
- *Around 25...with various methods of measuring or monitoring*
- *Changes in interest rates: leading indicator around 10-year treasury*
- *For IT cyber risk – we look at number of attempted hacks, regions, internal/external threat*
- *Roughly a half dozen*

- *The growing impact of financial volatility from the risks of climate change*
- *I don't know enough to answer this question.*
- *Pandemic – WHO tracking of cases*
- *For extreme market risks we will track interest rates, credit spreads, asset indices etc.*
- *We are monitoring glacial melt via press reports and satellite photos measuring the number of hectares covered by the major glaciers in the Alps, Rockies, Greenland, Himalayas. This is a proxy for water availability and temperature fluctuations.*
- *Yes, as we mentioned in the previous question, we have our ESG analysis and monitor, so we can appreciate if those environmental indicators have had changed vs previous year or not.*
- *Historical approach to understand and verify the information received*
- *For financial volatility, all indices are monitored, the VIX, DOW and S&P movement, interest rate fluctuation, etc.*
- *Corporate sustainability as it relates to cyber exposure*

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?

- 7%/5%/4%   Yes for all
- 75%/69%/73%   Yes for some
- 18%/26%/23%   No

Criteria for Action Based on Leading Indicators
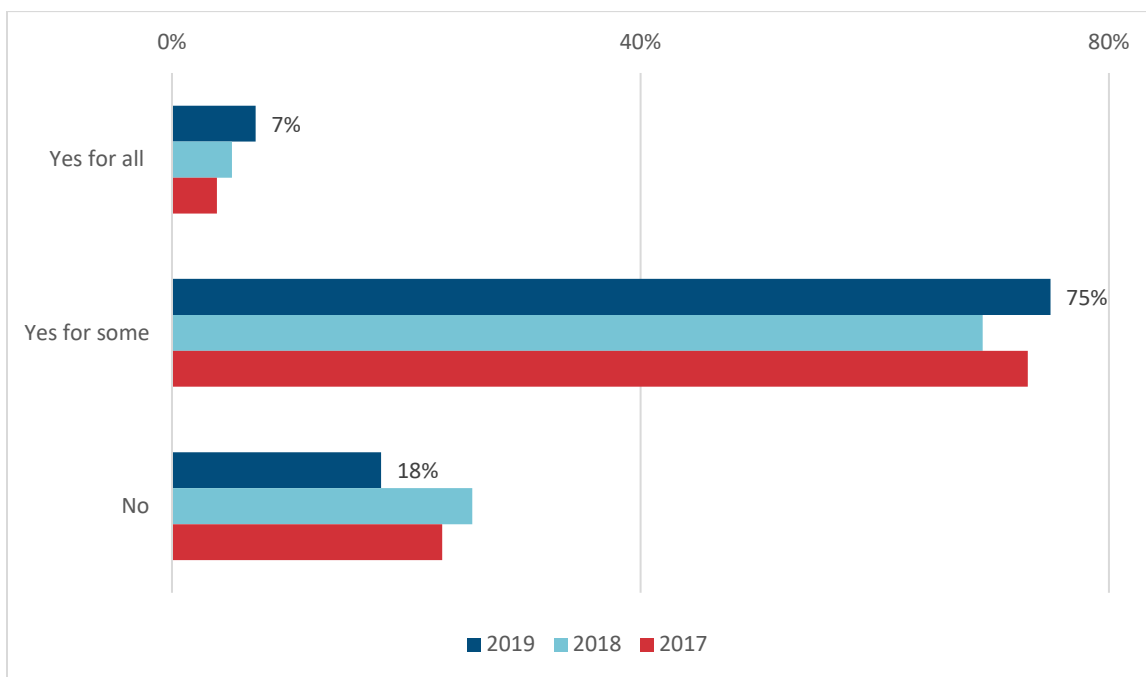
Question 7. If yes, please provide examples.

- *When I observe an unusual uptick in, for example, a certain disease prevalence or medical procedure use rate, I warn senior management regarding the implications.*
- *Thresholds*
- *Limit the area we do businesses*
- *Competition and focus group information*

- *Unique on a case by case basis generally. We consider them tipping points.*
- *For IT cyber risks, breaches are scored to identify potential impact severity and next steps.*
- *When financial outcomes are not as expected, we start scenario testing to see what other outcomes might be likely.*
- *We use our risk appetite framework (RAF) which contains clear trigger points for actions.*
- *Again – here it is to what extent that they can be modelled or a proxy can be modelled and to what extent they can be factored in to our pricing/capital models. Often it is via stress and scenario testing.*
- *According to our climate change example for our investments, every quarter of the year we update the information. If things get worse, we will probably be selling our position. That is why we must have our climate change analysis updated.*
- *Seek coverage to mitigate risk*
- *For financial volatility, investment portfolio may be modified, investments may be increased or decreased. For cyber risk, on-going improvements to security are made and more employee training provided.*

Section C: Methodology

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

- 54%/60%/55%   Positive
- 3%/2%/3%   Negative
- 27%/23%/28%   Neutral
- 16%/14%/14%   Not sure

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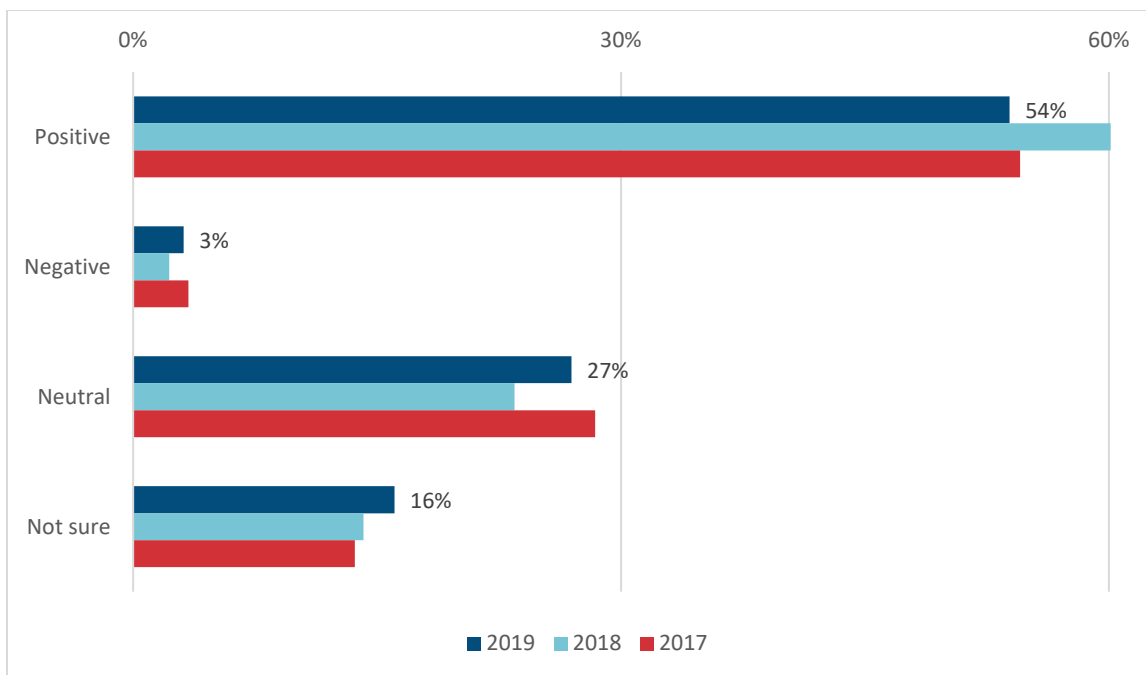
. Please share an example from the past year, if applicable, where another company (in any industry) used ERM in a positive way.

- *I can only think of negative examples.*
- *ERM has been used in Israel to prevent terrorist attacks.*
- *N/A*
- *NYT*
- *Discussion on longevity risk and live with quality and health*
- *Merger/acquisitions*
- **Continued exits of insurance from catastrophe exposures. Unfortunately, the effect has been to transfer risks to government and society, not reduce them.**
- *Set up risk appetite framework*
- *Application of scenario planning*
- *The ERM process was key to the setup of the new local legal entity, in particular on capital management and amount of retrocession given its risk profile.*
- *Impacts of current interest rate environment on existing products, used as risk awareness with senior management*
- *Inflation above 40% per annum and economic recession due to peso devaluation*
- *Don't know*
- *Most life insurance companies also sell payout annuities to act as a natural mortality hedge.*
- *Identifying emerging interest rate risks due to changing product mix at company level*
- *Pick any co. that set a reasonable strategy and then pursued it.*
- *Just implementing a robust process – discussions are initiated in senior management meetings (at least) monthly to discuss issues, progress, etc.*
- *I am retired.*
- *Resale car dealers looking at the future of their business with new cars with AI. Less demand is probable for older non AI vehicles. Also life of cars if increases, decreases their business*
- *A composite insurer has its ERM function looking at the financial impacts of the risks from climate change and is beginning the development of scenario testing (2 degrees C) on its liability and asset portfolios.*
- **I think Amazon is watching the risks and moving to alleviate the risk. They have opened new distribution centers, so when online orders are taxed, they are already in that state. They are closer to Walmart and other retailers, so it eliminates the risk that location will make a difference.**
- *Netflix has experienced a distribution in their clientele from companies that own some of their biggest drawers. They have used ERM positively in order to both hold on to their current business while continuing to eat away.*
- *ERM allows protection of the balance sheet and solvency ratio stabilization through stress test: changes in the portfolio mix product have been done.*
- **Tesla through expansion of production footprint to counter trade wars**
- *Insurance companies*
- *No idea*
- *ERM framework has added more discipline to our management of data assets and data integrity*
- *Targeting externalities (ESG) incl. impact valuation*
- *Maybe going back beyond a year, but I was involved in an operational risk assessment that highlighted weaknesses in cyber defences and galvanised executive support for investment to redress these.*
- *I think ERM could be "wider". What about construction risk for engineers? I am working on cases where clients need to choose between "build self" or "buy finished"...Cool actuarial work.*
- *N/A*
- *ERM helps the Company to quantify the risk exposure.*
- *ERM was used to help manage a large multi-disciplinary project.*

- *Technology Upskilling*
- *Measure the possible materiality in case a risk occurs*
- *Used ERM program to reduce premium for company insurance policy*
- **Looking at climate change and considering shortening the pricing time horizon**
- *Firm with large fleet exposure justified increased technology in its vehicles another firm terminated a CEO at the first indication of employee harassment*
- *Not sure*
- *Department of Defense uses ERM within program management to guide decisions*
- *Penn Mutual stopped writing business in NY due to regulatory risk and burden*
- *A hospital that was exposed to ransomware*

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

- 41%/46%/47%   Yes
- 9%/7%/10%/8%/   No
- 50%/47%/43%   Not sure

Does ERM Improve Returns Relative to Risk?
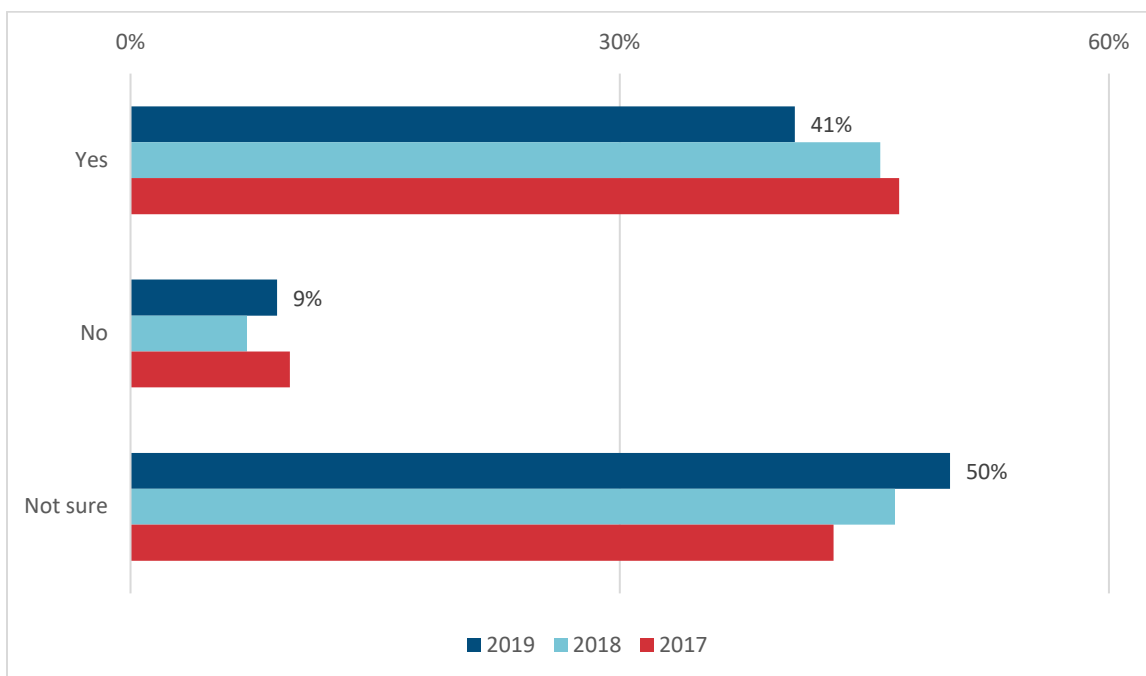
Question 4. Why or why not?

