

# 10<sup>th</sup> Survey of Emerging Risks





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CAS/CIA/SOA Joint Risk Management  
Section

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## ***10th Survey of Emerging Risks***

Enterprise risk management (ERM) considers risks to an entity through exposures that are susceptible to current or future events. Emerging risks are a key component of new or evolving risks, focusing on unknown unknowns and unknown knowns. Interactions between risks can cause unforeseen outcomes.

The unknown unknowns are impossible, by definition, to identify in advance. The best way to address them is to seek them out, providing your firm with a competitive advantage by identifying them before others. You can monitor these emerging risks using internal questionnaires and interviews with experts, external sources like consulting firms, reinsurers, historical, scientific and financial magazines, and other techniques that effectively keep your eyes open.

Unknown knowns, on the other hand, are risks where historical data has been predictive in the past but something has changed. This is the analogy where the risk manager is driving with the front windshield blocked and uses only the rearview mirror to steer a path forward. Some risks evolve slowly over time, requiring statistical techniques to extrapolate based on recent trends. This might include flood risk due to climate change, or auto insurance as seat belt usage became prevalent. Other risks shift suddenly, and prior data is harmful if used to describe the future. Insurance risks related to driverless cars, drones, and opioid use fall in this category. While evolving risks often occur slow enough for adaptation, those that move quickly increase solvency risk. By actively seeking out emerging risks, a risk manager increases firm resiliency by incorporating deterministic stress tests to identify risks to look at closer.

This survey attempts to track the thoughts of risk managers about emerging risks across time. It is the *10th Survey of Emerging Risks* conducted by the Joint Risk Management Section, a collaboration of the Canadian Institute of Actuaries (CIA), Casualty Actuarial Society (CAS) and Society of Actuaries (SOA). Trends are as important as absolute responses, helping risk managers contemplate individual risks, combinations of risks and unintended consequences of actions and inactions. The survey responses, especially the comments, give risk managers a way to anonymously network with peers and share the new ways they are thinking about risk. Each iteration of the survey enhances the knowledge of those who participate by helping them think more deeply about the topic.

Note that an Executive Summary hits the high points of the survey, a Results section provides commentary about the survey, and detailed survey results can be found in Appendix II. This allows the reader to scan specific sections or questions based on their level of interest.

## **Executive Summary**

Each year the risk management field evolves in ways that are then reflected in the *Survey of Emerging Risks*. In the past, highlights have included recency bias, the increasing importance of cyber risks, and the prominence of risk culture in long-term results. This year is no different. The rise of populist candidates in developed countries resulted in the Brexit vote, where U.K. voters expressed a desire to leave the European Union, and the election of Donald Trump as president of the United States. The survey's timing, just weeks after the U.S. election, reflects this as seen by increases in the *Retrenchment from globalization* risk across questions about current and emerging risks.

Risk management practices continue to evolve. Central banks, terrorism and climate change grab the headlines, but ever-changing technology, demographic shifts and failing states are interacting to form worrying risk combinations. The year 2016 saw limited risk escalations, but it seems there are shorter breaks between risk events than previously. The Middle East, Venezuela, Ukraine and North Korea are all hot zones (among others), and hackers seem to be a constant threat, but the public is lulled into complacency until something happens that is inconsistent with the past. This year's *Survey of Emerging Risks*, the 10th in the series, attempts to capture these shifts.

Recency bias places emphasis on risk events that recently occurred and remain in our short-term memory. This survey attempts to interpret emerging risks over a longer time horizon. Each year another data point is added. In addition, the evolving role of emerging risks in an enterprise risk management (ERM) process is explored. This survey will continue to explore the implementation of ERM, what has worked and where the challenges lie.

### ***Emerging Risks***

In addition to top five and top emerging risks over a longer time horizon, the survey also looks at the top current risk. Combinations of risks often follow the patterns shown when looking at emerging risks one at a time, but sometimes also show surprises. Some risks are more common when viewed with others than by themselves.

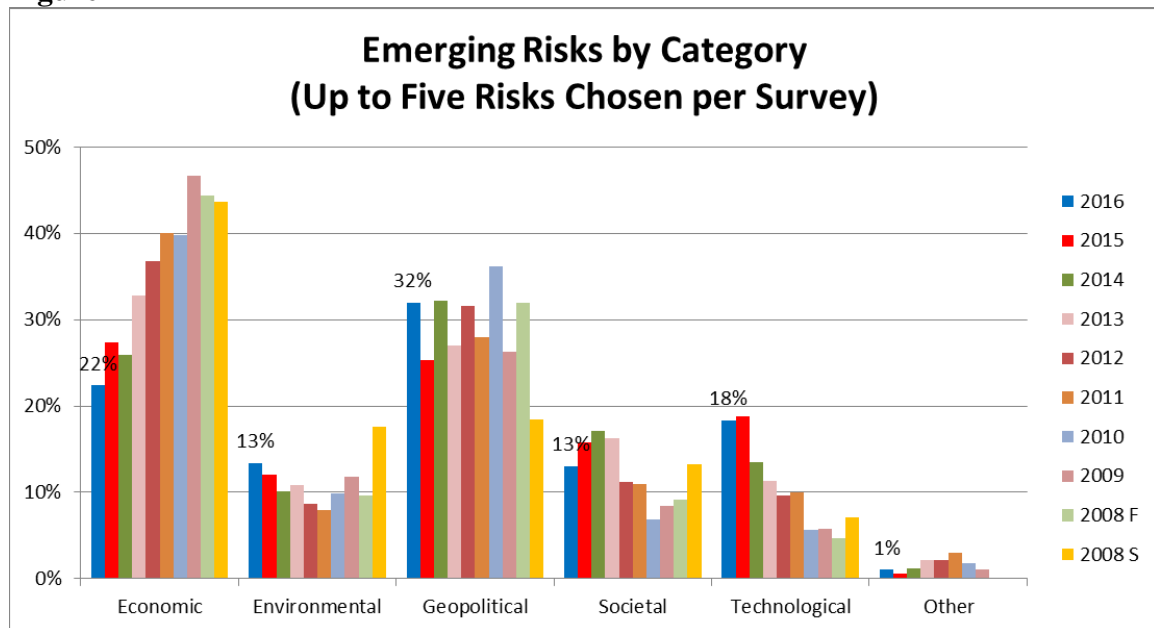
### ***Top Five Emerging Risks***

Each year's data set is fascinating to review both in isolation, given recent events (recency bias), and in the context of longer-term trends and the changing demographic makeup of the respondents. As shown in Figure 1, the survey combines 23 individual risks into five categories (Economic, Environmental, Geopolitical, Societal and Technological). The Geopolitical category of risks gained ground (32 percent of the total chosen when up to five emerging risks were selected), reclaiming the top category as Economic (down 5 percent) and Societal (down 3 percent) dropped from the previous survey. The Technological (down slightly) and Environmental (up slightly to its highest since spring 2008) categories each had small changes from the prior survey. The

uppermost choices (in the top five) in the Geopolitical category were *Terrorism* (40 percent of respondents choosing it in their top five, up from 37 percent) and *Retrenchment from globalization* (up from 6 percent to 30 percent). Risks with new highs across the survey history were *Climate change (includes space weather)* (29 percent), *Natural catastrophe: earthquakes* (9 percent), *Retrenchment from globalization* (30 percent and overall fifth choice), and *Technology* (34 percent and overall fourth choice). A new low was recorded by the *Chinese economic hard landing* (17 percent) risk for the sixth consecutive survey.

Overall, the primary trends relative to 2008 continue to be those noted in past surveys. The Economic category is much lower as we move further from the global financial crisis, and the Technological category remains higher as cyber risks and other technologies receive more attention from risk managers.

**Figure 1**



*Cyber/interconnectedness of infrastructure* continued in its position at the top of the list of emerging risks, but for the first time since its entry as a risk in 2009 it did not rise, falling from 65 percent to 53 percent of respondents.

In most years the survey has found evidence of recency cognitive bias, where responses gravitate toward risks that have occurred recently. This year’s results are consistent with these tendencies, driven by the rise of populism, environmental concerns, and lessened economic pressures.

The evolution of the top five risks chosen provides evidence that trends can be relied on in this survey, and the general continuity between survey iterations adds credibility. As

shown in Table 1, the emergence of risks like *Cyber/interconnectedness of infrastructure* (ranked 2, 1, 1 and currently 1 in the past four years) shows how concerns are evolving away from the Economic category as more time passes from the global financial crisis. In this survey, *Financial volatility* (12 percent) has overtaken *Cyber/interconnectedness of infrastructure* (11 percent) as the top current risk, but *Cyber/interconnectedness of infrastructure* remains the top emerging risk both when choosing five or a single risk.

**Table 1: Top Five Emerging Risks, 2013-2016**

Year	2013	2014	2015	2016
1	Financial volatility	Cybersecurity / interconnectedness of infrastructure	Cybersecurity / interconnectedness of infrastructure	Cyber / interconnectedness of infrastructure
2	Cybersecurity / interconnectedness of infrastructure	Financial volatility	Financial volatility	Financial volatility
3	Asset price collapse	Terrorism	Terrorism	Terrorism
4	Demographic shift	Regional instability	Asset price collapse	Technology
5	Failed and failing states / Regional instability (tie)	Asset price collapse	Regional instability	Retrenchment from globalization

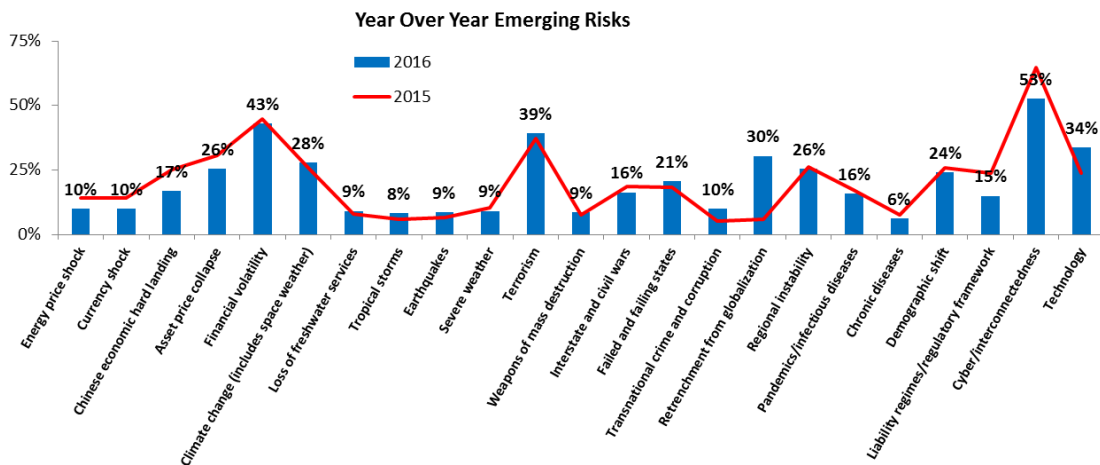
Three risks increased materially from the previous survey when respondents were asked to choose their top five emerging risks. *Transnational crime and corruption* doubled from 5 percent to 10 percent. *Retrenchment from globalization* and *Technology*, both discussed earlier, each rose by double digits. Quite a few risks were materially lower, led by those in the Economic category. They included *Chinese economic hard landing* (25 percent to 17 percent), *Asset price collapse* (from 31 percent to 26 percent), *Liability*



regimes/regulatory framework (24 percent to 15 percent), and *Cyber/interconnectedness of infrastructure* (65 percent to 54 percent). Geopolitical risks seem to be in a two-year cycle, increasing in even-numbered years. It was suggested that this might be due to U.S. elections and the corresponding news cycle.

Figure 2 shows the results for the top five emerging risks from the most recent two surveys.

**Figure 2**



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 for future surveys.

**Economic Risks**

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

**Environmental Risks**

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

**Geopolitical**

11. *Terrorism*

- 12. *Weapons of mass destruction*
- 13. *Interstate and civil wars*
- 14. *Failed and failing states*
- 15. *Transnational crime and corruption*
- 16. *Retrenchment from globalization*
- 17. *Regional instability*

**Societal**

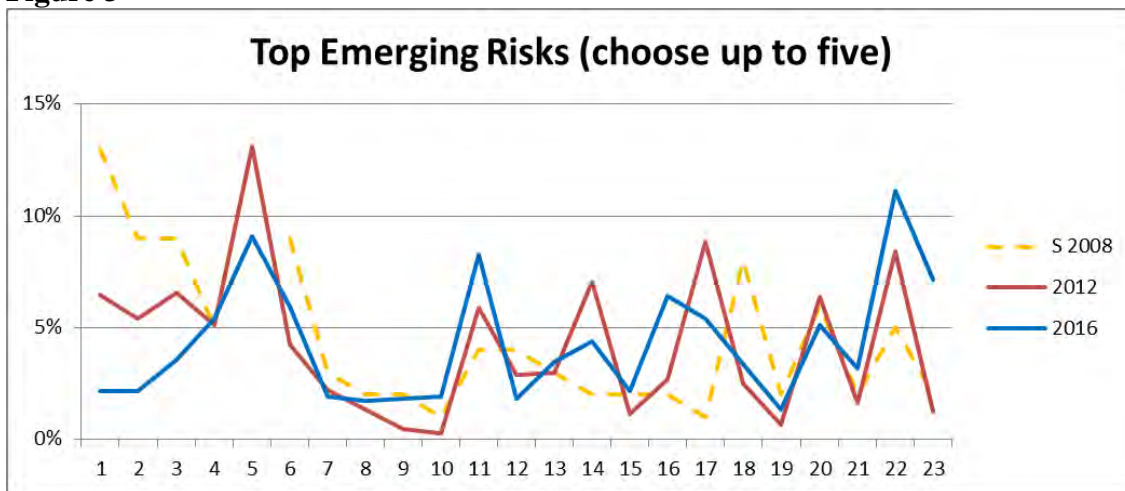
- 18. *Pandemics/infectious diseases*
- 19. *Chronic diseases*
- 20. *Demographic shift*
- 21. *Liability regimes/regulatory framework*

**Technological**

- 22. *Cyber/interconnectedness of infrastructure*
- 23. *Technology*

These results evolve over time, with risk responses ebbing and flowing. Figure 3 shows an example of how the responses for each risk have changed over time, displaying results from spring 2008, 2012 and 2016 (note that risk number 5 *Financial volatility* was added after the spring 2008 survey).

**Figure 3**



**Top Emerging Risk**

When asked for a single emerging risk from the respondents’ top five, the results are similar.