For those who responded *Yes*:

- *Strategizing is a lot more effective when we have a better understanding of our risk exposure.*
- *Minimizing risk with maximizing return*
- *If implemented appropriately it can have a measurable impact, but if treated solely as a regulatory exercise it probably won't.*
- *It increases returns because a company can maintain stability.*
- *Long term returns improve, as ERM improves long term viability.*

- *ERM should allow a company to better understand the risks it is taking and in doing so, should help to determine if the reward for taking that risk is acceptable. This type of awareness and subsequent analysis should drive improved returns – either through reducing risk that doesn't drive appropriate premium, or increasing risks that do.*
- *Better risk-return considerations that can benefit long-term growth*
- *Metrics are applied to enterprise value changes.*
- *Mostly I see it in catastrophe exposure at P/C companies. I think you will find isolated examples of financial services using ERM to take better (not necessarily more or less) risk taking, but when I look at what these companies are doing I'm not sure that ERM is driving too much decision area.*
- *More efficient capital allocation is possible through ERM.*
- *It allows an optimization of solvency capital.*
- *I believe it is a good way to monitor risks, to assess the impact and likelihood of each and to prepare a response in case they materialize, or better, mitigate or evade those risks.*
- *By reducing exposures to unexpected/extreme loss events, but what-if's are hard to quantify*
- ***Company rating (AM Best/S&P) gets better***
- *It provides the framework for a company to assess the returns in the midst of opportunities and threats it faces.*
- *It could also cause management to lose focus, and spend too much resources planning for contingencies or preparing for opportunities.*
- *When properly implemented and when risk and reward are quantified and compared to each other*
- *If considered from board of Directors, it allows you to identify the risk and plan an appropriate economic action plan.*
- *Risk management team supports the business in the risk/return optimization at different levels of the organization.*
- *Ensure that we identify, assess, monitor and report risks relative to our strategic objectives. Then set appetite and tolerance for those risk and ensure that action is timely taken if risk deviate and become excessive.*
- *Enables companies to set in place mechanisms to better manage profitability and earnings volatility*
- ***Silly question***
- *Mitigated risks could have had major impacts compared to the cost of mitigation.*
- *It improves the expected return and most likely the return by mitigating undesired impact of risk occurrence.*
- *Going through an ERM exercise can help you ensure your company's viability for the future. Kodak could have better survived the advent of the digital picture; reinvent itself before it was too late... Blockbuster stores... ERM helps planning company's strategies for their business.*
- ***It can highlight areas of underperformance and lead to action, as well as create consensus around riskier areas for cost effective remediation.***
- *Mitigate losses from shock events with lower gains during times of stability*
- *Helps in strategic decision-making*
- *It would increase returns, but only of it's done properly. A company could spend all its time on managing specific emerging risks, and not others, spending money the wrong way. **Mitigating risk does not have to be expensive to be effective.***
- *The implementation of a proper form of ERM has a tremendously positive impact on a company's return since it allows it to account for and design ways to take advantage.*
- *Yes avoiding major downside risk through ERM has a significantly positive impact over a longer (e.g., 10 year) time horizon, including in less tangible areas such as reputation risk.*
- *At the least, it helps to screen risks in the horizon.*
- *In case ERM includes also business opportunities resp. profitability KPIs*
- *I don't think ERM automatically improves returns but implemented effectively, it leads to companies avoiding unnecessary risks.*

- *So few people in multinational firms are able to look holistically in a way that Line 2/Risk can do. ERM also stops short-sightedness.*
- *Returns are maximized once you understand the level of risk you are taking. It enables you to take calculated risks and to take corrective measures where required.*
- *Proper risk management is done by identifying risk, taking position on what to do (managing) and then monitoring.*
- *To some extent. We were able to identify risks in advance and to establish a mitigation plan which reduced the time needed to resolve the situation when the risks were triggered.*
- *Prepares a workforce to deal with disruptive technology*
- *A better risk management will always mitigate those risks that could translate into monetary losses ERM gives you better control, better understanding and a better follow on to keep those risks under sight in order to take action when required.*
- *You have better sensitivity to volatile scenarios.*
- **Unfortunately you won't confirm until everyone has moved on.**
- *Difficult question, a truly well functioning ERM process can prevent or minimize the negative effects of risk or create opportunities to get around risk, often before competitors do. Some banks that watched what Wells Fargo got in trouble for stepped up their governance and compliance activities and avoided a similar pattern.*
- *Some risks and reactions are prepared for, and even when a different risk or response avails itself, ERM strategy provides a road map to follow.*

For those who answered *No*:

- *ERM is generally "window-dressing" and takes resources away from other important initiatives.*
- *It is hard to make it practical. My company manages risk without really needing an ERM framework.*
- **That's not what it's for.**
- *ERM seems bureaucratic and unnecessary to me. It just seems like traditional risk management with more interactions and holistic thinking, and we don't need a whole new system called ERM to achieve this.*
- *It helps to reduce risks rather than improve returns on the risks one is taking.*
- *There are more urgent issues to resolve on a daily basis.*
- **ERM is impossible to predict; and any implementation in advance won't help because it's unlikely to predict the actual crisis that might occur.**
- *Not enough quantification*
- *It does not relate to the amount.*
- *In a not-for-profit health insurer, returns are often overshadowed by other events or dynamics (regulatory pressures, business investments); more applicable measures for healthcare are competitiveness/affordability of premiums.*
- *ERM is too "wide" for me. We are a small M&A company.*
- **ERM is too broad to be effective. Largely a fad with a mixed, if not unsuccessful track record. The core techniques of risk management, prospective review, and trying to look at operational exposures are valuable but are really useful when performed in a focused risk management program.**
- *I feel ERM is still not being leveraged effectively. I think specific risk management has been very effective (ALM, hedging, etc.). While many claim to, I haven't seen insurance companies successfully operate/make decisions using a holistic approach to ERM.*

For those who answered *Not sure*:

- *Not sure if ERM methodology is the best way to manage risk. It seems to have taken on a life of it's own.*

- *Measurement is difficult.*
- *If current risks remain stable, efforts to monitor show little return.*
- *The increased analysis where one uses poorer models does not lead to improvement in value. The ERM ideals are a good goal, however, there are too many oversimplifications required to create the ERM model.*
- *Different teams are more aware of the risk, but the market sets prices for risk and it is challenging for one firm to influence the market.*
- ***Implementing ERM may not necessarily improve overall long-term returns relative to risk, but should help reduce the expected volatility of results – or a least create better awareness of the drivers of volatility.***
- *N/A*
- *It depends on how effective and efficient the ERM process is.*
- *Many ways to measure them. I am not sure how company measure them.*
- *It is difficult to measure how we improve since it could be the result from many factors.*
- *ERM on its own does not work unless it translates into actions that improve. There are dependencies on the company culture, the context in which ERM operates.*
- *Most companies where I work do not implement ERM, or only implement the minimum measures required by regulation for compliance purposes, and not because they find a value in implementing it.*
- *Concern about real commitment to ERM, as opposed to checking the box on some ERM activities*
- *No analysis supporting this fact has been made.*
- *It is subservient to company culture/risk tolerance which drive results.*
- *Depends on how quickly people acknowledge the efforts associated with ERM*
- *I am not sure because I believe it is the unknown unknowns that will do the most damage. It is hard to say how our mitigation of the known risks will impact the survival of the unknown. It is also hard to predict how cognitive errors may impact ERM decision making.*
- *It's going to depend on how its applied and what is done with the information.*
- *I'm not familiar with ERM so cannot answer the question.*
- *We are a small pension consulting firm.*
- *Too soon in our process to understand any measurable returns*
- *Perhaps this survey is not for me.*
- *The issue with assessing ROI is the lack of knowing what it would have been sans the changes.*
- *The taken measures protected the solvency ratio and the balance sheet. The measure did not protect the Profit & Loss (except in case of stress test).*
- *Have no information to assess*
- *ERM helps identify risks and how companies respond. However, it may or may not impact the variability of returns. Additionally, results are dependent on the actions of management, which may have a 'risk-taker' or 'risk-adverse' culture. So, I can see situations where it can reduce variability by having a plan for risks but also situations where it may not. Thus the 'not-sure' answer.*
- *The result (improvement in returns) is not always clearly attributable to ERM, as opposed to more specific focus on equity or interest rate risk, for example.*
- *Depends on how it is implemented. Some ERM implementation leads to nonsense redundant busy work.*
- ***I think that at its core the goal of ERM is not necessarily to "reduce" risk per se, but rather to view risk as a positive engagement. That is we should look to be as active as possible in taking risks, rather than expose ourselves passively and possibly unawares.***
- *Not enough data*
- *ERM is a long-term reward where results/outcome may not be seen immediately.*
- *It's very difficult to quantify these risks.*

- *Too much emphasis on risk identification & mitigation has the potential to lead to paralysis. The objective should be how to take reasonable risk given potential for rewards. Helen Keller – "Security is mostly a superstition. It does not exist in nature, nor do the children of men as a whole experience it. Avoiding danger is no safer in the long run than outright exposure. Life is either a daring adventure, or nothing."*
- *Not sure*
- *Department of Defense assessed risks and their impact is validated in major conflicts against a peer adversary...fortunately we haven't engaged against a peer to validate risk assessments in recent history*
- *Not a significant factor in my area of practice*
- ***Very dependent on how ERM is implemented. If it becomes a checkbox or an after-the-fact review it becomes simply another bureaucratic impediment rather than a holistic, strategic view of the enterprise.***

Question 5. For your area of expertise, what risks or practices do you consider systemic?

- *Data issues and mortality deterioration*
- *Regulatory, pricing, reserving*
- *Chronic disease impact on LTC experience*
- ***C4 risk, where bad leaders make bad decisions***
- *Underwriting risk, regulatory risk*
- *Longevity*
- *The tendency to continue to look only internally at risks and processes*
- *Partial Alzheimer "cure" that requires facility care and prolongs life*
- *Demographic shift*
- *N/A*
- *Widespread*
- *Climate change*
- *Economic Collapse*
- *Life insurance and annuities – systemic risks are demographic shifts and low interest rates as well as climate change*
- *Mortality risk*
- *Risk identification & prioritization, ALM, stress testing*
- *Not really sure what this question is getting at – we have six principal areas of risk and all impact our business in various ways; important to have broad identification and assessment processes and robust education tools so that everyone across the organization understands risk and is comfortable asking questions as appropriate*
- *Cyber/cloud*
- *Mortality, persistency, preferences*
- *Hedging of internal risks, especially since most large programs have to use dynamic approaches*
- *Political risk*
- *Overreliance on capital markets/financial derivatives to transfer risk*
- *Instability of politics*
- *Markets volatility, economic recessions, politics...*
- *Low interest rate risk*
- *Low interest rates, climate change, regulatory change*
- *Market, credit, technology disruption*
- *Combination of medical cost increases, rise in life expectancy, and overpopulation*
- *Financial market risks*
- *Low interest rates*
- *Regulatory risk*

- *Financial risks*
- *Modelling risks, Negative Interest rates, Binary losses*
- *Self-delusion*
- *Financial Volatility*
- *Those of a financial nature*
- *The reliance of first world countries on cheap debt and consumerism*
- *Financial volatility*
- *Interest rate market*
- *Non-stability of the economic and political system*
- *Earthquake risk in Canada with pooling amongst the industry, major event could trigger insolvency of the entire industry*
- *Shift from DB to DC retirement plans*
- *Climate change*
- *Policyholder behavior, asset values, defaults, mortality, company expenses*
- *Morality, interest rate*
- *Flawed decision making that fails to consider risk adjusted returns*
- *Longevity risk*
- *Regulatory risks at state/federal level*
- *Misunderstandings or miscommunication of contract terms leading to suits*
- *Global economic shifts*
- *Risk of government takeover of health care, which I believe will be detrimental to the quality and availability of health care services*
- *Longevity*
- *Financial*
- *The slow evolution of work cultures with today's work environment is causing many of our diseases and mental health issues. Companies need to adjust their expectations as to employees vs the speed of technology, the family unit, the cycle of life. Our brains are not able to cope and unless humans accept this and their productivity levels, it has a direct impact on their health; increase in stress, mental health issues that cause diseases within the body.*
- *Demographic changes*
- *Data security/integrity, financial volatility, operational integrity*
- *Opaque health care provider reimbursement methodologies*
- *Human Nature Interactions/transactions; example bitcoin. People reacted bitcoin driving up the price unrealistically and were unprepared for the eventual fall.*
- *Climate change*
- *Cyber crime, investment practices where all companies are buying from the same investment bank(s), regulatory changes*
- *Financial/Market risk*
- *Creation of new non physical currency (ex: Libra) which will move the transactions far from traditional currencies*
- *Regulatory change (e.g., companies struggling to assess full impact of IFRS17 and prepare in time for implementation)*
- *Disruptive Technology*
- *Birth rate*
- *Pandemics*
- *Business model for Big4 consulting is shifting rapidly due to impact of workforce structures and technology*
- *Cyber risks*
- *Regulatory/legislative risk*
- *In my opinion an industrial systemic risk is linked to a badly behavior of the people mainly.*

- *Life insurance underwriting: change in mortality, slow reaction to industry changes, e.g., life insurance is more a wealth management rather than a traditional insurance practice*
- *Economic risk*
- *Lack of savings, excessive consumption*
- *Supply chain risks, cyber risks, ESG, reputational risks...*
- *As a self-employed actuary and risk consultant mostly working with life insurers, the key systemic risks relate to wars and other events which may adversely affect investor appetite, triggering widespread market shocks which would have an adverse impact on life insurer solvency.*
- *Use of 3rd party outsourcing firms, e.g. administration firms for policies*
- *Data accuracy, resources, suppliers*
- *Financial collapse of markets*
- *Regulatory risk*
- *Asset collapse*
- *Health status of people (its assessment)*
- *Financial, infrastructure, governmental*
- *Environmental*
- *Economic, currency*
- *Under estimation of time/cost from third parties*
- *Demographic changes*
- *A risk is systematic based on its impact on broader markets as a whole. Any risk that affects all invested assets in a market is called a systematic risk.*
- *Economic, fundamental and technical analysis*
- *Not sure I understand the question. What's a non-systemic risk?*
- *Pandemic*
- *Lack of governance in information technology; not knowing your total exposure*
- *Any product that claims to hedge a risk like stock returns, where they all move in the same direction*
- *Financial risks, technology risks*
- *Rising health care costs*
- *Adversary threat capabilities*
- *Demographic changes, labour markets, financial volatility, asset prices, healthcare and delivery*
- *Pricing risk, financial risk*
- *Viewing Compliance as a nuisance*

Question 6. What low probability events do you worry about?

- *Cyberattacks*
- *Systemic shock impairing the functioning of the global financial market system, terrorist activities leading to mass casualty*
- *Detonation of nuclear device, simultaneous massive global cyber attack*
- *Sustained low growth environment, enshrined in socialist government policies*
- ***The one(s) I am not aware of today***
- *Conversion of a democracy society to a dictatorship*
- *Untimely changes to Medicare Advantage program*
- *Asset price collapse, regulatory changes*
- *Market events (e.g. equity crash), large data breaches*
- *Sudden (over 1-5 years) feedback loop disruptions in our climate that cause world destabilization due to loss of plants/animals key to our food chain.*
- *Extreme low probability – asteroid hit*
- *Global war*

- *Collapse of the state of California, due to riots, infectious diseases, fires and financial collapse*
- *U.S. civil war*
- *Loss of the power grid in the US*
- *Natural catastrophe*
- *Overturn of foreign governments*
- *Coronal mass ejections*
- *Climate Risk – significant increase in average world temperatures*
- *Epidemics*
- *US political crisis leading to North American economy crash*
- *Earthquakes*
- *Collapse of American Democracy and trust/reputation of the US from other nations*
- *Severe weather*
- *Pandemic event raised from global warming effect*
- *Earthquake*
- *Asset bubble in a major economy (e.g. China)*
- *Cyber threats*
- *A loss of liquidity in our financial system. Also, very long term low rates affecting the ability of insurers and pension plans to honor guarantees, such as a beefed up Japanese scenario or perhaps what we're seeing in Europe*
- *Nuclear conflict involving the US*
- *Pandemic*
- *Me personally being killed in an auto accident*
- *Natural disaster*
- *Catastrophes*
- *Epidemic risk*
- *Climate change (although high prob in my view), pandemics in humans and in algorithms due to the high connectedness of people and systems*
- *Pandemic*
- *US housing market collapse giving rise to another 'great' recession*
- *War*
- *Market collapses*
- *Civil chaos/civil war*
- *Pandemics, disruption in medicine supplies and disruption in electronic communication*
- *Earthquakes*
- *Big losses from unknown underwriting accumulations, Sudden change in business environment, Negative changes from regulations*
- *The dollar losing its reserve status*
- *Cyber threat*
- *Pandemics*
- *Cyber attacks, Ransomware, Terrorism strikes*
- *Failure of financial systems driven by asset collapse/the housing bubble*
- *Meteorological phenomena lead to disruption*
- *Natural catastrophes*
- *Social Collapse*
- *Earthquake*
- *Earthquake, Pacific Nuclear Detonation (West Coast EMP), Electric grid cyber attack*
- *(US) Social Security cutting benefits*
- *Earthquakes*
- *Natural disasters, civil war, anything that might moderately affect mortality*
- *Pandemic; USD not being reserve currency*

- *Pandemics; regulatory overreach (no longer low priority, but some ideas are so bizarre they were unexpected), accounting overreach (IFRS17 and Group capital requirements)*
- *Market crash*
- *Monetary system meltdown; major regulatory changes*
- *Elimination of defined benefit plans*
- *Devaluation of certain asset classes*
- *Civil war*
- *Severe market corrections*
- *WMD attack by terrorist state or group*
- *Earthquake, drug-resistant bacteria, income inequality, re-election of the Liar*
- *Fresh water loss*
- *The end of the world... Planet becoming uninhabitable. Complete financial dismay, scarce resources, unable to survive with basic needs such as food, roof over our heads and safety. Total chaos, no more order in the world, major civil wars everywhere in the world causing it to be unsafe for my children and their families*
- *High cost drugs or high cost medical claimants*
- *Catastrophes, market melt downs*
- *Pandemics and sudden changes in population health*
- *None*
- *The shift of energy resources from non-renewable to renewable sources, with commensurate loss of asset value for the non-renewable assets*
- *Negative treasury rates, a cure for diabetes, Credit Suisse bankruptcy*
- *Sustainability in a prolonged low interest rate environment*
- *Regulatory fines*
- *Every extreme event with probability under 2%*
- *Depending of HKD/USD, loss of confidence in Hong Kong financial industry, major economic recession in China, etc.*
- *Climate Change and the inability to support current western lifestyles long term*
- *Climate change*
- *Pandemics*
- *War, famine, disease*
- *Earthquake*
- *Superbugs*
- *Mainly natural catastrophe*
- *Cyber attack*
- *Wars*
- *Violent climate events (hurricanes, wildfires); maybe not low probability anymore*
- *Solar storms*
- *I don't believe markets are properly pricing in geo-political events like wars, trade disputes or political shocks (e.g., Italian exit from Euro).*
- *Failure of a material outsource, not just because of the immediate effects within my firm but for the effects across the insurance sector*
- *Boom in interest levels, reallocation from real estate/equity to interest instruments*
- *Negative interest rates*
- *Pandemics*
- *Funding health care*
- *Civil war*
- *Financial systems collapsing*
- *Nuclear weapons, economic collapse*
- *Catastrophe*
- *Pandemic*

- *Anti-selection, fraud*
- *Annuity insurance companies failing*
- *Radical political shifts, demographic migration combined with pandemics, regional instability in Europe, radical extension of human lifespan*
- *Failure of Banks, economic Recessions, climate change*
- *15%*
- *Pandemic. At least it's low probability in any given year. Ultimately, it likely will happen.*
- *Pandemics*
- *Disruptors/insurtechs*
- *Potential to lose private customer data*
- *Pandemics, power grid, US constitutional crisis and ramifications (guns, barter system, Mad Max scenario when tied to climate change)*
- *War on our shores*
- *Mispricing of premiums relative to claims/costs*
- *Nuclear war, disruptive technology, Cyber/networks, and triggers for global war*
- *Financial market collapse leading to wipe out of asset prices*
- *Catastrophes, pandemics*

Section D: Current Topics

Question 1. Your expectations for the 2020 global economy are:

- 13%/6%/4%   Poor
- 55%/61%/54%   Moderate
- 28%/30%/35%   Good
- 4%/2%/7%   Strong

Global Economic Expectations
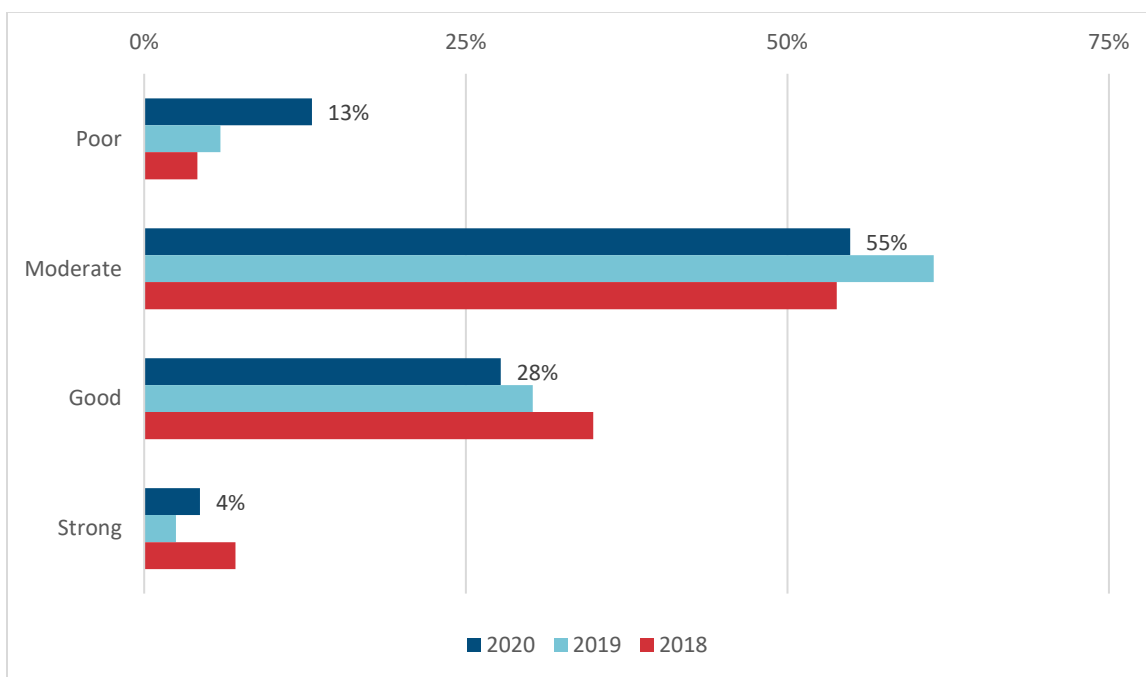
Combined Good + Strong Economic Expectations
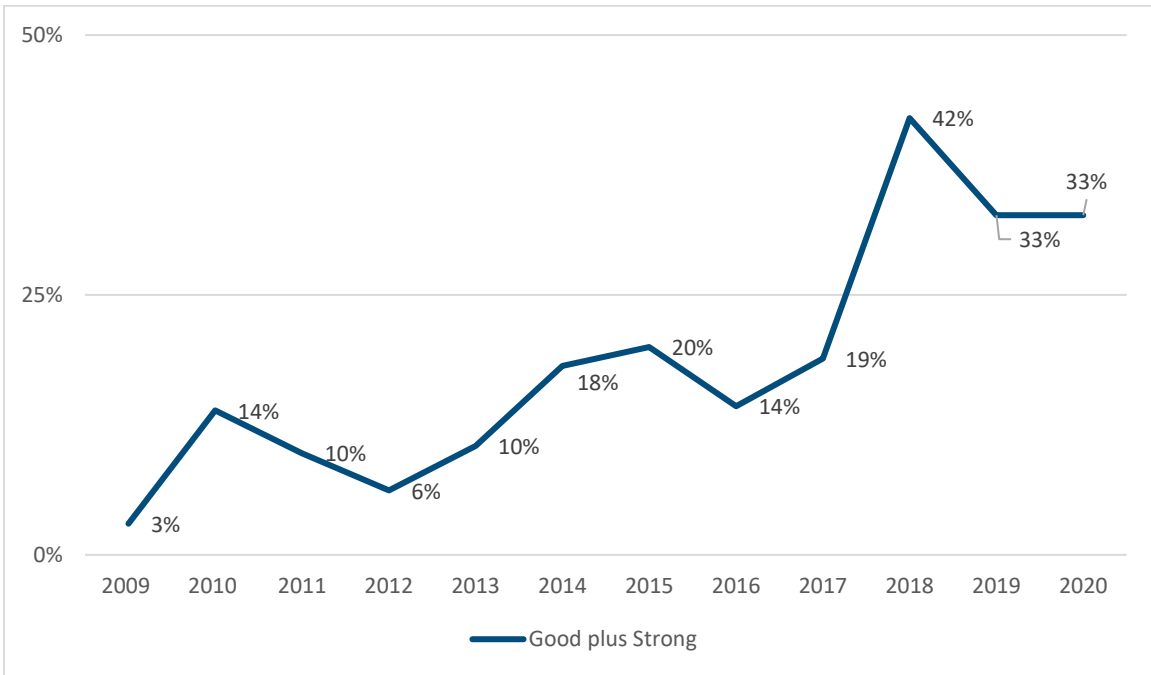
Question 2. Did you experience a change in the level of ERM-focused activities for your organization or clients in 2019?