The results for the top emerging risk in November 2016 were as follows (the five highest were named by 58 percent of respondents, up from the previous survey’s result of 57 percent):

1. *Cyber/interconnectedness of infrastructure* (17 percent)
2. *Financial volatility* (13 percent)
3. *Asset price collapse* (11 percent)
4. *Retrenchment from globalization* (10 percent)
5. *Technology* (7 percent)

*Chinese economic hard landing, Terrorism and Liability regimes/regulatory framework* dropped out of the top five. Interestingly, *Asset price collapse* and *Retrenchment from globalization* both had much higher results when considering the top emerging risk, resulting in shortfalls for most of the other risks.

All of the risks except *Loss of freshwater services* received at least one vote for top emerging risk in this year's survey.

### **Trending**

Figure 4 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. When a risk manager feels a risk is not represented in the list (Other), then it is felt to be an important risk (the most common reference in the Other category was to newly elected U.S. President Donald Trump). To reduce clutter, only one survey question includes a data label for each category (the highest response rate).

**Figure 4**

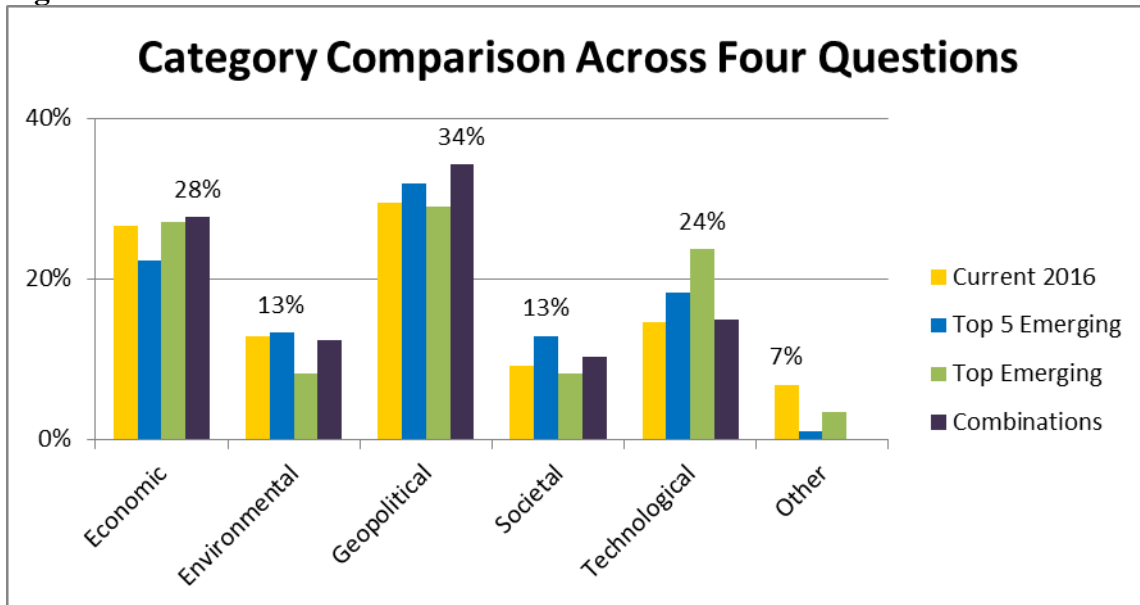


Figure 5 compares the current risk results to the top five and top emerging risk at the individual risk level. Hypothesizing why there are discrepancies is useful, and readers

may have different viewpoints. The risks with the greatest disparity (above 2 percent) favoring the current risk over the top emerging risk are

- *Climate change (includes space weather)* (3.9% differential)
- *Terrorism* (2.6%)

The risks with the greatest disparity (above 2 percent) favoring the top emerging risk over the current risk are

- *Cyber/interconnectedness of infrastructure* (5.9%)
- *Technology* (3.1%)
- *Regional instability* (2.9%)

The risks with the greatest disparity (above 2 percent) favoring the top five emerging risks over the top emerging risk are

- *Terrorism* (4.9%)
- *Demographic shift* (2.2%)
- *Regional instability* (2.0%)

The risks with the greatest disparity (above 2 percent) favoring the top emerging risk over the top five emerging risks are

- *Cyber/interconnectedness of infrastructure* (5.4%)
- *Asset price collapse* (5.3%)
- *Financial volatility* (4.0%)
- *Retrenchment from globalization* (3.3%)

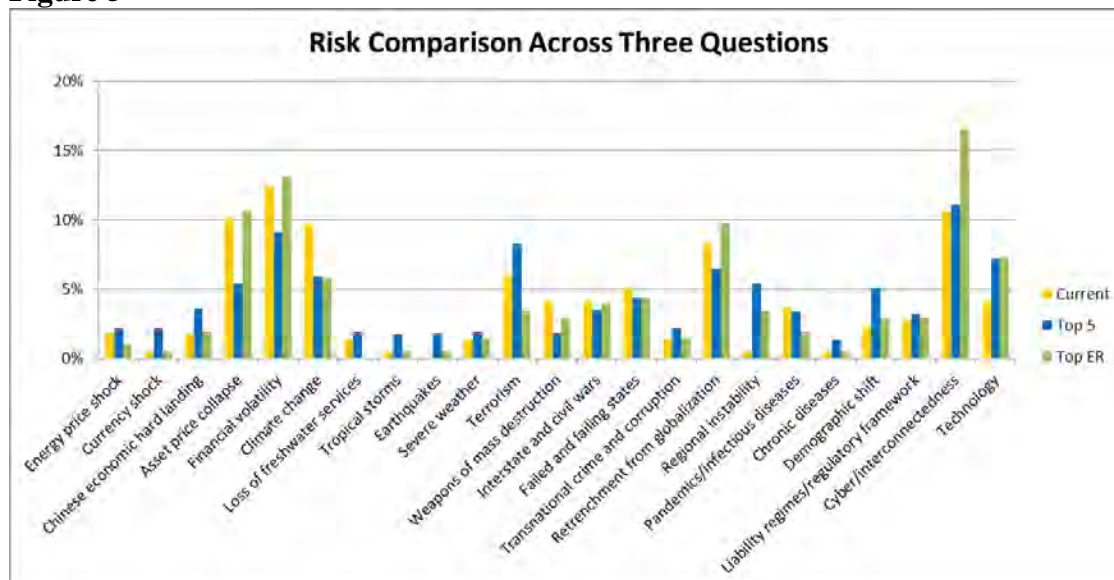
The risks with the greatest disparity (above 2 percent) favoring the top current risk over the top five emerging risks are

- *Asset price collapse* (4.7%)
- *Climate change (includes space weather)* (3.8%)
- *Financial volatility* (3.4%)
- *Weapons of mass destruction* (2.3%)

The risks with the greatest disparity (above 2 percent) favoring the top five emerging risks over the top current risk are

- *Regional instability* (5.0%)
- *Technology* (3.0%)
- *Demographic shift* (2.8%)
- *Terrorism* (2.3%)

**Figure 5**



### **Risk Combinations**

This year’s survey again asked about concerns due to combinations of emerging risks. The top risks chosen in combination included *Financial volatility*, *Cyber/interconnectedness of infrastructure*, *Terrorism*, *Asset price collapse*, *Retrenchment from globalization* and *Regional instability*. One combination ranked in the top five after being unranked in the 2015 survey. In third position was *Financial volatility* and *Retrenchment from globalization* (4 percent). Overall, Geopolitical risks were up, taking share from the Economic and Technological categories.

Top five combinations selected:

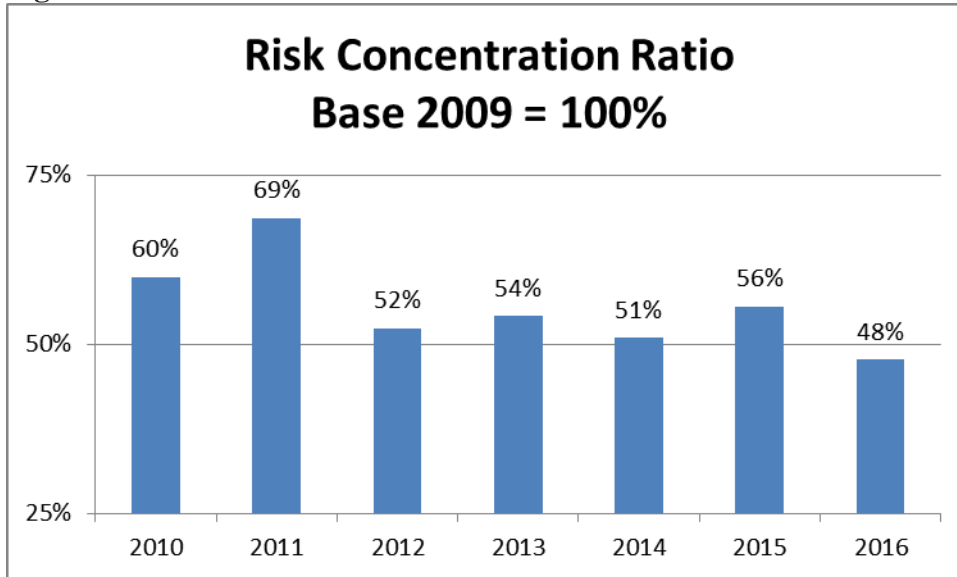
- Terrorism* and *Cyber/interconnectedness of infrastructure*—6 percent
- Cyber/interconnectedness of infrastructure* and *Technology*—5 percent
- Financial volatility* and *Retrenchment from globalization*—4 percent
- Asset price collapse* and *Financial volatility*—4 percent
- Chinese economic hard landing* and *Asset price collapse*—3 percent

There was much less concentration in the results this year for the top five combinations, with their total adding to only 21 percent after last year’s comparable total of 33 percent.

There are 253 possible two-risk combinations from the 23 risks. As shown in Figure 6, the distribution of results was the least concentrated it has been in the survey. The period immediately following the financial crisis is likely the extreme case, so 2009 is used as

the base year of 100 percent for the risk concentration ratio. Comparisons are made by ranking the risks and comparing the resulting statistics, looking at the 25th percentile, median (50th percentile/median), 75th percentile and total. A higher percentage reflects greater concerns.

**Figure 6**



As a relative measure, the risk concentration ratio represents the current feeling among the risk management community. With a theme of populism in this survey, a reduced ratio could be interpreted as reduced concentration in an economic crisis. In past surveys a low risk concentration ratio was interpreted as reduced risk, but in this year's survey it may mean a greater variety of risks are being worried about.

### ***Emerging Opportunities***

Best practice risk management is evolving toward what is being called strategic risk management, and the respondents shared instances where emerging opportunities are being monitored. In addition to demographic shifts and opportunistic trading examples, respondents looked at opportunities to benefit from deregulation, advances in medical science, cyber security innovations, and autonomous cars. Driverless cars (including taxis, trucks, and trains) and drones have a strong likelihood of impacting the casualty insurance business, as would rapidly changing gas prices. Mean reversion of prices may provide opportunities to those who can overcome cognitive biases such as overconfidence and overreliance on efficient markets.

### ***Leading Indicators***

As formal risk appetite policies and regulatory processes are implemented, about half of firms are formally identifying emerging risks (48 percent). Most respondents who identify leading indicators for emerging risks also have criteria for action based on them

(71 percent). Some respondents described a continuous exercise tied to the planning process or a standing committee. Risks being followed included various economic and health related, technology, climate change, mortality (e.g., opioid epidemic) and regulatory changes. Some followed continuous variables and some considered scenarios such as how the Brexit vote would resolve itself.

Some leading indicators identified include sales trends by distribution platform, to monitor a potential transition to technology-driven sales, various public indices designed to monitor climate change or health, and private indices based on internal views of risk.

### ***Risks versus Returns***

About half of respondents (48 percent) said that ERM improves returns relative to risks. When asked why it had a positive effect on their company/industry, some suggested that better communication, transparency, awareness and alignment were reasons for this, while others noted that decision making was improved due to proactive risk analysis. Those who disagreed with this view found that the process was bureaucratic and compliance driven, providing a false sense of security. Some expressed a neutral response, citing a lack of change from previous common sense practices or lack of alignment with incentive compensation practices.

One respondent who answered *Not sure* about the effect of ERM at their company framed the debate in an interesting way: *It depends on what is meant by “enterprise risk management.” If this means a strong risk management framework and strong culture of risk identification, assessment, measurement and mitigation, then ERM has had a positive impact. If this means having a dedicated ERM department running complex economic capital models, then ERM has had no impact. Our company believes that ERM assessments should be simple and easily understood by all.*

Another noted that *Results from poor ERM has been disastrous, as seen in 2008. Short-term returns are reduced by effective ERM, but so-called tail scenarios, which occur every 10 to 15 years, are avoided. There is a net benefit to solvency and viability, but discipline is needed to stay the course during “normal” years.*

Respondents provided numerous examples where qualitative and quantitative assessments enabled better decision making and where ERM improved returns. Here is a specific response: *Yin and yang. If things are too complex to quantitatively capture or there is too much noise, “qualitative analysis” may explain and provide better analysis for a decision maker.*

Risk managers were also asked to share their experience with future risk managers—what works and what doesn’t. As usual there were a lot of great comments, including specifics such as integrate the framework, avoid falling in love with your models, keep it simple, don’t expect instant buy-in, and insist on a supportive tone at the top. *Each organization has to find what works for them.* Avoiding cookie cutter approaches and bringing a wide

variety of expertise to the table during implementation will pay off. This section of Appendix II is excellent reading material for both new and experienced risk managers.

## **Predictions**

Risk managers continue to identify risks and perform scenario analysis across a range of outcomes to detect vulnerabilities, but there remain interesting nuances in the responses received that show how difficult it is to look at the “right” risks proactively. Here are three separate comments received on the topic:

- *Getting the timing right can be tricky. Being too early could be the same as being wrong.*
- *A crisis can be anticipated, but not predicted.*
- *Once you’ve anticipated a crisis, it’s less of a crisis and more of a scenario to address.*

## **Risk Activities**

Risk managers report that risk tools are being used more frequently to add value and make firms more resilient. Many activities related to ERM continued to grow in 2016, with 51 percent expecting activity growth in 2017, but only 29 percent anticipating an increase in funding. Implementation of regulatory requirements related to ORSA and PBR are winding down, and federal regulation is not expected to increase. If the financial crisis becomes ever distant and no new crisis erupts, risk functions may be considered overhead and be susceptible to downsizing. Since risk grows in the dark<sup>\*</sup> during periods of growth, and we only know who has been swimming naked when the tide goes out,<sup>†</sup> one could argue that small risk events reduce the likelihood of major events.