- 42%/41%/52%   Increased
- 1%/4%/4%   Decreased
- 57%/55%/44%   Stayed the same

ERM Activity
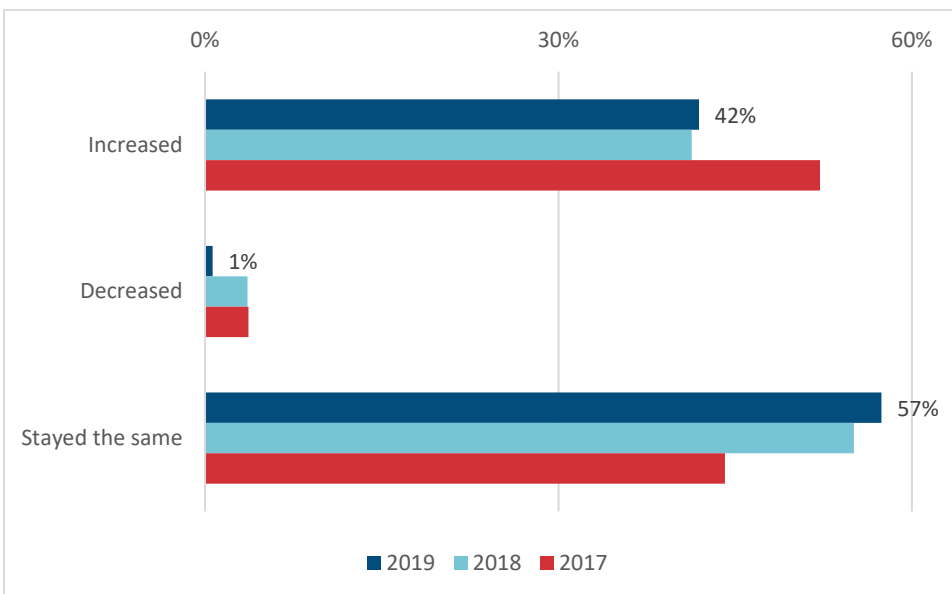
Question 3. Did your internal ERM staff increase in 2019?

- 21%/27%/35%   Yes
- 79%/73%/65%   No

ERM Internal Staff Growth
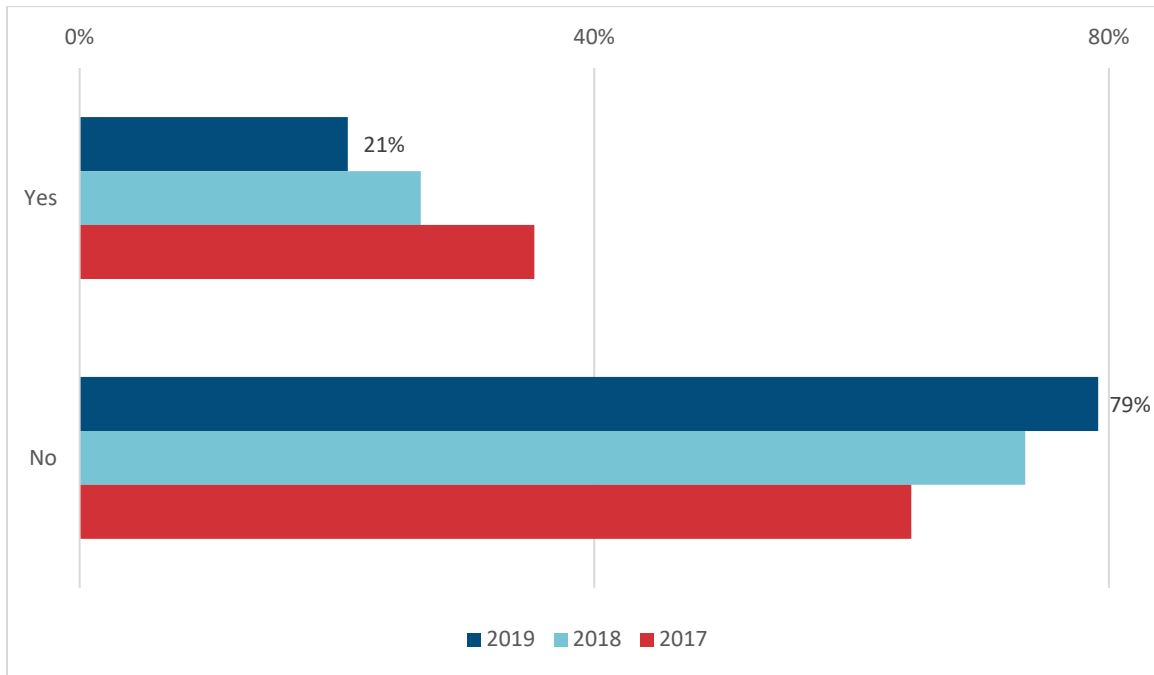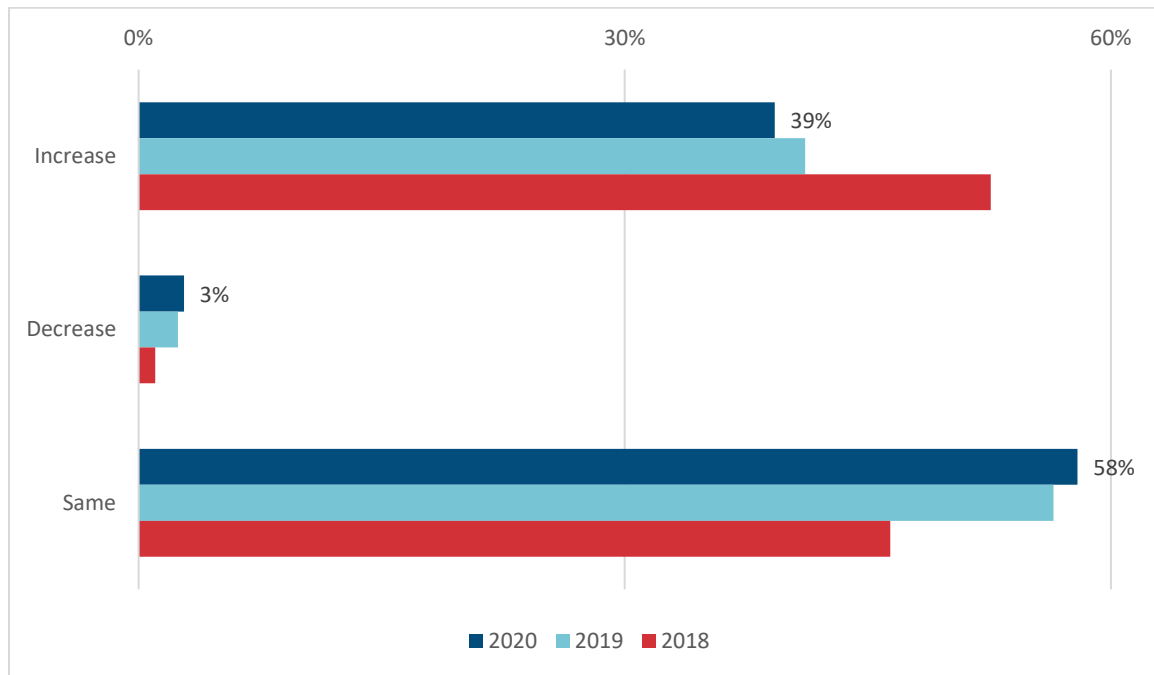

Question 4. Do you anticipate a change in the level of ERM-focused activities for your organization or clients in 2020 relative to 2019?

- 39%/41%/53%   Increase
- 3%/2%/1%   Decrease
- 58%/56%/46%   Stay the same

Future Expectations – Activity

Chart showing Future Expectations – Activity with categories Increase, Decrease, Same for years 2020, 2019, 2018:
- Increase: 2020 = 39%
- Decrease: 2020 = 3%
- Same: 2020 = 58%

Legend: ■ 2020 ■ 2019 ■ 2018

What types of Cyber/networks and Disruptive technology scenarios do you analyze?

- *Cyberattacks, insurtech, fraud*
- *Insurtech, use of AI/predictive analytics*
- *None*
- *Monitor for hacking*
- *I don't analyze any scenarios. I have been experiencing the disruptive technology for the past 1.5 years. Our division is reorganizing around new data science tools and the use of new workflow control tool (Alteryx).*
- *Large scale data breaches, both externally and internally driven; Inability to keep pace with competitor technology developments; inability to leverage technology due to lack of scale*
- *Cyber attacks on a massive scale*
- *N/A*
- *None*
- *I was not involved in such activities.*
- *Phishing Malware*
- *Specifically looking at machine learning, cloud computing, digitization, third party risk – in this particular space there is a lot of cross over – the nature of the scenarios is to understand industry activities versus our own, where we see benefits versus risk, how to prudently manage, do we have robust incident management if and when something happens that requires action.*
- *Internal/external, large/small scale, vendor, virus*
- *None that I'm aware of.*
- *Breach of data/customer privacy issues*
- *More hacks as more information goes to "the cloud". More leakages thanks to social networks. More automation in many processes*
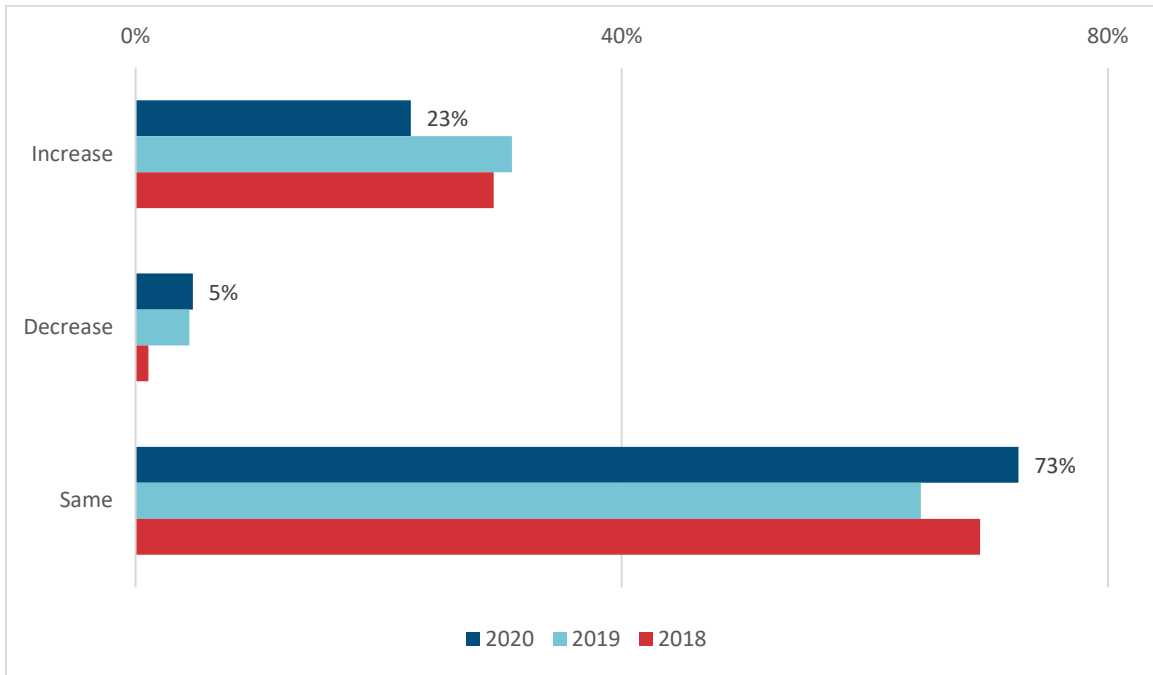- *AI, CRSPR*
- *Not sure*