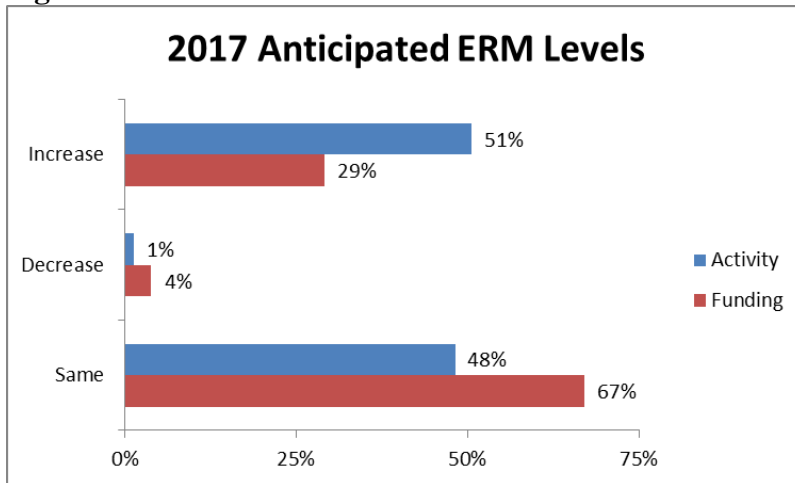
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<sup>\*</sup> Ingram, David. 2009. Risk and Light. *ERM Symposium*, 2009, <http://www.ermssymposium.org/2009/pdf/2009-ingram-risk-light.pdf>.

<sup>†</sup> Lowe, Janet. 1997. *Warren Buffett Speaks: Wit and Wisdom from the World’s Greatest Investor*. Hoboken, NJ: Wiley, 108. While Buffett has said this many times, in this case she is quoting from the 1993 Berkshire Hathaway Annual Meeting.



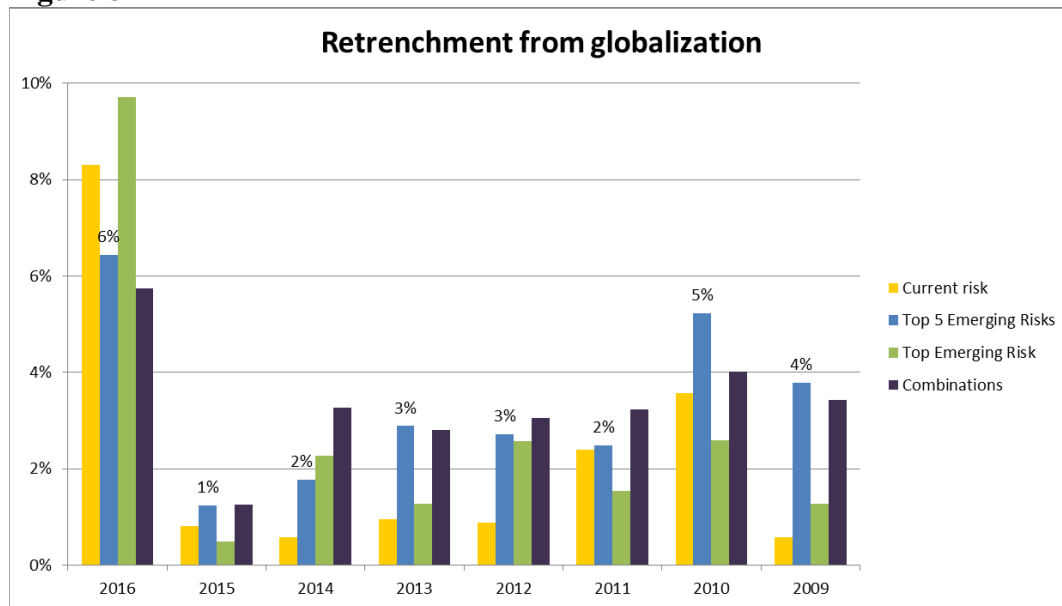
**Figure 7**



### ***Highlight—Retrenchment from Globalization***

The survey reflected concerns about uncertainty due to populist candidates in the United States and Europe. This appeared with higher responses for *Retrenchment from globalization* in each of the surveyed categories: current risk, top five emerging risks (measured as a percentage of the total rather than of the number of survey respondents), top emerging risk, and risk combinations. In some cases the 2016 result was greater than the sum since 2009. Together with *Financial volatility*, this risk was ranked third among all combinations. While impossible to determine exactly why a specific risk goes up and down, for this risk it is notable that it had gone down right before it skyrocketed. This result is fascinating and intriguing at the same time. Figure 8 shows the progression of this risk since 2009.

**Figure 8**



## Top Takeaways

While this report provides many additional nuggets of information to those who read it in its entirety, some scan the initial pages looking for the primary conclusions. The following bullets provide interesting tidbits that may prompt you to read further. Reviewers with different background and experience from the researcher may highlight alternative comments. This is why the entire data set is reproduced in Appendix II.

### ***What Risk Managers Are Thinking***

- Cyber risk concerns are stabilizing but remain strong.
- Geopolitical category risks are higher, highlighting a pattern of even-numbered-year increases possibly tied to the U.S. election cycle.
- Economic and Societal categories fell.
- The election cycle impacted the survey as the Brexit vote and election of Donald Trump as U.S. president displayed a wave of populism, reflected by increased choice of *Retrenchment from globalization* and reduced *Liability regimes/regulatory framework*.
- *Retrenchment from globalization* and *Cyber/interconnectedness of infrastructure* are ranked higher when considering the top emerging risk than the current risk or the top five emerging risks. *Climate change* is ranked highest as a current risk. *Terrorism* and *Demographic shift* are higher under the top five emerging risk question.
- *Technology* risk continues to move up the rankings and is now in the top five for both emerging risks and top emerging risk. This risk highlights the insurance industry's unique role in risk management, not only managing its own risks but

seeking out and accepting the risks of others to help businesses increase resilience.

### ***Leading-Edge Actionable Practices***

- Enterprise risk management has had a positive effect for many, with improved returns relative to risk when culture encourages engaged discussions.
- Risk management is moving toward strategic planning in best practice companies.
- Risk managers consider it their job to present scenarios that cover a range of possible outcomes.
- Over half of respondents expect increased ERM activity in 2017 but less than 30 percent expect increased funding.
- Over 90 percent of risk managers report that they have a role when strategic opportunities are considered.

### ***Conclusions***

Emerging risks are increasingly viewed as important to monitor, but they also must be put in perspective relative to a firm's strategic plan. Current risks can be managed, modeled, and tested against various scenarios. Emerging risks deserve attention, but the analysis may be qualitative or a combination of qualitative and quantitative. Models are very hard to get right for risks that may not develop for 10 years or more.

This is a great challenge for management teams—how do you manage risks with long time horizons while incentives are set over much shorter spans? How can a CEO keep the focus on intermediate and long-term decisions when short-term fires are so distracting?

How can modelers incorporate the changing impact when historical data may not be similar to future results? Unknown unknowns will impact everyone in unique ways, and stress scenarios are hard to develop. Unknown knowns, where past historical data fails to be predictive, should be tested as thoroughly as possible.

The rapid changes in technology and climate are impacting biodiversity, with negative consequences for the earth's ecosystem. Central banks have pushed the global economy in directions never seen before, resulting in low interest rates and high debt that subsidizes some while hurting others. Are these scenarios sustainable? These changes will impact the insurance industry in material ways; examples include driverless cars, drones, extreme weather events, rising seas and artificial intelligence. Each has unknown and unintended consequences. Some are opportunities, while others require mitigation strategies. Should firms continue dancing as long as the music plays, as bankers did a decade ago, or consciously consider changes to their business models in advance? Those who take the time to consider increasingly changing circumstances will also have considered solutions and have a step up on their competition, who is thinking about these risks as they develop.

## **Background\***

This research project was funded by the Joint Risk Management Section (JRMS) of the Canadian Institute of Actuaries, Casualty Actuarial Society and Society of Actuaries. A survey was developed and made available through an email link to members of the Joint Risk Management Section. Others were invited to participate using the International Network of Actuarial Risk Managers (INARM) Listserv and social media such as Twitter and LinkedIn groups related to risk management. A total of 223 responses were received. This represents a material percentage relative to the number distributed (more than 2,500 to JRMS). This is the 10th 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, November 2010, October 2011, October 2012, October 2013, October 2014, and November 2015. This year's survey was conducted in November 2016. All articles and previous research reports can be found at

<http://www.soa.org/Research/Research-Projects/Risk-Management/research-emerging-risks-survey-reports.aspx>

April 2008—First survey

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

November 2008—Second survey

- Research report <http://www.soa.org/research/research-projects/risk-management/research-2009-emerging-risks-survey.aspx>

December 2009—Third survey

- Research report <http://www.soa.org/research/research-projects/risk-management/research-2009-emerg-risks-survey.aspx>
- Article: pages 12–14 of *The Actuary* August/September 2010 issue  
<http://www.soa.org/library/newsletters/the-actuary-magazine/2010/august/act-2010-vol7-iss4.pdf>

November 2010—Fourth survey

- Research report <http://www.soa.org/research/research-projects/risk-management/research-2010-emerging-risks-survey.aspx>

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\* This section has been updated with new information but is otherwise consistent with prior surveys.

- Article: pages 6–9 of *Risk Management* August 2011 issue <http://www.soa.org/library/newsletters/risk-management-newsletter/2011/august/jrm-2011-iss22-rudolph.pdf>

October 2011—Fifth survey

- Research report <http://www.soa.org/research/research-projects/risk-management/research-2011-emerging-risks-survey.aspx>

October 2012—Sixth survey

- Research report <http://www.soa.org/research/research-projects/risk-management/research-2012-emerging-risks-survey.aspx>
- Article: pages 12–17 of *Risk Management* August 2013 issue <https://soa.org/Library/Newsletters/Risk-Management-Newsletter/2013/august/jrm-2013-iss27.pdf>

October 2013—Seventh survey

- Research report <https://www.soa.org/Research/Research-Projects/Risk-Management/2013-Emerging-Risks-Survey.aspx>
- Article: pages 34–35 of *Risk Management* August 2014 issue <https://www.soa.org/library/newsletters/risk-management-newsletter/2014/august/jrm-2014-iss30-rudolph.aspx>

October 2014—Eighth survey

- Research report <https://www.soa.org/Research/Research-Projects/Risk-Management/2014-emerging-risks-survey.aspx>
- Article: pages 5–6 of *Risk Management* April 2016 issue <http://www.soa.org/Library/Newsletters/Risk-Management-Newsletter/2016/april/rm-2016-iss-35-rudolph.aspx>

October 2015—Ninth survey

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

Rather than developing a unique set of emerging risks for consideration, the research team chose one originally developed by the World Economic Forum (WEF) for the initial survey. The WEF reports, starting in 2007, can be found at [www.weforum.org](http://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, as *Weapons of mass destruction (WMD)* replaced *Proliferation of weapons of mass destruction (WMD)*, and *Cyber/interconnectedness of infrastructure* replaced *Cybersecurity/interconnectedness of infrastructure* since some respondents felt cybersecurity was a narrower term and that was not the intent. Each risk has been categorized as either Economic (5 risks), Environmental (5), Geopolitical (7), Societal (4) or Technological (2). 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 minimal editing.

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

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

### ***Researcher***

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## Results

The *10th Survey of Emerging Risks*, sponsored by the Joint Risk Management Section, includes sections covering Current Risks, Emerging Risks, Leading Indicators, Methodology, Predictions, and Current Topics. Highlights of each section are presented here, with complete results found in Appendix II. A total of 223 surveys were submitted (electronically). The survey asks for individual rather than company responses. It uses an anonymous electronic format encouraging the expression of opinions, and the respondents delivered! Many multiple-choice format questions are followed up with “why” or “provide examples,” allowing expansion of the concept and additional learning for readers. 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. It is likely that this will stimulate additional questions for you to ponder and consider alternative perspectives.

Some respondents did not answer all the questions. Partially completed surveys have been included, 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. Analysis of this year’s trends was very thought-provoking for the researcher, as occurs each year, and hopefully you will agree.

### ***What Changes in Responses Mean***

Note that each survey is taken at a different point in time, so the same risk managers do not necessarily respond. Increases and decreases reflect the respondents’ perception of the risk, not actual changes in assessment of the risk itself. A perceived risk may not have changed at all, but another risk is perceived to be higher or lower and that impacts the other risks.