- *Fragility of high tech networks, as gridding (i.e., wireless smart street lights, smart homes, 5G, IOT, etc.) and dependency on wireless everything occurs. Also, health effects of massive increase in exposure to electromagnetic frequencies under 5G*
- *Data breach (cyber), hacking (cyber) and new service providers (disruption)*
- *Not a scenario: There are claims already*
- *Various scenarios from small disruption to larger disruption with critical systems*
- *Impacts to internal systems, impacts from third-party vendors, potential regulatory impacts*
- *Work in progress*
- *Data security*
- *Cyber: internal and third party data leak*
- *Disruptive Technology: we look at everything that could increase customer satisfaction in offering better experience.*
- *Many – we even apply cyber "variables" to our individual BC plans*
- *None*
- *None*
- *Data breach; phishing/malware*
- *These are done at the corporate level and are outside my knowledge.*
- *Process just beginning for us, not reviewing these scenarios yet*
- *Loss of power leading to need for data backups. Privacy security breaches (theft of confidential data)*
- *We have multiple scenarios related to the following topics: Extortion, Denial of Service, and Data Breach.*
- *I don't analyze these, I just try to plan for them. How would I change reserve calculations if cyber crime becomes more than taking $$ from a single policy? How would I change my model to anticipate extreme changes in mortality? What scenarios do I need to analyze for this? How would I change my asset portfolio strategy to manage these?*
- *Capital One type of identify theft scenario*
- *Change in the market: customers will leave traditional insurers for new insurtechs with more information sharing and less data protection (privacy)*
- *Cyber financial crime, network disruptions affecting claims payment, hacking of personal information, disinformation, etc.*
- *Population*
- *Data breach*
- *None as yet*
- *AI, insurtech, evil empires (i.e., google) getting into a type of insurance selling activity leveraging all the spying they do through phones/alexas/internet searches/etc.*
- *Networks impact on traditional sales*
- *Not in my direct scope; company is investing more efforts in machine learning and AI*
- *Centralization, data aggregation via multiple devices and platforms./Less diversity, by platform predation*
- *To the extent I do analyse these for clients, it tends to be more focused on the operational losses from cyber events than the strategic disruption posed by technology. In terms of operational losses, there is a shift from data loss and theft to the disruption caused by ransomware attacks.*
- *I foresee more scenarios where there are data breaches and greater number of cyber attacks on our systems.*
- *N/A*
- ***Complete shutdown for more than 24 hours/New competitors such Amazon or Google to compete against big insurers***
- *Usual cyber hacking and ransomware. Possibly a major cloud hack that reverses the relatively positive perspective IT folks currently have about the cloud*

- *Data breach, especially breach of personal medical information. Disruptive technology scenarios include new ways to deliver care (telemedicine, crowdsourcing, etc.), and innovations in the healthcare sphere.*
- *Impact of network failure or a cyber breach/Impact of a large player (Google, Amazon, etc.) entering the market and changing it quickly*
- *Monetary loss from a fraudulent transfer induced by a cyber attack. Criminals steal funds or valuable information./Hacker disables operating system./Hacker hijacks information and asks for money in return*
- *Delay of information in markets and identity attacks*
- *Quantification of a cyber attack scenario.*
- *Cyber Criminal/Malicious: gains access to laptop with customer data./2. Cyber Criminal/Malicious: penetrates perimeter and gains read only access./3. Cyber Criminal/Malicious: penetrates perimeter and gains admin access./4. Website denial of service./5, Privileged insider with malicious intent./6. Non-Privileged insider with malicious intent*
- *Silent cyber in insurance company portfolios, employee reaction to new technology and their lack of sophistication in avoiding phishing or other indications of cyber threats*
- *War related. Disruptive technologies that are war related cover a diverse set of categories, such as artificial intelligence, nano technology, hyper-sonics, bio targeting, pandemics, bio-computer melding, weather as a weapon, space dependency, network dependency, cloud computing*
- *None explicitly*
- *None at this point, but keeping a eye at a high level for such technologies*
- *Third party risk management*
- *Identity Access; monitoring of security events on network and endpoints*

Question 6. Do you anticipate a change in the level of funding dedicated to ERM-focused activities for your organization or clients in 2020 relative to 2019?

- 23%/31%/29%   Increase
- 5%/4%/1%   Decrease
- 73%/65%/69%   Stay the same

Future Expectations – Funding

Chart showing Future Expectations – Funding with categories Increase, Decrease, Same for years 2020, 2019, 2018.

- Increase: 2020 = 23%
- Decrease: 2020 = 5%
- Same: 2020 = 73%

Legend: 2020, 2019, 2018

2020 Anticipated ERM Levels

Chart showing 2020 Anticipated ERM Levels with categories Increase, Decrease, Same for Activity and Funding.

- Increase: Activity = 39%, Funding = 23%
- Decrease: Activity = 3%, Funding = 5%
- Same: Activity = 58%, Funding = 73%

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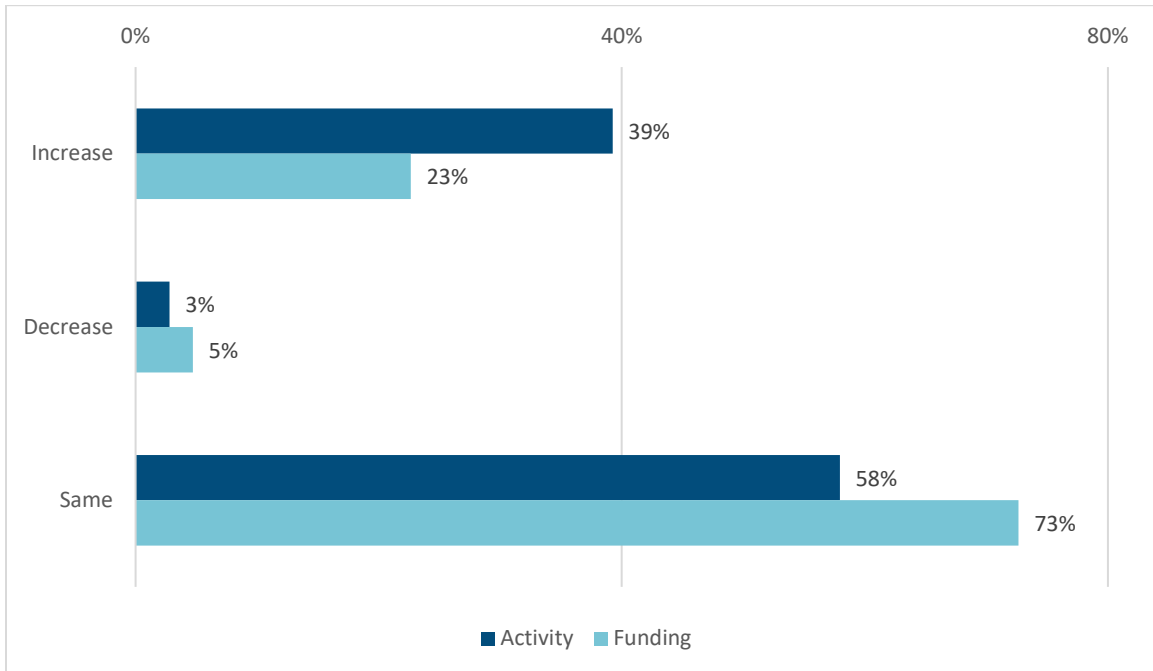
The true measure of an ERM program is how it is received by the board and senior management. Which of these is true in your situation? (Please select all that apply.)

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

- 9%/8%/10%/16%   Our ERM function can say no to a strategic opportunity.
- 38%/41%/48%/42%   Our ERM function has input but not a vote when a strategic opportunity is being considered.
- 49%/45%/38%/46%   Our ERM function has input and a vote when a strategic opportunity is being considered.
- 4%/6%/4%/6%   Our ERM function has no input when a strategic opportunity is being considered.

- *We would always seek to understand and then present areas of concern and risk – it needs to be collaborative.*
- *Continues to be a struggle to ensure Risk has a seat at the strategic table*
- *ERM is still a small department in our organization so is not often at the table when strategic decisions are made; concepts are sometimes utilized by key decision makers (i.e. CFO, executives).*

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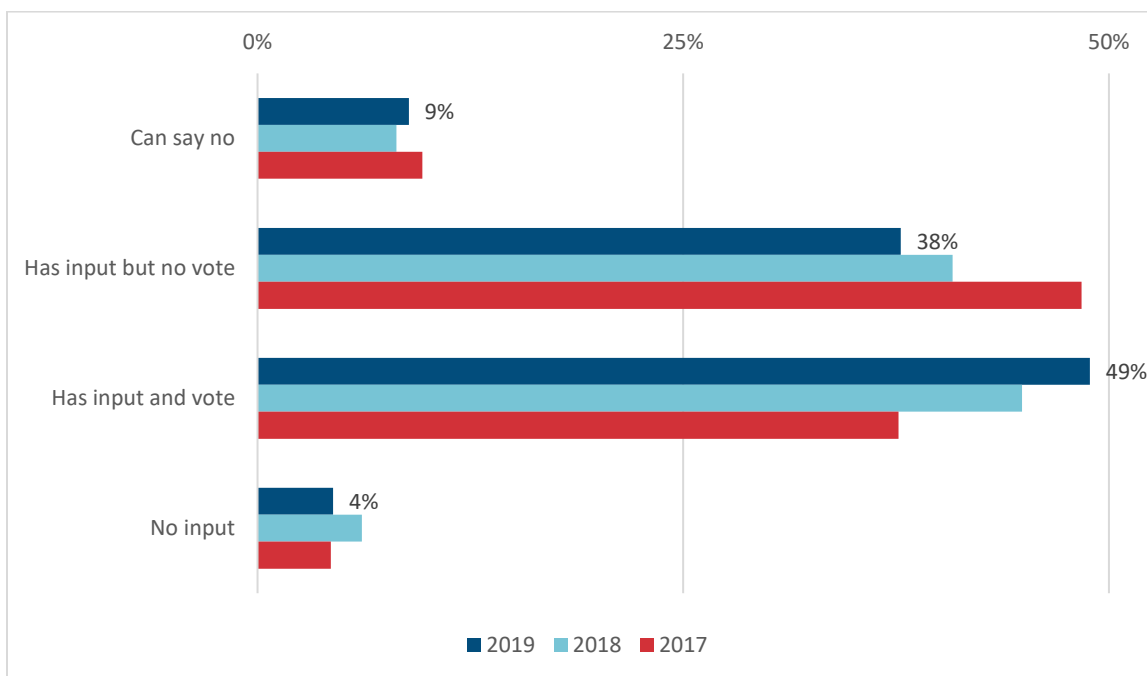
Question 8. Please share an example where the ERM department was recognized, either positively (e.g., proactive mitigation) or negatively, following a risk event.