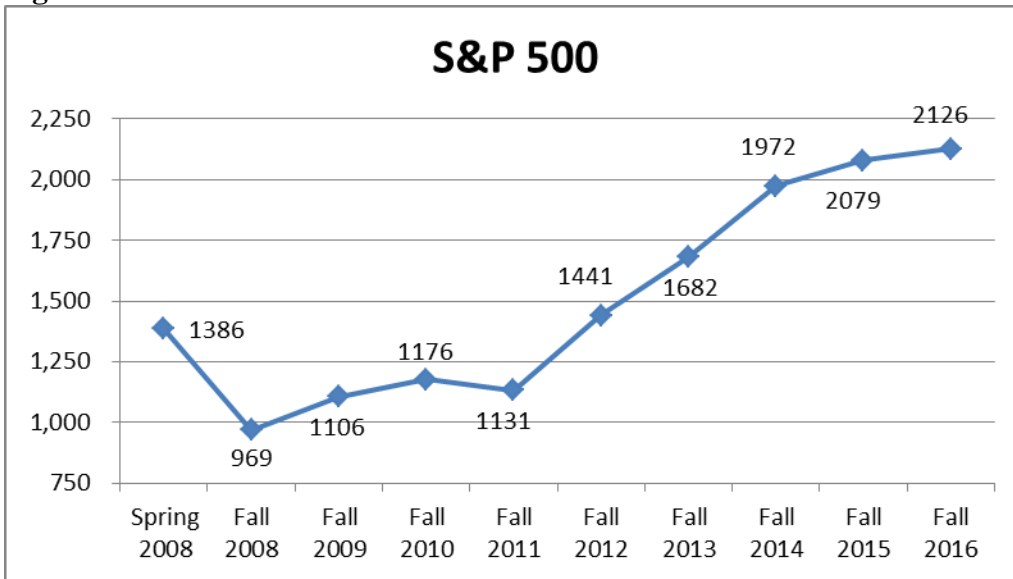
### ***History***

As in previous reports, the survey results show that current values of the Standard & Poor’s 500 (S&P 500) equity index (Figure 9), a barrel of oil (Figure 10), and the U.S. dollar relative to the euro (Figure 11) seem to anchor perceptions of risk. Results have evolved over time, often led by current news topics. Only economic factors are shown here, and the researcher would be interested in suggestions of other metrics that are considered drivers of emerging risks.\*

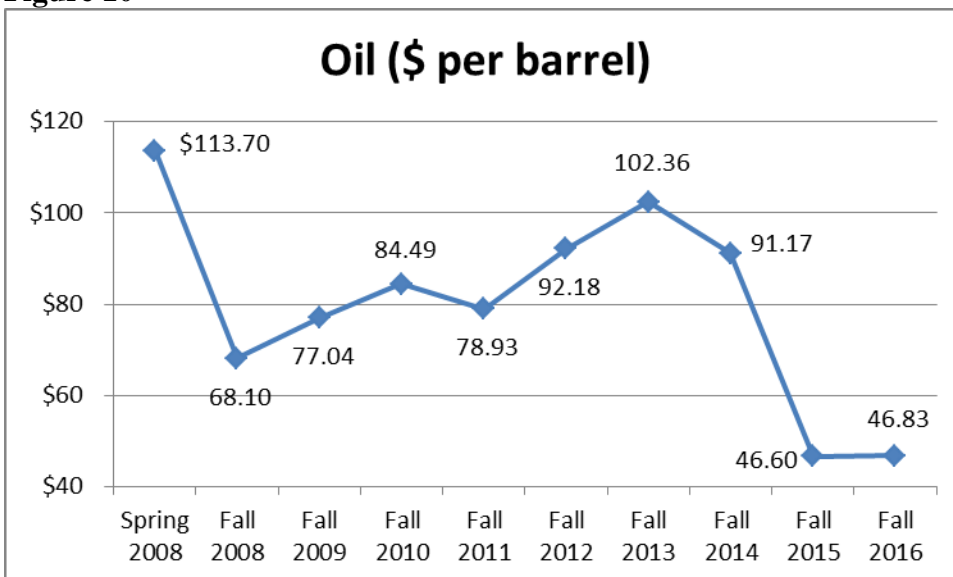
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\* Sources: S&P 500, Yahoo Finance; price of oil, the Energy Information Administration at <http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D>; dollar/euro exchange rate, [http://www.federalreserve.gov/releases/h10/Hist/dat00\\_eu.htm](http://www.federalreserve.gov/releases/h10/Hist/dat00_eu.htm).

**Figure 9**

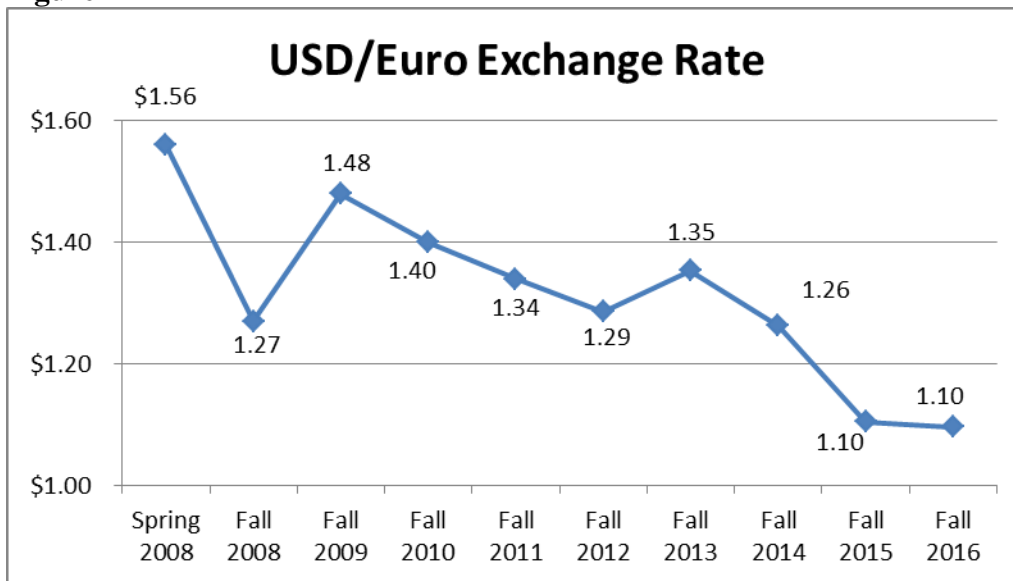


**Figure 10**





**Figure 11**



World events that transpire while surveys are open significantly influence the results. Although the metrics tracked here did not have appreciable movement, the geopolitical environment changed considerably following the “Brexit” vote for Britain to exit the European Union in the summer and the election of Donald Trump as U.S. president just prior to the 2016 survey. The rise in populism was noted throughout the survey and in the comments. The following information provides context to previous surveys. Note that these responses are to a question asking for their top five emerging risks. For example, in Survey 1 listed immediately below, *Oil shock* is listed by 57 percent 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 percent of respondents)
- 2T. *Climate change* (40 percent)
- 2T. *Asset price collapse* (40 percent)
4. *Currency trend* (38 percent)

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 percent, the price of a barrel of oil had decreased 40 percent, and the U.S. dollar had strengthened 23 percent. The top four emerging risks from this second iteration of the survey were as follows:

#### Survey 2 (November 2008)

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

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 president. The third survey was in December 2009. The S&P 500 had increased 14 percent, the price of a barrel of oil was up 13 percent and the U.S. dollar had weakened 17 percent. The economy had begun to recover. The top four emerging risks included *Chinese economic hard landing* for the first time.

#### Survey 3 (December 2009)

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

The indicators had not changed materially by late 2010 as the European debt crisis ramped up. The stock market was up 6 percent, the price of oil was up 10 percent and the dollar had further strengthened by 6 percent. 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 percent)
2. *International terrorism* (43 percent)
3. *Chinese economic hard landing* (41 percent)
4. *Oil price shock* (40 percent)
5. *Failed and failing states* (38 percent)

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

The risks were updated for the 2011 survey. One risk was moved to a different category, two were combined and one 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. The 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 percent)
2. *Failed and failing states* (42 percent)
3. *Cybersecurity/interconnectedness of infrastructure* (38 percent)
4. *Chinese economic hard landing* (32 percent)
5. *Oil price shock* (32 percent)
6. *Regional instability* (32 percent)

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

#### Survey 6 (October 2012)

1. *Financial volatility* (62 percent)
2. *Regional instability* (42 percent)
3. *Cybersecurity/interconnectedness of infrastructure* (40 percent)
4. *Failed and failing states* (33 percent)
5. *Chinese economic hard landing* (31 percent)

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

#### Survey 7 (October 2013)

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

By the fall of 2014, the dollar had started to strengthen against the euro (7 percent), the stock market was up (17 percent) and the price of oil had started to go down (12 percent). 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 potential pandemic.

#### Survey 8 (October 2014)

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

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

#### Survey 9 (November 2015)

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

The current survey occurred during a period of transition, but it was not clear where the geopolitical environment was heading. The metrics were steady from the previous survey, with oil and the dollar stable and equities increasing 2 percent. 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, wild fires, and flooding, due to both tropical storms (e.g., Hurricane Matthew) and thunderstorms.\*

#### Survey 10 (November 2016)

1. *Cyber/interconnectedness of infrastructure* (53percent)
2. *Financial volatility* (44 percent)
3. *Terrorism* (40 percent)
4. *Technology* (34 percent)
5. *Retrenchment from globalization* (30 percent)

### **Introductory Questions**

In late 2015, during the previous survey, cyber risk continued to be a constant in the news and the conflict in Syria heated up as Russia entered the fray and ISIS continued to battle for territory. These issues persisted into late 2016 with uncertainty about how, as president, Donald Trump would govern and how Brexit would be accomplished.

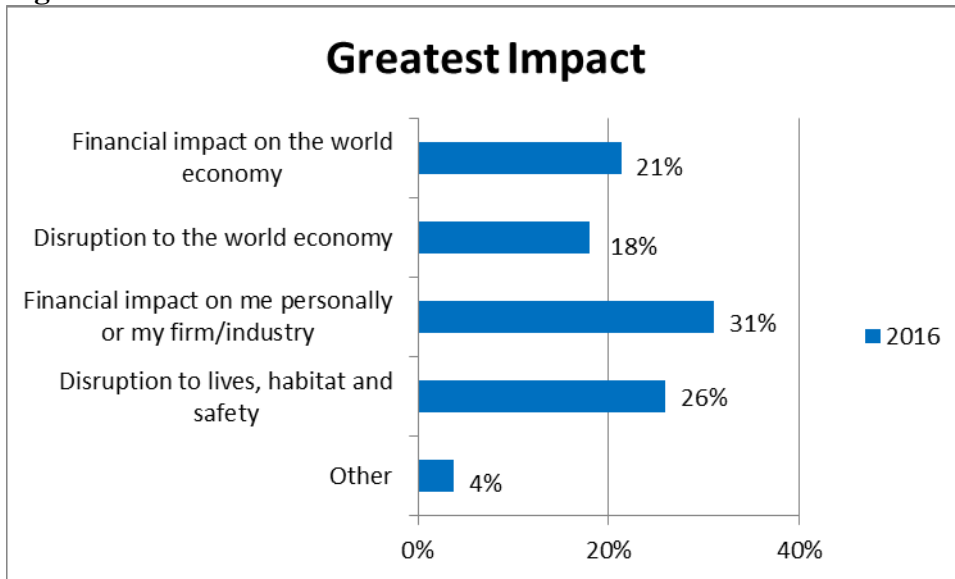
Respondents have varying definitions of emerging risk. Four options each received at least 18 percent. As shown in Figure 12, the answer most commonly reported was *Financial impact on me personally or my firm/industry* (31 percent), with *Disruption to lives, habitat and safety* (26 percent) also receiving material support.

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\* A good source of information about catastrophes is Swiss Re. Their report on 2016 events notes that top insured losses were due to a Chinese port explosion and winter storms in the United States.

[http://media.swissre.com/documents/news\\_release\\_preliminary\\_cat\\_estimates\\_FY\\_2016\\_EN.PDF](http://media.swissre.com/documents/news_release_preliminary_cat_estimates_FY_2016_EN.PDF) .

**Figure 12**



Each year a benchmarking question is asked about the top current risk (not emerging). When the respondents answer this question, they are reminded of recency cognitive bias, an anchoring effect identified in prior surveys. In the field of behavioral finance, it is thought that recognizing our shortcomings will help us overcome them.

Complete definitions of the 23 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 economic hard landing*
4. *Asset price collapse*
5. *Financial volatility*

### **Environmental Risks**

6. *Climate change (includes space weather)*
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 (WMD)*
13. *Interstate and civil wars*
14. *Failed and failing states*

- 15. *Transnational crime and corruption*
- 16. *Retrenchment from globalization*
- 17. *Regional instability*

**Societal Risks**

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

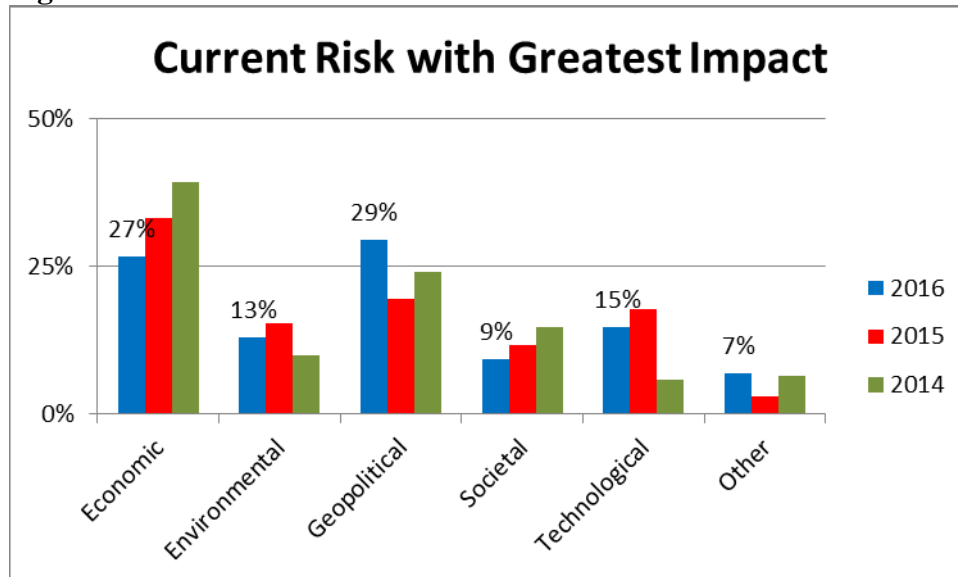
**Technological Risks**

- 22. *Cyber/interconnectedness of infrastructure*
- 23. *Technology*

**Current Risk**

Changes to risk classifications since the original WEF-defined risks are documented in Appendix I. The 23 emerging risks used in this iteration of the survey were reviewed, and the names were changed for two risks and eight risks had their definitions updated. Some of the changes were to align the wording around natural catastrophe and similar risks. *Demographic shift* added migration to the definition and *Cybersecurity/interconnectedness of infrastructure* shortened its name to *Cyber/interconnectedness of infrastructure* as some respondents had noted that cybersecurity was a subset of cyber. *Natural catastrophes: earthquakes* clarified that all seismic activity should be considered, including volcanos.

**Figure 13**



- Economic 27%/33%/39% (2016/2015/2014 surveys)
- Environmental 13%/15%/10%
- Geopolitical 29%/19%/24%
- Societal 9%/12%/15%
- Technological 15%/18%/6%
- Other 7%/3%/6%

As shown in Figure 13, the Geopolitical category advanced to be respondents' top choice for the risk currently having the greatest impact, increasing 10 percent. It was the only category (except Other) to increase this year. The previous leader, the Economic category, fell by 6 percent for the second consecutive year. The Societal category reduced again by 3 percent, with the Technological and Environmental categories also dropping. *Financial volatility* was the top individual risk response with 12 percent, with *Cyber/interconnectedness of infrastructure* (despite a 4 percent drop) finishing second. The top gainer was *Retrenchment from globalization* (increase from 1 percent to 8 percent). Several of the *Other* responses referred to the rise of populism and the interest rate environment.

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

The top five current risks chosen were

1. *Financial volatility* (12 percent)
2. *Cyber/interconnectedness of infrastructure* (11 percent)
3. *Asset price collapse* (10 percent)
4. *Climate change (includes space weather)* (10 percent)
5. *Retrenchment from globalization* (8 percent)

Some of the category changes were driven by one or two risks. The Environmental category saw decreases in all risks except *Climate change (includes space weather)*. The Geopolitical category results are very interesting again this year. This category continues to be more volatile than the others, and this was mostly an "on" year. *Regional instability* decreased by 4 percent while three of the other risks increased. The Societal category saw a decrease, led by a drop in *Liability regimes/regulatory framework* as political promises were made to reduce regulations.

## **Section 1: Emerging Risks**

### **Top Five: Geopolitical Risks Surge**

After choosing which risk has the greatest current impact, respondents chose up to five emerging risks that "you feel will have the greatest impact over the next few years." The World Economic Forum suggests a reasonable time horizon of 10 years, but that is not

required here. The data are compared across surveys and consider recent events as part of the analysis. Each survey has come at a unique time in history.

While 81 percent of respondents chose the full complement of five risks, the average of 4.82 was higher (previously 4.72) than the previous survey. Percentages in 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.

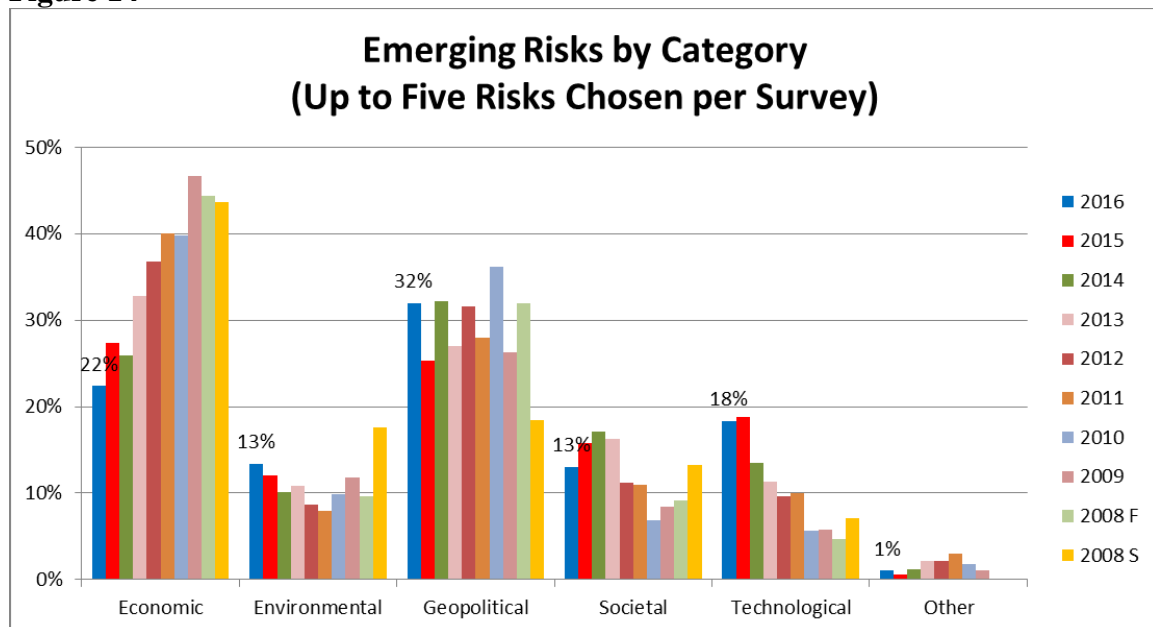
The Geopolitical category surpassed the Economic category to retake the top position. The results distributed by category (using percentages of total responses) are

1. Geopolitical      32%/25%/32% (2016/2015/2014 surveys)
2. Economic        22%/27%/26%
3. Technological    18%/19%/13%
4. Societal         13%/16%/17%
5. Environmental    13%/12%/10%

The Geopolitical category increased materially (up 7 percent—it has surged in the last several even-numbered years), while Economic saw a 5 percent decrease after the last survey broke its downward trend. The Societal category was down 3 percent.

As Figure 14 shows, each category has its own story during the period the survey has been completed. Technological risks have grown materially, and Economic risks have received less attention, while Environmental, Geopolitical, and Societal risks have their own cycles.

**Figure 14**





There were material increases in several individual risks. In the Geopolitical category, *Transnational crime and corruption* doubled from 5 percent to 10 percent and *Retrenchment from globalization* increased by five times from 6 percent to 30 percent. In the Technological category, *Technology* increased from 24 percent to 34 percent.

The top five specific responses to “What are the emerging risks that you feel will have the greatest impact over the next few years?” were spread across the Economic, Geopolitical 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 percent. The top five total 203 percent in 2016 as each was listed on over 30 percent of the surveys.

1. 53%/65% (2016/2015)      *Cyber/interconnectedness of infrastructure*
2. 44%/45%                      *Financial volatility*
3. 40%/37%                      *Terrorism*
4. 34%/24%                      *Technology*
5. 30%/6%                        *Retrenchment from globalization*

The top individual risks from the most recent four years are shown in Table 2.

**Table 2: Top Five Emerging Risks, 2013–2016**

Year	2013	2014	2015	2016
1	Financial volatility	Cybersecurity / interconnectedness of infrastructure	Cybersecurity / interconnectedness of infrastructure	Cyber / interconnectedness of infrastructure
2	Cybersecurity / interconnectedness of infrastructure	Financial volatility	Financial volatility	Financial volatility
3	Asset price collapse	Terrorism	Terrorism	Terrorism
4	Demographic shift	Regional instability	Asset price collapse	Technology
5	Failed and failing states / Regional instability (tie)	Asset price collapse	Regional instability	Retrenchment from globalization

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 were analyzed as a percentage of all responses. Four of the five primary categories were higher than their average over the ten survey cycles. Environmental (13 percent vs. 11 percent average), Geopolitical (32 percent vs. 29 percent average), Societal (13 percent vs. 12 percent average) and Technological (18 percent vs. 10 percent average) each satisfied this criterion, while Economic (22 percent vs. 36 percent average) was lower. Among individual risks, eight of the 23 had above-average results. The greatest positive differential was 5 percent for *Technology*. Several other risks were above average by at least 2 percent, with *Cyber/interconnectedness of risks* and *Retrenchment from globalization* each higher by 3 percent. Eleven trended below average, led by 5 percent for *Currency shock*. All five risks in the Economic category were again below their long-term average, while the Environmental category had four out of five above their longer-term average.

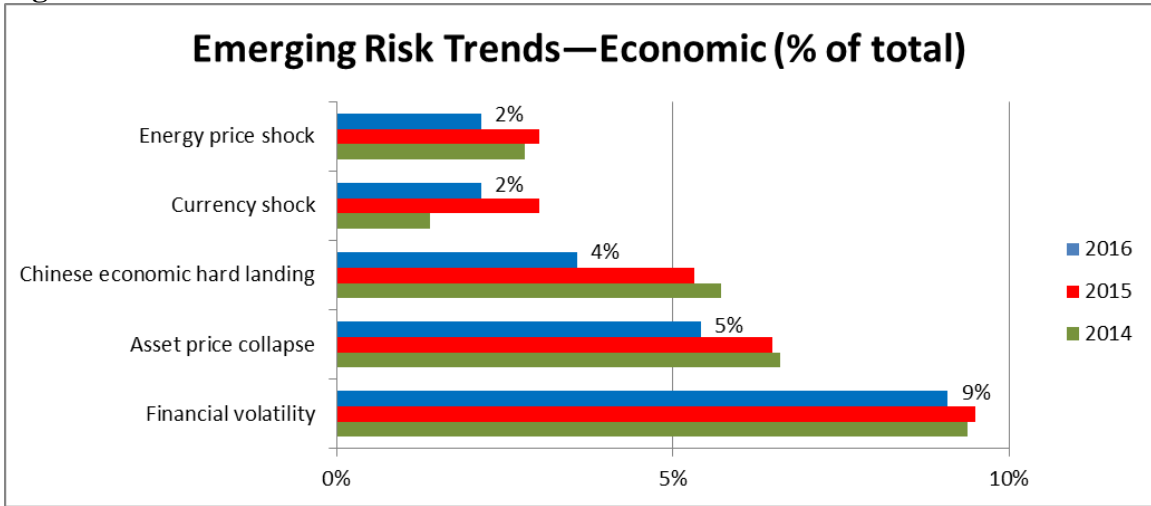
The Economic category had two risks that decreased by 5 percent or more. *Chinese economic hard landing* (from 25 percent to 18 percent) and *Asset price collapse* (from 31 percent to 26 percent) each had material decreases. Two other risks showed large drops. *Liability regimes/regulatory framework* (from 24% to 15%), following a three-year spike apparently tied to the Own Risk Solvency Assessment (ORSA) legislation and principles-based approaches to reserves and capital (PBA or PBR) efforts (perhaps reflecting a reduced regulatory burden following the U.S. election), and *Cyber/interconnectedness of infrastructure*, which dropped from 65 percent to 53 percent but remains the highest risk chosen. While over half of respondents listed it as one of their top five emerging risks, *Cyber/interconnectedness of risks* recorded its first decrease since being added to the survey in 2009.

Trends of at least two consecutive years may act as a leading indicator. Increasing trends include *Climate change (includes space weather)* (three years), *Natural catastrophes: tropical storms*, *Natural catastrophes: earthquakes*, and *Technology*. Decreasing trends include *Chinese economic hard landing* (six years), *Natural catastrophe: severe weather* and *Pandemics/infectious diseases*. One risk, *Transnational crime and corruption*, rebounded materially after falling in the previous survey.

Figures 15 through 20 show recent trends for individual risks when five emerging risks are chosen. 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.

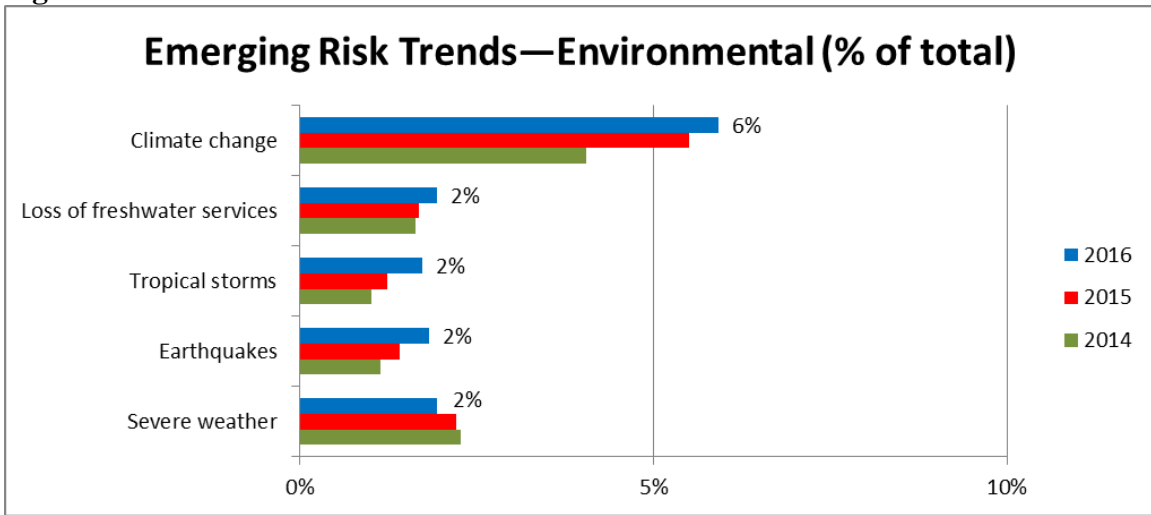
Economic risks consistently were lower than in the previous survey, as shown in Figure 15.

Figure 15



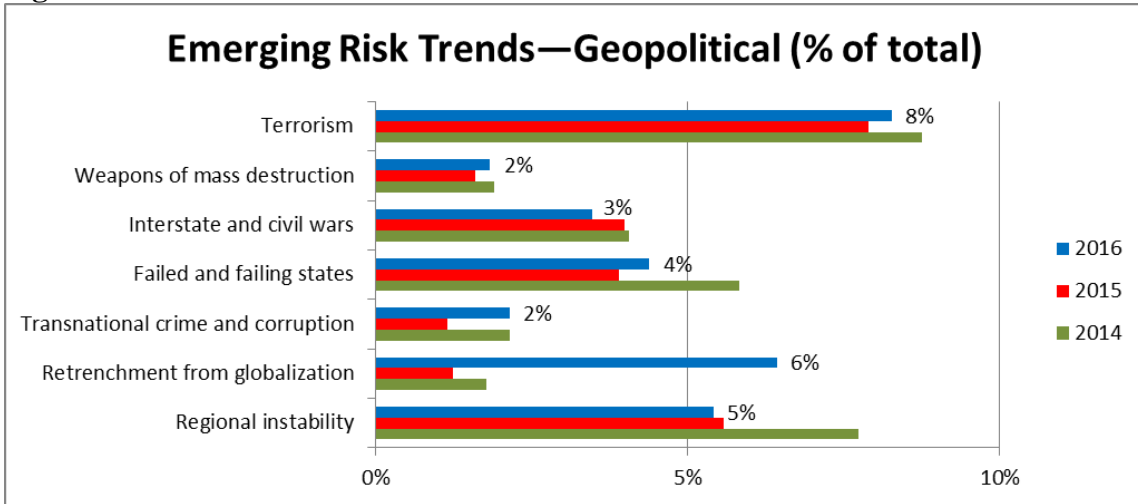
As shown in Figure 16, Environmental risks were up except for *Natural catastrophe: severe weather*.

Figure 16



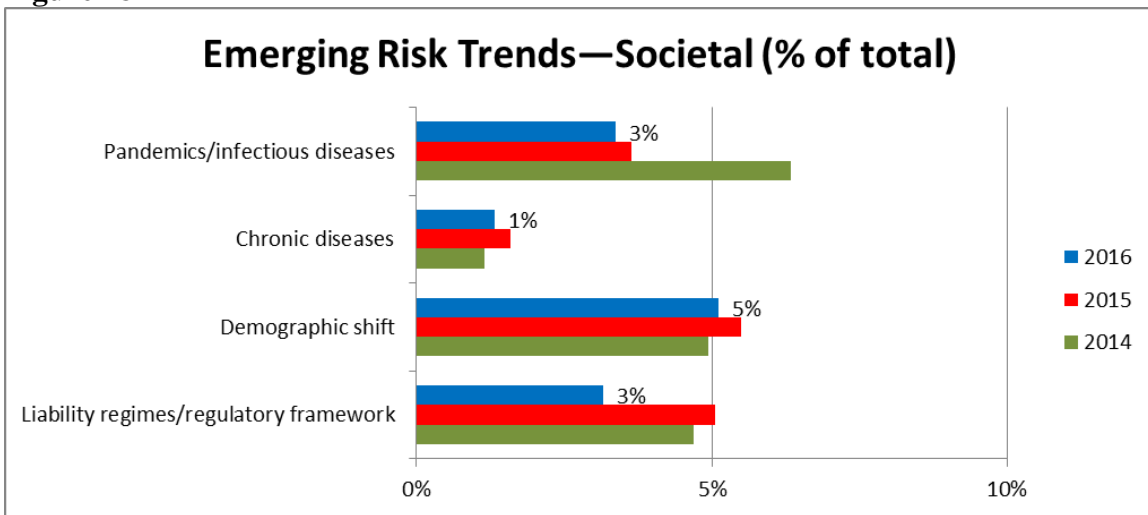
While five of seven risks increased, and some materially, both *Interstate and civil wars* and *Regional instability* fell within the Geopolitical category, as shown in Figure 17.