- *Decisions about future acquisitions rely on risk assessment.*
- *N/A*
- *Review on large claims – trace back to the beginning point and review what if situation*
- *Evaluation of sales/staffing strategies*

- *Correctly identified that California wildfire risk was something that needed to be reduced, unfortunately, this was not done quickly enough to reduce exposure prior to 2018 fires*
- *Reviewed quantitative risk tolerances in light strategic initiatives and proactively adjusted risk limits*
- *We have now created a Risk Committee in the Company. We now recognize and manage several risks with different approaches. We have just made a trial in which the offices are supposed to be inaccessible and we had to solve the problem of keeping continuity of the business. It was achieved in 4 hours (thanks to IT, Human Resources, Operations, and each head of each area). We were recognized for planning the whole exercise and having ready the tools to cope with the trial.*
- *Post M&A transaction*
- *Product ERM recognized for increased challenge place on product areas during approval process; Operations ERM summary and recommendations following tornados in one of our locations*
- *No ERM Department. Function embedded*
- *It is not taken into consideration, as there is no real knowledge on the ERM and are not called adequately skilled people on the subject*
- *Closely monitor operational incidents and business is generally very receptive of our inputs such as business interruptions or corporate security events*
- *More so on the CM side with recent event management*
- *Not sure*
- *Evaluating a large business opportunity in a foreign country on a risk adjusted return on capital basis*
- *Positive review for analysis surrounding potential outcomes of reinsurance. Positive review for analysis of operational risks of several vendors*
- *There have been no risk events.*
- *Our CRO blamed the actuaries for not anticipating an assumption change on a recently purchased block of business. This assumption change led to a significant increase in reserves and infusion of capital. The CRO was so focused on operational risks that he forgot to consider the insurance risks.*
- *When we bought a start-up for insurance services extension, we did a risk survey with alerts and recommendation to reduce the risk. 2 years later, the start-up fall down. The facts have been recognized.*
- *Usually ERM function doesn't get credit for risks that don't happen, but in fact they are often responsible for avoiding those risks.*
- *Positively – correctly predicting staff retention risk as very high, shortly after which there were a string of high level staff resignations*
- *Not familiar*
- *We recently sold off insurance wing. This was decision motivated by ERM function as the insurance business was too risky and demanded too much capital from the balance sheet.*
- *Restriction on investments*
- *We recently found out that South Africa was under evaluation to reduce its credit rating profile due to a poor governance strategy. We sold out our position in government bonds.*
- *Proactive mitigation*
- *When an employee did something unethical, it was asked why ERM did not identify the specific issue. It was really Internal Audit's failure to see how invoice dates could be manipulated.*
- *F-35 Joint Program Office, cross service mitigation of risk*
- *No examples available*
- *In our (small) company, the ERM department is equal to senior management.*
- *ERM highly encouraged the purchase of a software to fill a gap and employee training to improve the human side of the gap.*

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?

- *Acquisition opportunities develop as other companies lower their risk appetite.*
- *N/A*
- *Large claims and frequent claims*
- *Bargain asset purchases during a downturn*
- *We try to have a balanced approach in looking at all risks – are there ways to manage that might create an advantage? Are there risks areas where we could "afford" to take on more and create value for our stakeholders. Historically we have been conservative in many ways and are looking to prudently be less conservative where it makes sense.*
- *Mergers, distribution, and product*
- *Really not the organization's mentality, except that it does like a wide portfolio of businesses and hence risks*
- *Capital and regulatory arbitrage*
- *We had found opportunities in many investment products by knowing better the emerging markets. Also, by giving daily monitoring but with patience and cautious movements. We do not react to panic, we assess risks and likelihoods, and we manage exposure to them.*
- *Climate change impact on asset portfolios*
- *The mortality gap between pensions and life insurances*
- *Provide diversification*
- *Autonomous vehicle, 3D Printing, Big Data, IoT*
- *To some extent, investments in distressed real estate, private equity, etc.*
- *N/A*
- *Fraud mitigation – ways to reduce fraud in benefits programs, Preferred provider network to mitigate unnecessary spending of benefits programs*
- *This is not relevant for our business.*
- *Talent development*
- *Taking advantage of forced seller in adverse situations*
- *New consumption uses: insurance for electronic devices, insurance for specific events (parties, weddings, etc.), insurance as you drive, etc.*
- *Critical illness cover in China*
- *At a more micro or industry level, monitoring customer purchasing trends to anticipate where the market is headed and how to respond*
- *Fake climate change leading to opportunities to take share from pollyannas*
- *None*
- *Usage of methodologies in other contexts, pricing done using imaginative approaches*
- *I am very pessimistic about market prospects given the wide range of geo-political threats faced, the fact these do not appear to be reflected in market valuations and the potential for market shocks should something awry occurs (e.g. war in Gulf). Such opportunities I see would be in de-risking for the moment so that one is able to exploit opportunities that would arise during market shocks (e.g. depressed share prices, elevated bonds spreads).*
- *We try to monitor all emerging opportunities in exactly the same way we monitor emerging risks.*
- *We look at potential acquisitions of smaller competitors.*
- *Low price for stock market and negative (temporary) news*
- *How shifts in what customers want can affect revenue and growth*
- *Creating multiple tactics, techniques, and procedures to mitigate risk, while creating dilemmas to the adversary*
- *Substandard risks*

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

- *No*
- *N/A*
- *The stock market*
- *Stock market and bond market (interest rates AND spreads are too low)*
- *Not sure*
- *I don't know what that means.*
- *China shadow banking system*
- *Market & political*
- *Not explicitly*
- *Accelerated growth in fee-based personal financial advisory space. Not clear if all parties have thought through the different incentives this creates*
- *We believe some stocks, for example, are overvalued. Somehow economics are not that good but luxury/trending companies continue to grow.*
- *Just about everything financial is in a bubble: bonds, stocks, derivatives.*
- *Yes*
- *Asset prices*
- *Housing bubble in Canada*
- *Real estate market in some Canadian cities. Some equity markets*
- *Yes*
- *N/A*
- *Risks in equities and commercial real estate, though we have immaterial holdings*
- *Yes*
- *No*
- *Asset over-valuation for fossil fuel industries*
- *The whole world seems to be going crazy around marijuana (medical use or otherwise). There is significant risk for this sector (investment or medical).*
- *CLO market for example*
- *Not yet bubble identification*
- *Real estate prices, energy prices, professional services fees (e.g., disruption and new sophisticated AI will outcompete a lot of these complacent professionals)*
- *Real estate price*
- *Real state in Bogota, too expensive, not worth while*
- *It strikes me that most markets do not offer attractive returns relative to risks, and I would be particularly wary of US stocks and sub-investment grade bonds.*
- *US stock market*
- *Some investment classes like cryptocurrencies have proved to be bubbles.*
- *New players in our industry such as Google, Amazon*
- *Bond market*
- *Cryptocurrencies*
- *Low in price with consistent high returns*
- *Anything with the word collateralized in it, debt to GDP ratio, student debt (something has to change), shadow banks*
- *No*
- *Japan entered WWII for multiple reasons, but the primary one was a denial of resources. Arguably, the same situation is facing China today...a shortage of resources. It has enabled a trade situation weighted heavily in its favor, however, the US is forcing an equitable trade deal...which is forcing many companies that migrated to China to exit, either back to the US or to other nations...further harming China's ability to manufacture its own goods. It is a more complicated situation than Japan faced, however, its solution may still be war. It is in the process of claiming all of the South*

China Sea as its own national domain – all resources, fish, oil, etc. are its to control. It has established bases around the South China Sea to defend its claim...even though the World Court ruled against China. China is buying property at all the maritime trade choke points...bases are being built around the world...it has a world class cyber capable army...it is heavily invested in disruptive technology...it is building a power projection capable Navy. **China's stability is far more important than simply its economy...but its solution may be Japan's of WWII, a world war.**

- *Below investment grade assets, certain annuity products*
- *Identity access*

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

- *N/A*
- *Pandemic e.g., the spread of African swine diseases*
- *Cyber threats – use industry stats*
- *The impact of low interest rates. Has caused us to dial back exposure to institutional programs with substantial interest guarantees*
- *Projected interest rate environment (are low rates really a 'new normal'). Stress testing and scenario analysis to ensure company preparedness*
- **Many things are unpredictable nowadays! Somehow the world behaves differently that it had before in many situations. We reduce exposure with diversification.**
- *Cost of Care for Long Term Care; scenario analysis*
- *Real inflation, not that which is measured by the bureau of labor statistics. Subscribe to a service that publishes their own measure of inflation, and try to be aware of ongoing uncertainty about it.*
- **Pandemics, like the Spanish flu**
- *Cyber risk. Do the best you can. Don't be stupid.*
- *Cyber risk. There is industry data available but I feel it's an ever increasing inherent risk.*
- *Term-to-100 lapse rates in Canada*
- *BCP impact of Hurricane*
- **Interest rate risk in a post-great recession, central bank-controlled world economy requires the use of thoughtful IR scenarios**
- *N/A*
- *An unknown known risk could be: lapse of best customers (lower risk) with the new competitors (insurtechs, non traditional insurance).*
- *Increasing natural catastrophes – use of more sophisticated AI predictive modelling*
- *Critical illness incidence trend./monitor and experience study*
- *A left-field shock would be the introduction of withholding taxes on government and agency bonds which are currently free of tax to overseas residents as governments seek to address growing fiscal pressures. One could envisage this being levied on T-Bonds as part of a "Trump shock", just as the "Nixon shock" removed the convertibility of the US$ into gold.*
- *Brexit – we know something will happen soon, but with a UK general election upcoming there's no way of knowing where things will land.*
- *N/A*
- *Low interest rates. The risk of the US going to negative rates is serious and would lead to a major global slowdown. Not a lot can be done but a balanced investment approach.*
- *Impact of regulatory fines/The potential scope and cost is unknown so a qualitative assessment is made*
- **Non-liquid assets in unit-linked contracts**
- *CAT events, pricing on CAT coverages is re-negotiated every year*
- *With previous experience*

- *Climate change e.g., coastal sea level rise – avoid commercial mortgages and property ownership in areas likely to flood permanently, also areas where living will be insufferable*
- *N/A*
- **Collapse of the Central Banking System...the system collapses roughly every 40-60 years, and resets itself.** *Currently the expected collapse has been delayed, however, there is an effort to interrupt the reset in an attempt to replace the system vs reset it. Time will tell if it will be successful, or the current system will simply reset once again.*
- *Pandemics, we employ catastrophe reinsurance*
- *Awareness that bad cyber actors will always deploy workarounds, a cat-and-mouse scenario, even when stilted in their efforts. Managing risk is by staying on top of the latest tactics and developments.*
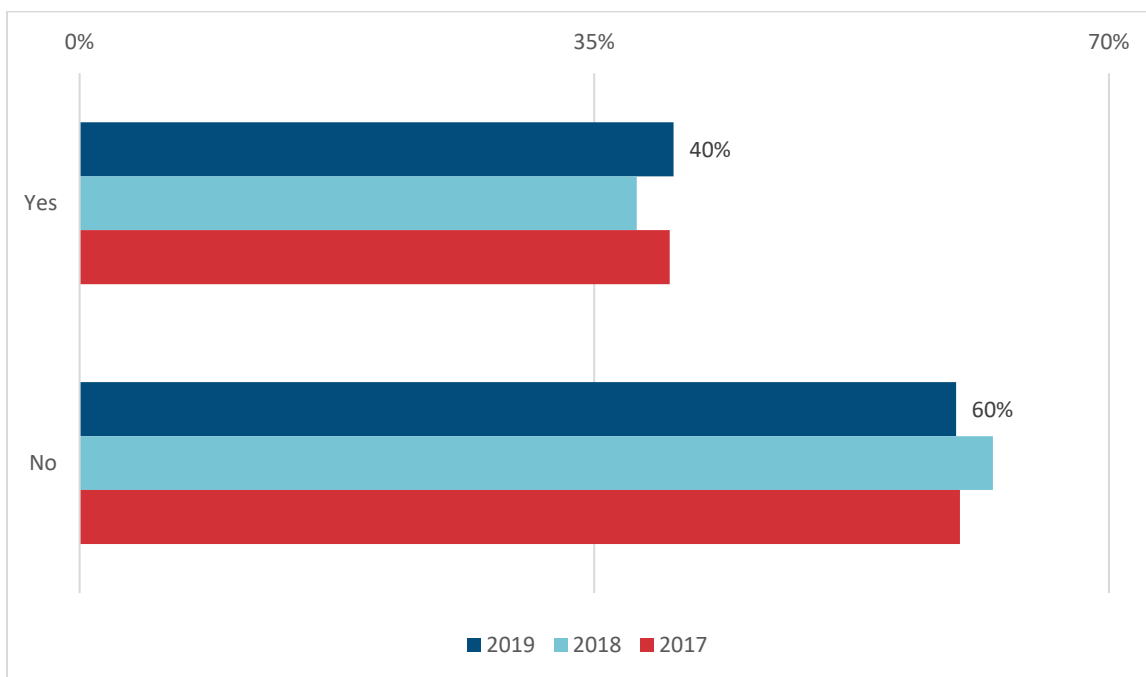
Section E: Demographics

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

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

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

## Previous Survey Participant

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

366 responses from 166 surveys (average of 2.2 responses per survey)

Percentages are based on 166 surveys.