**Figure 17**



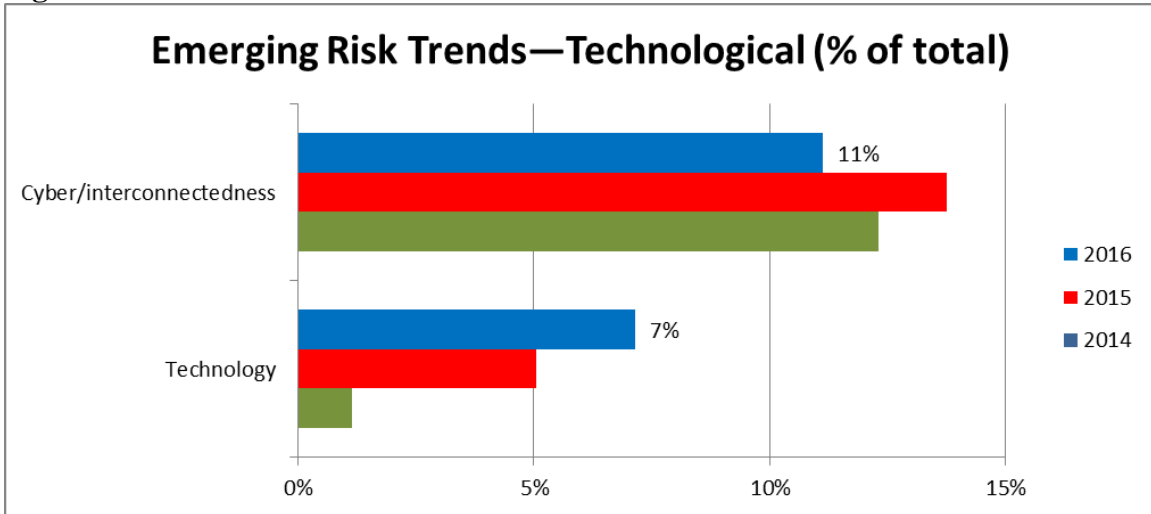
Each of the Societal risks decreased, reversing some of the previous year’s increases, as shown in Figure 18.

**Figure 18**



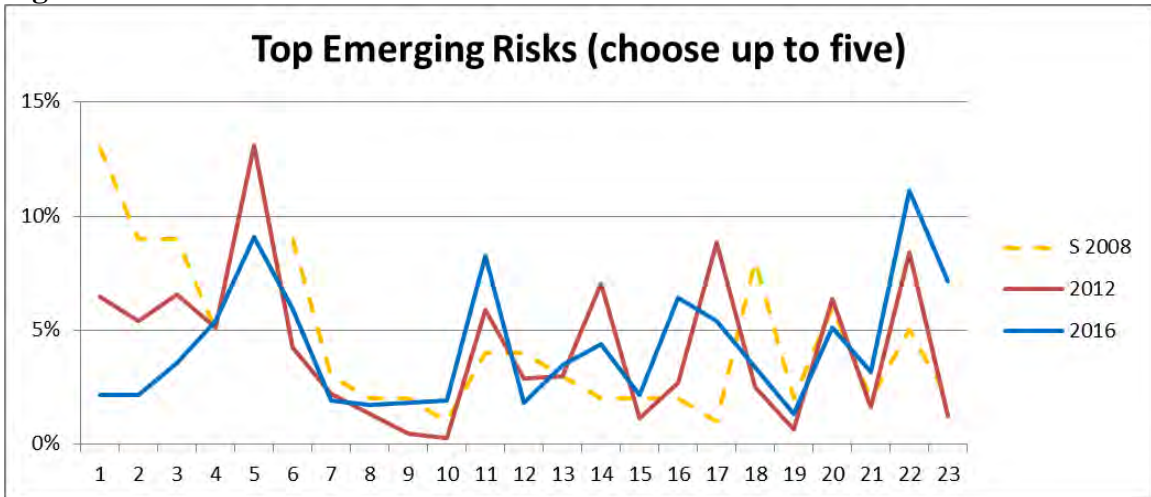
Technological risks varied, with *Technology* joined *Cyber/interconnectedness of infrastructure* in the top five overall selections.

**Figure 19**

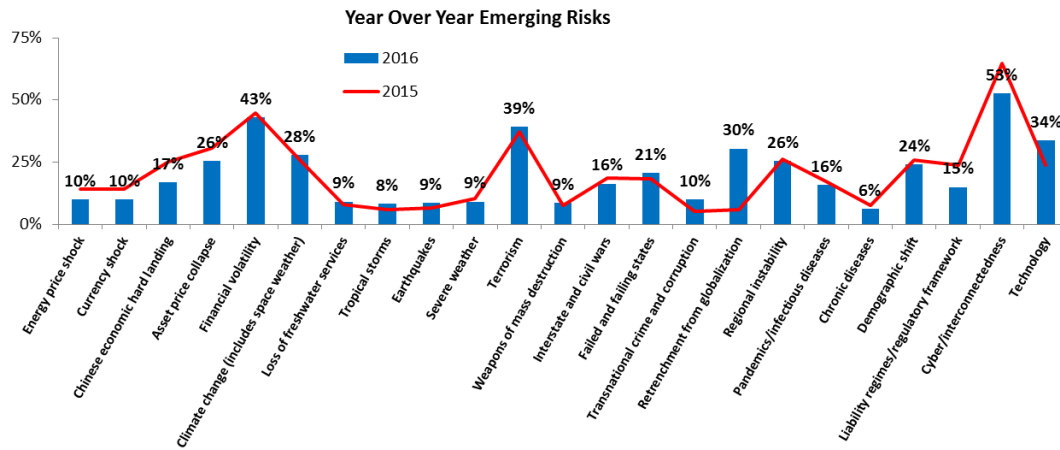


Some of the changes over time are highlighted in Figure 20 and Figure 21. It is interesting to see how certain risks have become more or less popular among respondents over various periods of time.

**Figure 20**



**Figure 21**



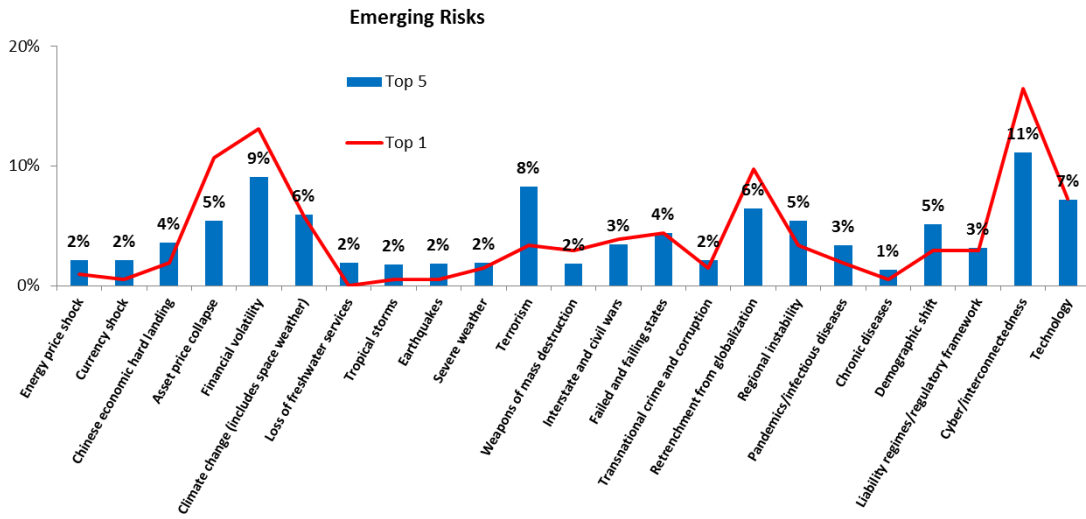
**Top Emerging Risk: *Cyber/Interconnectedness of Infrastructure***

Respondents were asked to state the single emerging risk they expected to have the greatest impact. The responses to this question tend to be volatile and likely represent a recency bias. Overall the Geopolitical category surged ahead with 29 percent, but right behind was the Economic category. The Technological and Societal categories fell, and Environmental was steady. *Retrenchment from globalization* rose from 0 percent to 10 percent, and *Asset price collapse* rose from 5 percent to 11 percent (was 10 percent in the 2014 survey). Of those risks dropping, *Cyber/interconnectedness* retained its top overall ranking despite a 6 percent decrease, and *Chinese economic hard landing* fell 5 percent.

- 1. 29%/22%/31% Geopolitical
- 2. 27%/30%/31% Economic
- 3. 24%/28%/15% Technological
- 4T. 8%/10%/16% Societal
- 4T. 8%/8%/5% Environmental

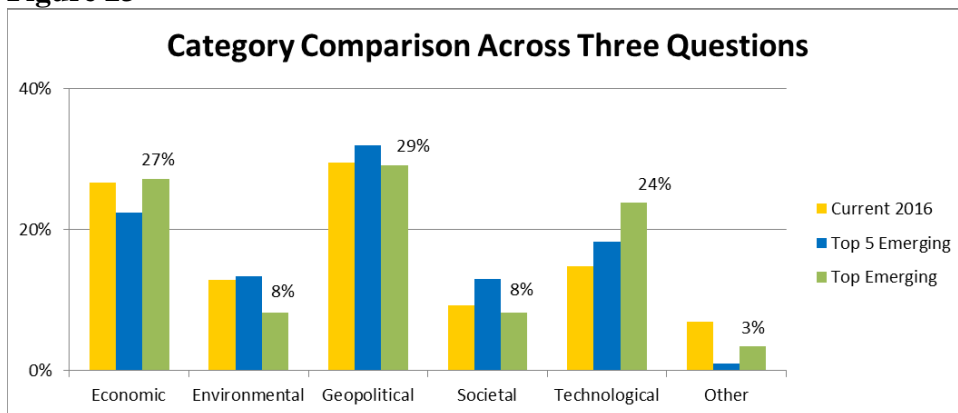
As seen in Figure 22, several risks vary in their importance between the top five and overall top emerging risks. With the highest positive differential, so marking the importance of being the top overall risk relative to inclusion in the top five list were *Cyber/interconnectedness* and *Asset price collapse*, both at 5 percent. The highest negative differential was *Terrorism* at -5 percent.

**Figure 22**



An interesting comparison is to look at the highest of the three metrics for each category; current risk, top five emerging risks and top emerging risk, as shown in Figure 23. No categories reflect current risks as the highest; Societal, Environmental and Geopolitical have the highest percentage as the top five risks; Economic and Technological have the top emerging risk. The results show a mixed pattern of the current risk preferences pulling the emerging risk results up or down. Note that several categories are very close, especially between the current risk and the top emerging risk, and that the Other category is larger for the current risk.

**Figure 23**

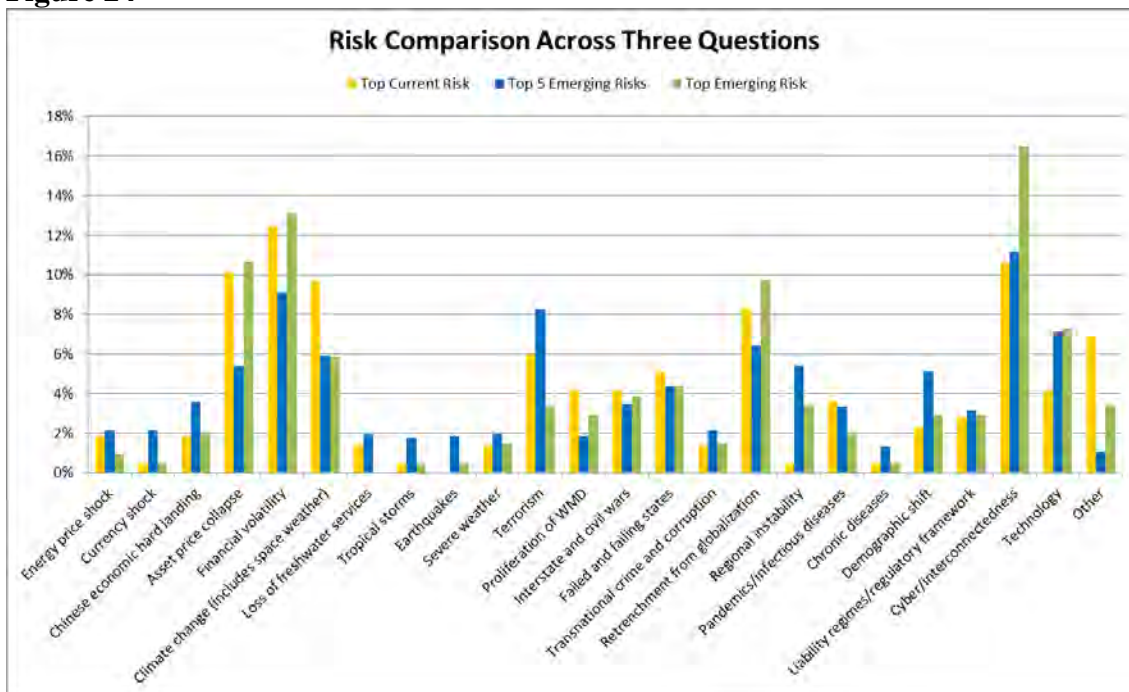


While the top five choices might be thought to come from a different distribution, both the top current risk and top emerging risk can be compared to see which risks are expected to be more important in the future. The largest positive differential (current

greater than top emerging risk) is *Climate change*, with 4 percent, followed by *Terrorism* at 3 percent. The largest negative differentials, indicating higher risk in the future, were *Cyber/interconnectedness of infrastructure*, at 6 percent, and *Technology* at 3 percent. The risks that have higher concentration risk, meaning their top five score is materially lower than their current and top emerging risk scores in this year's survey, are *Asset price collapse*, *Financial volatility* and *Retrenchment from globalization*.

Another interesting characteristic is when the top five response is the highest of the three. This could reflect a risk that respondents are worried about but can't quite get their hands around it as the most important risk. These could also be risks seen more in combination with others. As shown in Figure 24, this characteristic is seen with 13 risks: *Energy price shock*, *Currency shock*, *Chinese economic hard landing*, *Loss of freshwater services*, *Natural catastrophes: tropical storms*, *Natural catastrophes: earthquakes*, *Natural catastrophes: severe weather*, *Terrorism*, *Transnational crime and corruption*, *Regional instability*, *Chronic diseases*, *Demographic shift* and *Liability regimes/regulatory framework*.

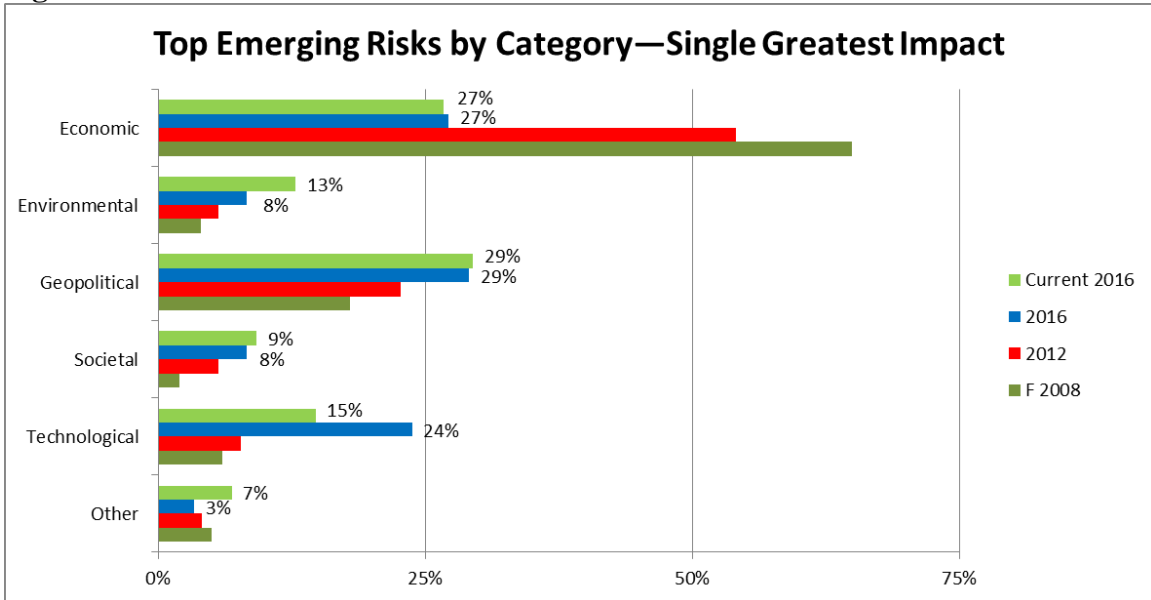
**Figure 24**



In Figure 25, the current risk with greatest impact has been included with the emerging risk choices from the fall 2008, 2012 and 2016 surveys for comparison with results during the financial crisis. Current 2016 results reflect the current risks chosen by respondents. The chart shows each category in the selected years and includes the results for this survey's top current risk.



**Figure 25**



For the top emerging risk, *Cyber/interconnectedness of infrastructure* continues as the top choice. The Economic category has two risks in the top five. The major risk increases were *Retrenchment from globalization* and *Asset price collapse* (which had a similar drop in the prior survey). Drops were recorded by *Chinese economic hard landing*, *Terrorism*, *Regional instability*, *Liability regimes/regulatory framework*, and *Cyber/interconnectedness of infrastructure*. Here are the leading responses.

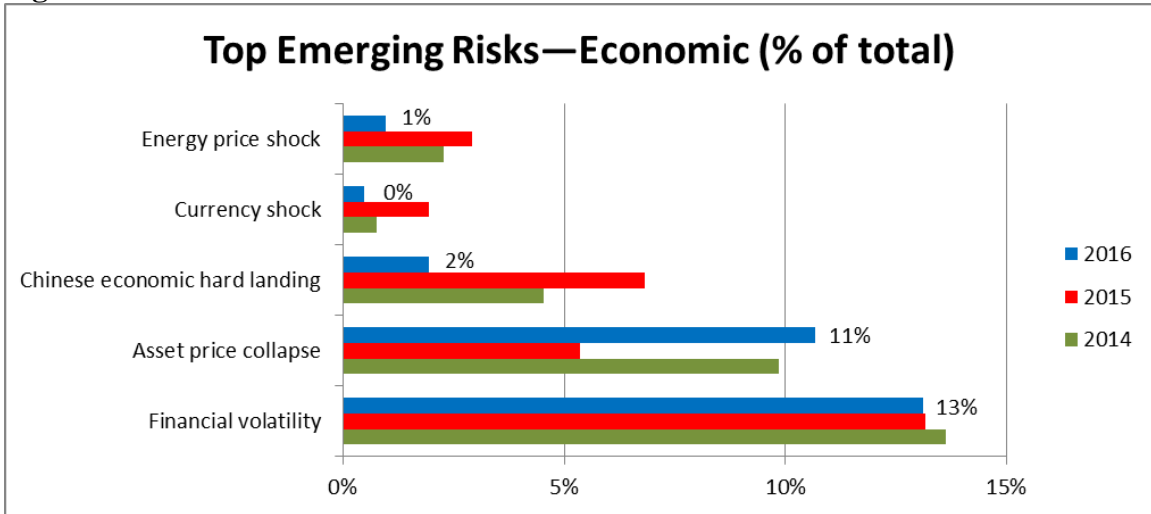
- |                |   |
|----------------|---|
| 1. 17%/23%/14% | <i>Cyber/interconnectedness of infrastructure</i> |
| 2. 13%/13%/14% | <i>Financial volatility</i>                       |
| 3. 11%/5%/10%  | <i>Asset price collapse</i>                       |
| 4. 10%/0%/2%   | <i>Retrenchment from globalization</i>            |
| 5. 7%/5%/1%    | <i>Technology</i>                                 |

Figures 26 through 30 show each emerging risk within its category for the most recent three surveys in response to the question for the top emerging risk. Note that the x-axis for each chart is chosen to match the data and is not consistent between categories.\*

As shown in Figure 26, the Economic category shows surging responses in some years among all risks except *Financial volatility*.

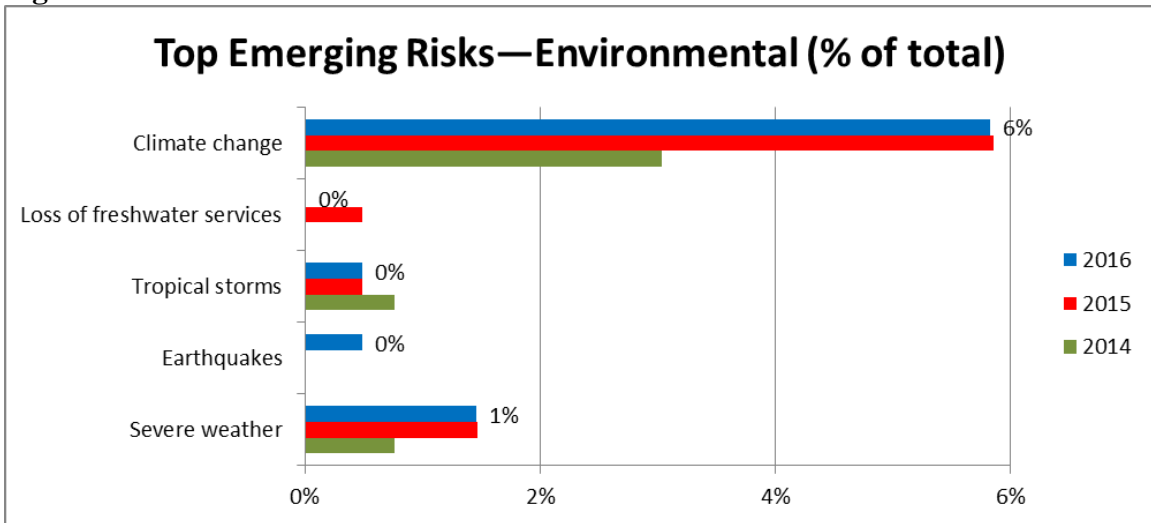
\* Data labels are rounded to the near percentage point, and are generally shown for the most recent survey.

**Figure 26**



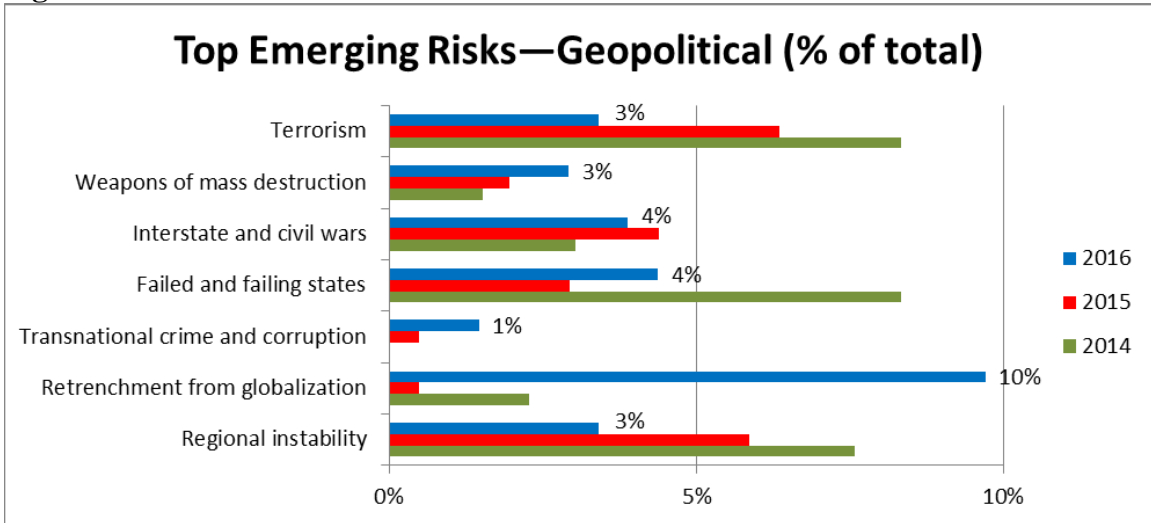
As shown in Figure 27, Environmental category risks have been small except for *Climate change*, which maintained its 2015 jump.

**Figure 27**



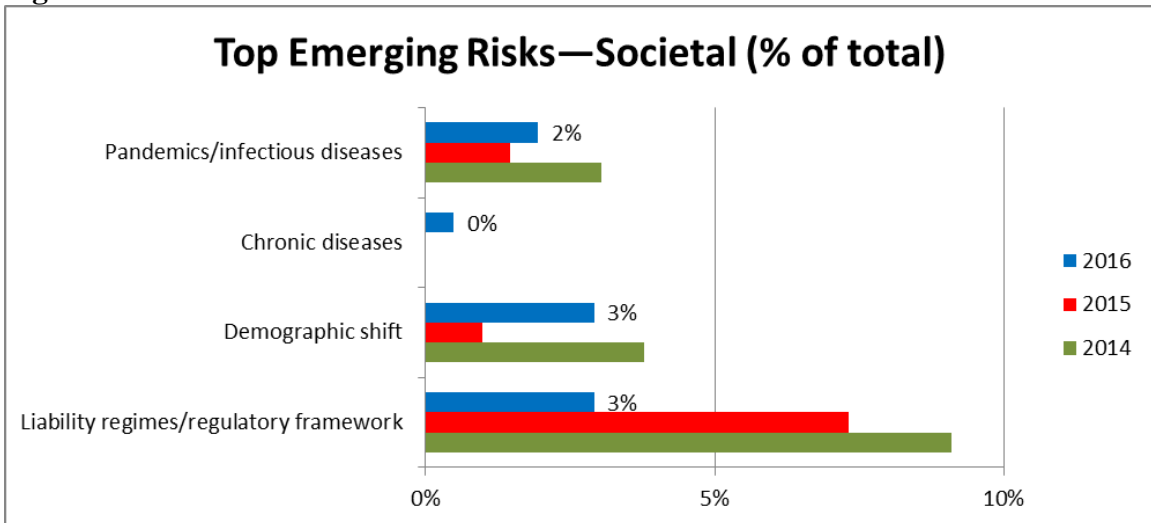
Geopolitical risks tend to be the most volatile in the survey, so it is not surprising to see *Terrorism* and *Regional instability* trending down while *Weapons of mass destruction* is increasing. The jumps in *Retrenchment from globalization* and *Transnational crime and corruption* were the highest in the survey. Their levels are nearly equal to the sum of all previous survey responses for that risk. Given the comments received, this seems to be a result of the international rise in populist sentiment.

**Figure 28**



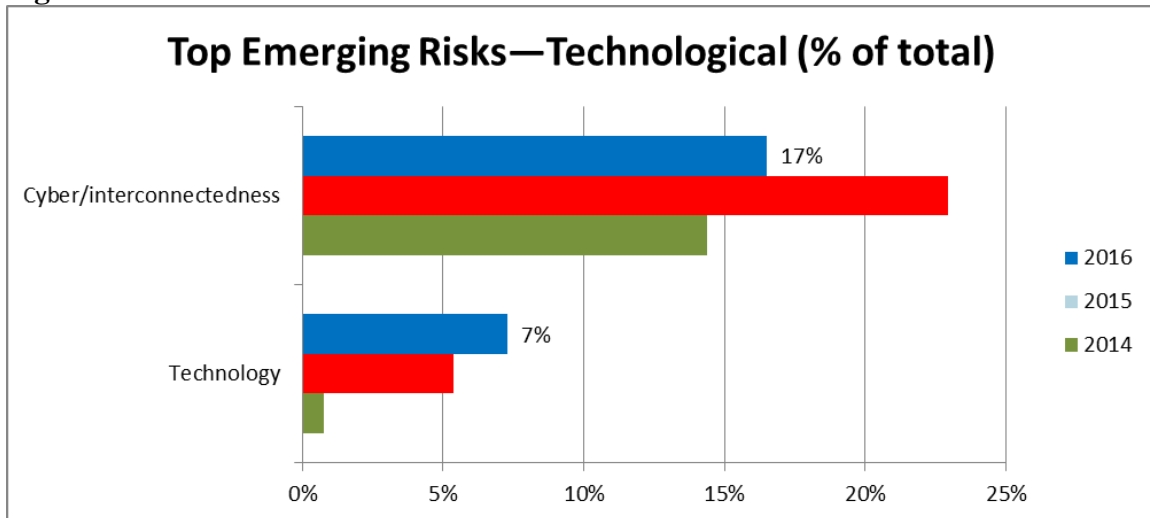
The change in Societal category results were driven by a downward trend in *Liability regimes/regulatory framework*, shown in Figure 29. Constant regulatory changes seem to be trending down over the past couple of years and may also reflect the fall election results in the United States. The *Demographic shift* risk rebounded to 3 percent.