- 21%/17%/19%   CERA
- 8%/10%/9%   FCAS/ACAS (Fellow/Associate, Casualty Actuarial Society)
- 78%/70%/90%   FSA/ASA (Fellow/Associate, Society of Actuaries)
- 14%/12%/13%   FCIA/ACIA (Fellow/Associate, Canadian Institute of Actuaries)
- 42%/49%/57%   MAAA (Member, American Academy of Actuaries)
- 1%/0%/0%   PRM (Professional Risk Manager, PRMIA)
- 2%/2%/2%   FRM (Financial Risk Manager, GARP)
- 7%/7%/5%   CFA (CFA charter, CFA Institute)
- 5%/4%/1%/3%   FIA (Fellow, Institute of Actuaries)
- 1%/0%/0%   FIAA (Fellow, Institute of Actuaries of Australia)
- 7%/8%/7%   MBA (Master of Business Administration)
- 1%/2%/1%   CPCU (Chartered Property Casualty Underwriter, The Institutes)
- Other actuarial credential (please specify)
    - *MSPA*
    - *AAG*
    - *Member of Swiss Actuarial association*
    - *Degree*
    - *I'm Actuary, with mini Master of MIB Trieste in ERM*
    - *Fellow of the Conference of Consulting Actuaries*
    - *FASSA*
    - *AIAA*
    - *Fellow of the Faculty of Actuaries (FFA) in the UK*
    - *FFA*
    - *Qualified Actuary*
    - *CIA*
- Other non-actuarial credential (please specify)
    - *FLMI*
    - *FLMI*
    - *FLMI*
    - *FLMI*
    - *CIA*
    - *ALMI*
    - *FLMI, FALU, CLU, ChFC*
    - *ASC*
    - *ARM*
    - *FLMI*
    - *Actuarial student*
    - *MA*
    - *CAIA*
    - *MS*
    - *FLMI*
    - *MSc*
    - *ICD.D*
    - *FLMI*
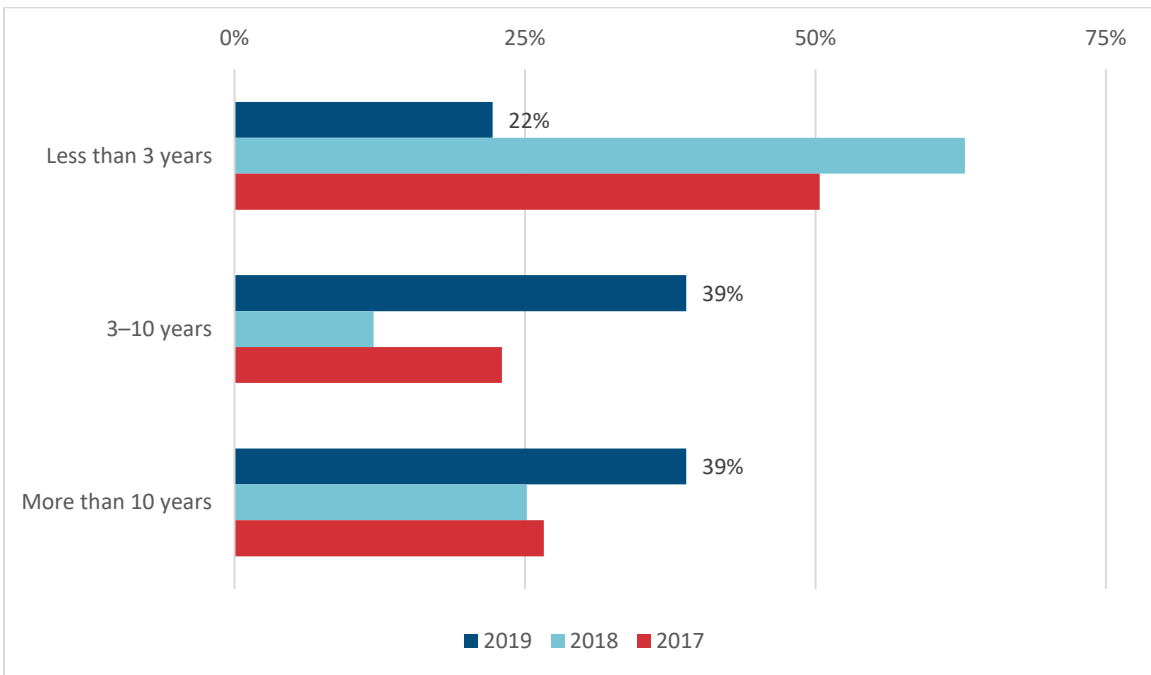   - *FLMI, RHU*
    - *FLMI, MA*

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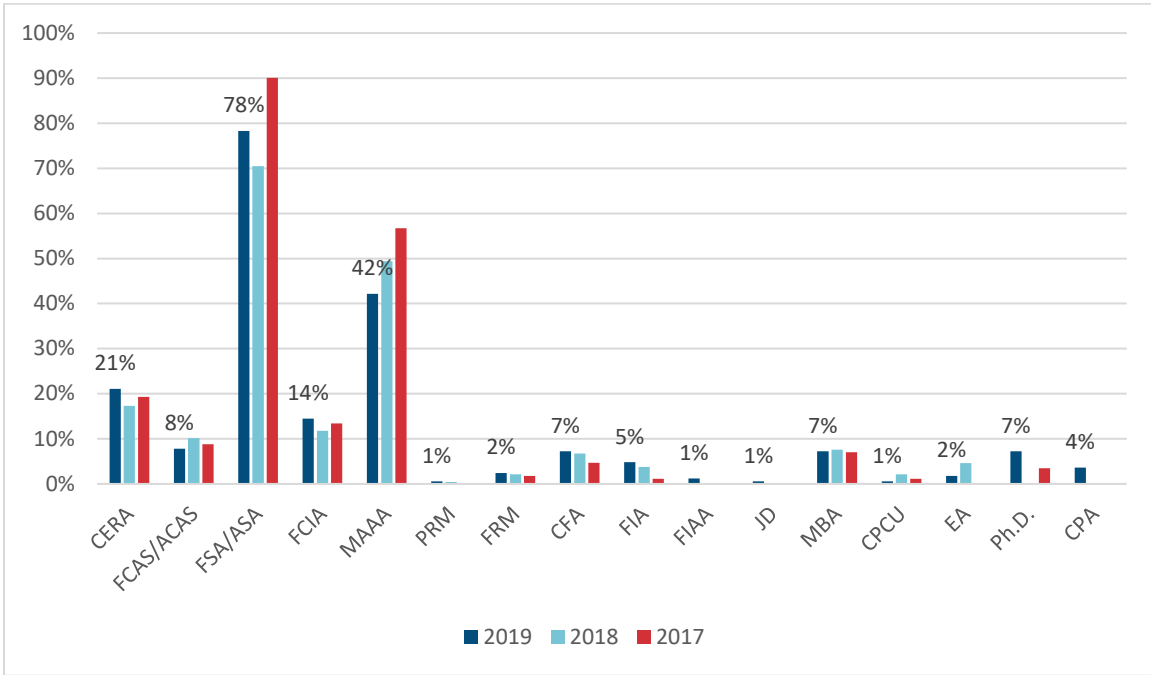
Question 3. How long have you been a risk manager?

- 22%/63%/50%   Less than 3 years
- 39%/12%/23%   3–10 years
- 39%/25%/27%   More than 10 years

Experience

Employer type (Please select all that apply.)

- 27%/23%/21%/16%   Consultant
- 2%/4%/1%/3%   Software
- 2%/2%/2%/3%   Banking
- 1%/2%/1%/3%   Brokerage
- 0%/1%/1%/1%   Intermediary
- 52%/49%/60%/61%   Insurance/reinsurance company
- 4%/2%/2%/3%   Asset management
- 1%/6%/3%/3%   Regulator/rating agency
- 2%/3%/4%/4%   Academic
- 0%/0%/1%/0%   Manufacturing/services
- 0%/1%/0%/1%   Energy
- 0%/0%/1%/0%   Military
- Other
    - *Auditor*
    - *Government*
    - *Government Insurer – Workers' Compensation*
    - *Financial/accounting nonprofit support*
    - *Third party administrator*
    - *Health Organization*
    - *M&A*
   - *Government agency*
    - *Technology Integrator*

Employer Type
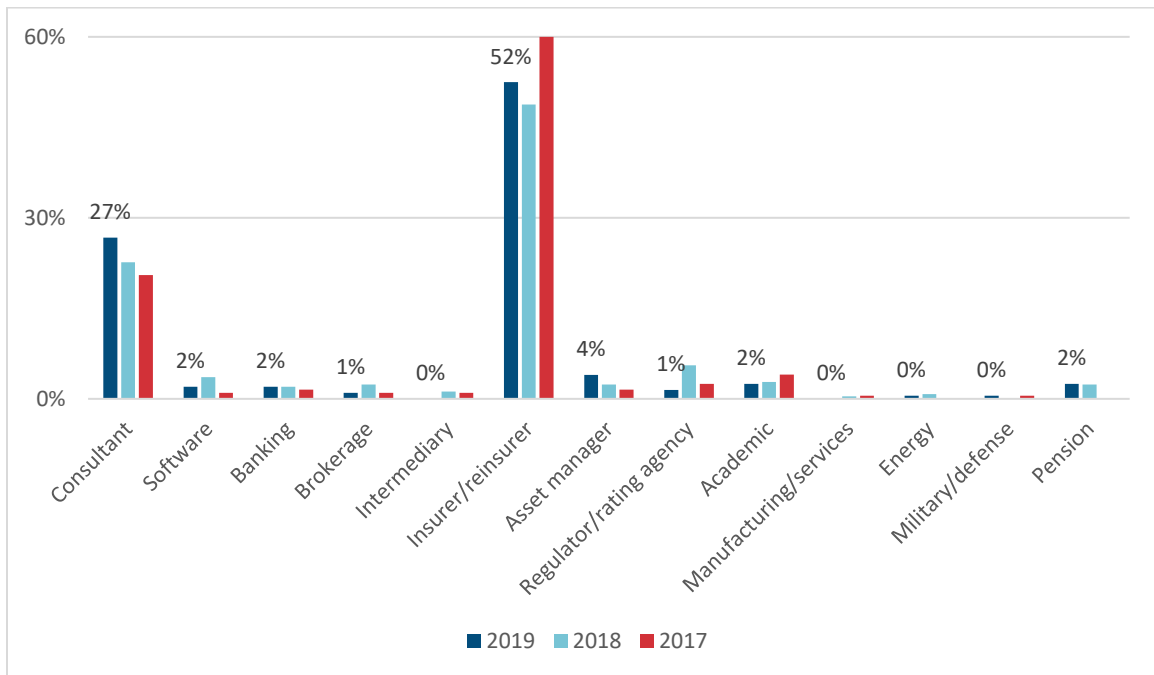
Question 5. Primary region (Please select one.)

- 8%/5%/2% — Europe
- 79%/87%/89% — North America
- 2%/1%/1% — South America
- 3%/4%/6% — Asia
- 1%/1%/1% — Africa
- 1%/0.5%/1% — Middle East
- 2%/1%/0% — Caribbean/Bermuda
- 1%S/0%/1% — Australia/Pacific
- 2%/1%/0% — Other
  - *Not sure where do you allocate Mexico. North America?*
  - *North, Central, South and Caribbean*
  - *Global*
  - *Global focus, sub divided by regional threats, either as peer competitors (Russia and China) or simply regional threats such as Iran and Korea*

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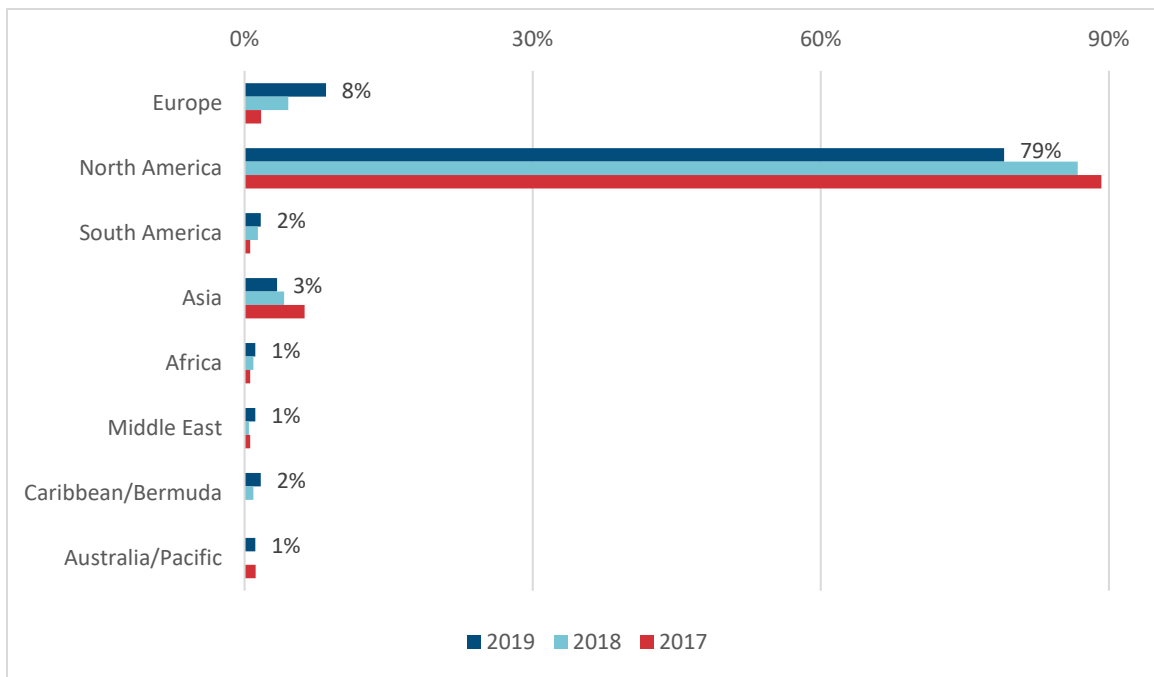
Question 6. Primary area of practice (Please select one.)

- 36%/35%/37% — Life
- 12%/16%/11% — Property/casualty (general insurance, nonlife)
- 14%/7%/10% — Pension
- 16%/21%/24% — Health
- 4%/5%/4% — Investments
- 2%/1%/1% — Financial services (noninsurance)
- 2%/0.5%/0% — Manufacturing/services

- 11%/11%/10%   Risk management
- 1%/1%/1%   Generalist/academic
- 1%/0%/1%   Military/defense
- 3%/1%/1%   Other
    - *Social Security*
    - *General Insurance including Life & Health*
    - *Retirement benefits, both pension and health*
    - *Public sector/government*

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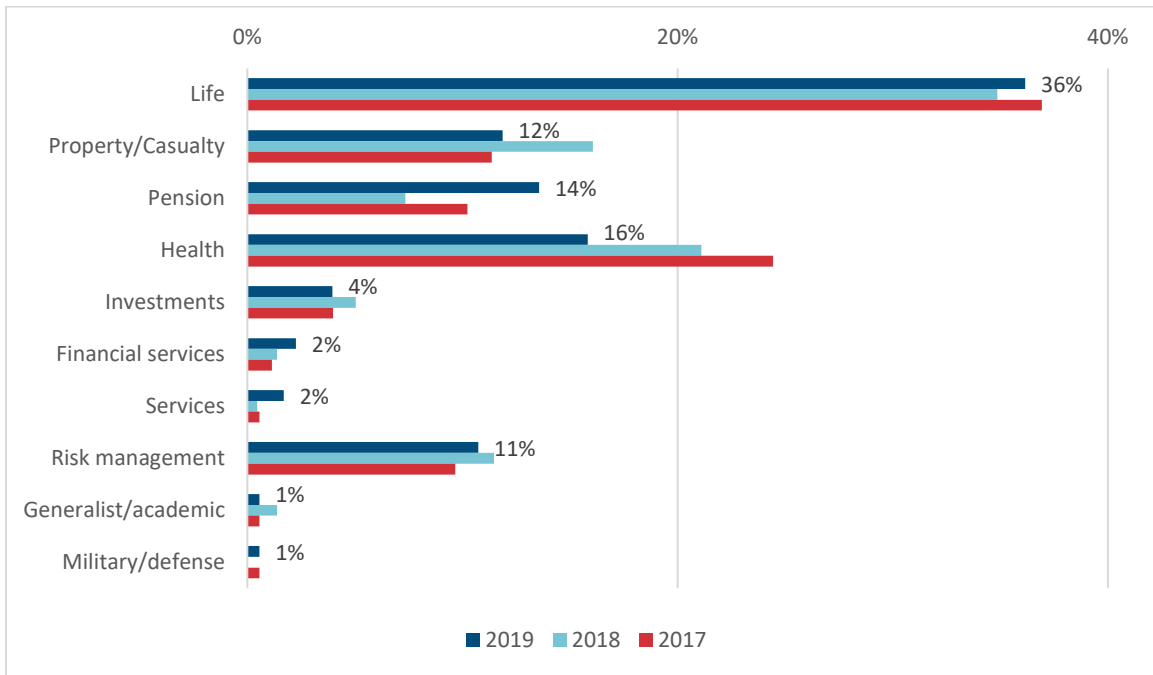
Question 7. What sources do you find valuable when scanning for emerging risks (list up to 3)?

- *CLHIA*
- *News (various sources)*
- *Global news feeds*
- *SOA, AAA*
- *Google and news services and blog subscriptions*
- **JRMS emerging risks survey***, general news sources, industry news*
- *Zerohedge.com*
- *Industry news*
- *Reinsurers, Actuaries*
- *ERM publication, trade conference*

- *News networks*
- *Social media*
- *This survey as well as World Economic Forum and CEB/Gartner*
- *PESTLE analysis/working sessions with Management*
- *CRO Forum*
- *Banana Skins report*
- *Trade publications, national and international news*
- *Magazines and other periodicals, colleagues, scientific publications*
- *SwissRE SONAR*
- *Economist The World in 20xx*
- *Bloomberg*
- *FT*
- *The Economist*
- *Internal guideline, reading from SOA, Life risk management exam*
- *UN reports*
- *De Correspondent*
- *My personal experiences and skin in the game (like my children)*
- *GARP, MIT Technology Review, SNL*
- *News headlines*
- *Magazines*
- *Internet*
- *Industry publications*
- *Internet/newsletters such as solari report*
- *International actuarial seminars*
- *Publications by public government departments*
- *International news*
- *Swiss Re SONAR report*
- *World Economic Forum report*
- *Google search*
- *10-Ks from public companies, consulting company annual risk surveys*
- *Internet, SMEs*
- *Scientific magazines, economic magazines, new books*
- *Tech news*
- *Swiss Re Sonar, Big 4 accounting firms*
- *Focused more on the physical and the cyber – many open source tracking tools. Specifically, I focus on a network of partners to stay ahead of things like the PSPS in CA – we monitored this closely since back when it was pending legislation.*
- *I don't scan for emerging risks.*
- *WSJ*
- *Various reinsurance partners/websites, former colleagues at other companies who are ERM managers*
- *News*
- *Actuarial publications*
- *N/A*
- *News media/Industry news*
- *News (television, online, social media); conferences in field; research papers*
- *WSJ, Barron's, alternative news media*
- *General news articles, industry newsletters (SOA/AAA), and radio news*
- *Anything I can read*
- *Global Risk Institute research*

- *Wall Street Journal, Fast Company magazine, FaceBook*
- *SOA Research, Investment Reporting, Leading Experts*
- *Reinsurer data/Line 1 knowledge*
- *www.ffa-assurance.fr*
- *www.institutdesactuaires.com/*
- *www.amrae.fr*
- *Asia Insurance News/Bloomberg/Social Media*
- *CDC, WHO, CMS*
- *Insurance ERM*
- *Various Financial News Publishers (both print and online)*
- *Consulting company publications*
- *Hackernews, tech blogs/feeds, twitter*
- *Panel discussions*
- *Stock market analysis: overall and at a company level*
- *Macro trends*
- *None*
- *Literature from actuarial organizations (SOA, AAA)*
- *Quartz readings*
- *Industry-wide working groups (CRO ERI, WEF, EU-vri)*
- *Economist magazine – a good overview of the issues arising in different parts of the world which may have a wider impact going forward*
- *Reading history – helps provide context and extrapolate how current issues (e.g. trade disputes) may evolve*
- *World Economic Forum/Regulator Notifications (e.g. PRA, FCA in UK)*
- *Global interest levels/Oil prices/News general*
- *Market studies and research*
- *WSJ.com/Internet*
- *Daily news, CDC, industry trend reports*
- *The internet/Surveying people across departments in the company/Industry publications*
- *General news from sources such as NYT, Washington Post, Boston Globe*
- *Magazine such as the Atlantic Monthly and the Economist*
- *Wall Street Journal and similar publications*
- *WHO, Reddit*
- *WHO, ERI Radar, PwC Insurance Banana Skins*
- *RMMagazine.com*
- *Global risk management survey (www2.deloitte.com)*
- *SOA (www.soa.org/globalassets/assets/files/resources/research-report/2019/12th-emerging-risk-survey.pdf)*
- *Bondradar, Bloomberg and local papers*
- *Swiss RE Emerging Risk Report*
- *CRO Forum Emerging Risks Initiatives*
- *SOA Survey of Emerging Risks*
- *National Geographic, Smithsonian, Economist*
- *WEF, Marsh and other broker surveys, financial news, insurance trade publications, network business channels, risk management publications, e.g. RIMS magazine*
- *Department of Defense sourcing typically originates within the intelligence side of the organization.*
- *SOA publications/IAA publications/OECD publications/World Bank publications*
- *Actuarial literature, vendors, reinsurers*
- *I read the Wall Street Journal and The Economist. I listen to the news programs on TV. I read news on the internet (e.g. AOL).*

- *Unfortunately no.*
- *Give a case study and see how different individuals give recommendations on what should be done.*
- *No.*
- *My observation is that when risk managers are in general agreement as to a risk, then they are dealing with it. What you worry about is a type of group think, in which they all identify similar solutions using the same "resources" and assumptions. So one of the biggest unspoken risks is that some of these assumptions become invalid. Examples would include the assumption of a reasonably effective hedge market (which disappeared during the financial crisis), treasury liquidity. etc. Perhaps identification of these implicit assumptions might be something to think about including in future surveys.*
- ***More attention to holistic thinking and the connectivity of supposedly stand-alone risks. To ecosystems, to global fragility levels. To the level of skin in the game of powers***
- *Fewer written answer open questions*
- *Some visualizations like a heat map would be useful*
- *How companies link emerging risks to strategy?*
- *No.*
- *No.*
- *Opinions of retirees might not be useful.*
- *I think it would be great if the survey provided for a ranking of various risk, and allowed for a more detailed explanation behind the reason for your selection.*
- *No.*
- *A summary of current activities by industry*
- *Since this was my first one, maybe consider making it shorter and more concise.*
- *More diversity*
- *Define more terms up front.*
- *Felt the list of emerging risks we had to choose from was too rigid. For instance, I am concerned about geo-political events in general including wars but also trade disputes and political shocks (e.g. election of a Corbyn government in the UK) but felt "shoe-horned" into opting for the first by the list of risks.*
- *I also felt there was a lot of overlap between risks e.g. climate change and natural catastrophes, and it was hard to choose.*
- *There could have been more clarity about what some categories meant e.g. Regional Instability? does this mean trade disputes? or territorial disputes? or both?*
- *My suggestion would be to not try restrict responses into a prescribed list but to seek free from suggestions as to what respondents see as the top 5-10 risks say over short-, medium- and long-terms. Such free form responses but would be more tricky to analyse but with the right technology (e.g. searches of key words) it should be possible to identify key themes and permit a wider expression of what people see as the key risks.*
- *None*
- *Great survey. Perhaps ask about which risks the Board or Boards seem to be most concerned about.*
- *No, other than* ***considering adding Global Food Shortage, and Collapse of the Central Banking System.***
- *None*

Researcher's Notes for Future Questions

- Add questions probing:
  - 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)?
  - Currency shock – include risk of Bretton Woods type overhaul
  - Section 4 question 3 add shrink to options
  - COVID and all things 2020

Appendix III: Survey Results 2018 and Earlier

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