**Figure 29**



This is the first material decrease for *Cyber/interconnectedness of infrastructure*, but it remains the top overall choice, as shown in Figure 30. *Technology* is now in the top five overall.

**Figure 30**



### **Risk Combinations**

Risks do not occur in a vacuum. For example, a U.S. Federal Reserve Bank hike in interest rates results in higher uncertainty in emerging markets around the world. Other risks interact in ways not always apparent in advance and tend to have unintended consequences. As central banks influence financial markets and debt remains high, impacts on Economic risks may seem obvious, but indirect impacts will also be felt by Societal and Geopolitical risks.

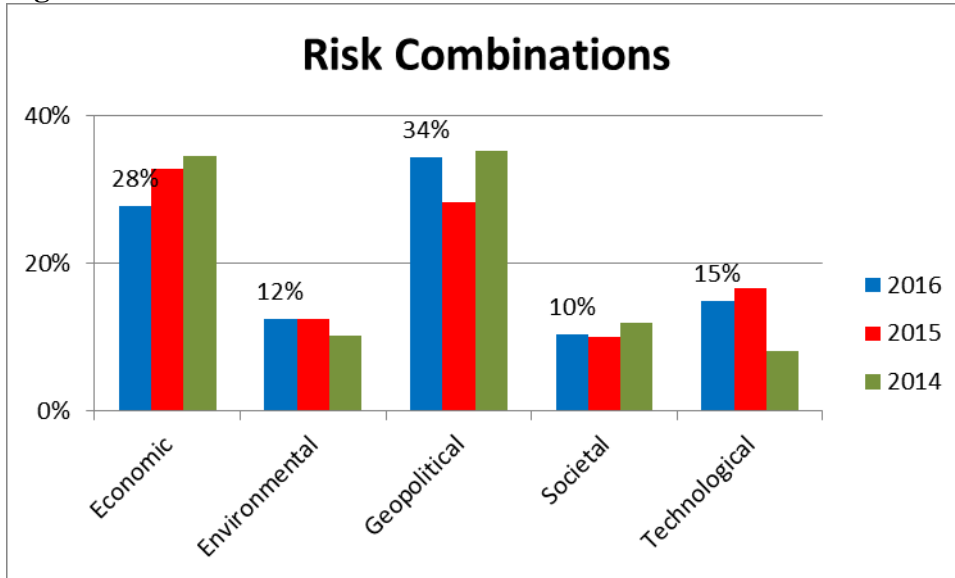
Combinations of emerging risks interact in ways that often are not fully understood. Risk combinations can happen simultaneously or sequentially. For example, the Environmental risk *Loss of freshwater services* could sequentially drive the Geopolitical category's *Regional instability*. Concurrent emerging risks could exacerbate a scenario, as in 2011 when the Japanese earthquake and tsunami, followed by the Fukushima Daiichi nuclear disaster, led to a scenario that stressed the supply chain for many products.

Each respondent could choose up to three combinations of two risks and was asked to list their top combination first for a follow-up question. 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 risks chosen in isolation. Economic and Geopolitical remain the most frequent response categories, switching spots from the previous survey, and Technological maintained most of its 2015 increase. See Figure 31.

- |                |               |
|----------------|---------------|
| 1. 34%/28%/35% | Geopolitical  |
| 2. 28%/33%/35% | Economic      |
| 3. 15%/17%/8%  | Technological |
| 4. 12%/12%/10% | Environmental |
| 5. 10%/10%/12% | Societal      |

**Figure 31**



Individual risks were led by *Financial volatility* as it recaptured first place from *Cyber/interconnectedness of infrastructure*. Similarly to other questions, a big move was made by *Retrenchment from globalization*.

- |                |   |
|----------------|---|
| 1. 11%/12%/13% | <i>Financial volatility</i>                       |
| 2. 10%/12%/7%  | <i>Cyber/interconnectedness of infrastructure</i> |
| 3. 9%/8%/9%    | <i>Terrorism</i>                                  |
| 4. 7%/8%/10%   | <i>Asset price collapse</i>                       |
| 5T. 6%/5%/7%   | <i>Regional instability</i>                       |
| 5T. 6%/1%/3%   | <i>Retrenchment from globalization</i>            |

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 it.

Leading combinations among the 566 responses were (top five are listed) as follows:

1. 6%, No. 1 in prior survey  
*Terrorism*  
*Cyber/interconnectedness of infrastructure*
2. 5%, No. 2  
*Cyber/interconnectedness of infrastructure*  
*Technology*
3. 4%, unranked in prior survey  
*Financial volatility*  
*Retrenchment from globalization*
4. 4%, No. 3  
*Asset price collapse*  
*Financial volatility*
5. 3%, No. 5  
*Chinese economic hard landing*  
*Asset price collapse*

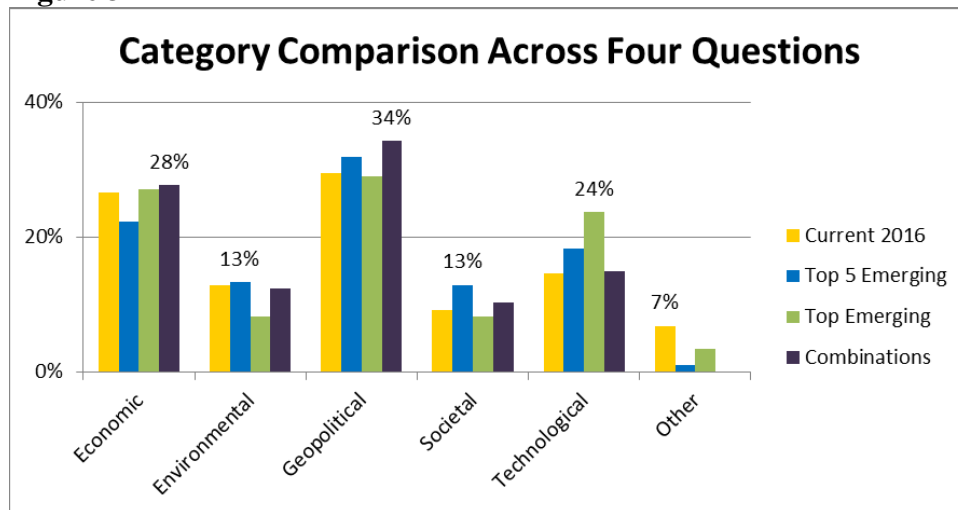
The major category combinations were

19%/15%	Geopolitical–Geopolitical
15%/10%	Economic–Geopolitical
14%/21%	Economic–Economic
11%/12%	Geopolitical–Technological
8%/8%	Environmental–Environmental
6%/7%	Economic–Societal
5%/7%	Technological–Technological
4%/5%	Economic–Technological
4%/3%	Societal–Technological
4%/3%	Environmental–Societal
3%/3%	Environmental–Geopolitical
3%/3%	Societal–Societal
2%/2%	Economic–Environmental
2%/2%	Geopolitical–Societal
1%/1%	Environmental–Technological

Geopolitical risks continued their rise with the combination question, especially when paired with Economic or Technological risks. The primary reductions were Economic-Economic combinations.

By category, respondents do not vary by a large amount when viewed across the four major questions. Exceptions occur for the Economic category (top five emerging risks is low), Geopolitical (combinations is high), Societal (top five emerging risks is high) and Technological (top emerging risk is high).

**Figure 32**



Risk by risk there is much more variation, as shown in Figure 33.

Top current risk is highest for

- *Climate change (includes space weather)*
- *Weapons of mass destruction*
- *Interstate and civil wars*
- *Pandemics/infectious diseases*

Top five emerging risks is highest for

- *Earthquakes*
- *Severe weather*
- *Chronic diseases*
- *Demographic shift*
- *Liability regimes/regulatory framework*

Top emerging risk is highest for

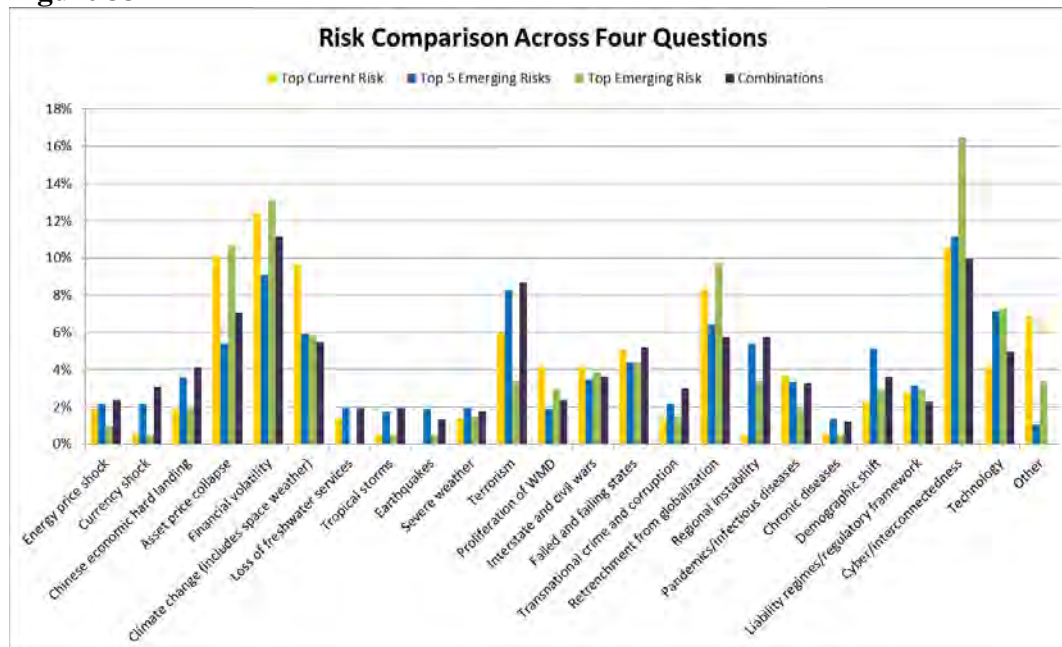
- *Asset price collapse*
- *Financial volatility*
- *Retrenchment from globalization*
- *Cyber/interconnectedness of infrastructure*
- *Technology*

Combinations is highest for

- *Energy price shock*
- *Currency shock*
- *Chinese economic hard landing*
- *Loss of freshwater services*

- *Tropical storms*
- *Terrorism*
- *Failed and failing states*
- *Transnational crime and corruption*
- *Regional instability*

**Figure 33**



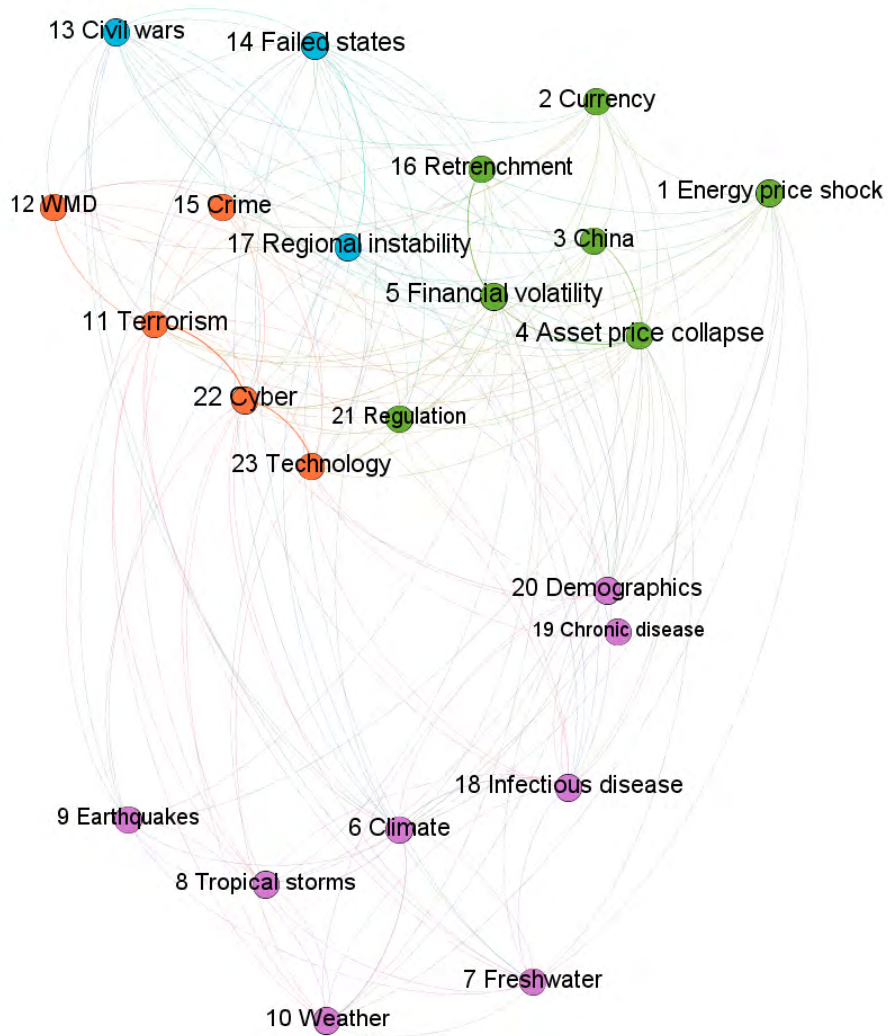
Risk combinations can be viewed graphically using the open-source Gephi software 0.9.1 package, as seen in Figure 34. All combinations have been included (in the previous survey, combinations of four and fewer were ignored for clarity). For those who think visually, this can make the analytical process easier than reviewing the details. Interestingly, each risk (node) had at least one risk combination of at least six. In the previous survey, one of two that did not have at least five was *Technology*, which had large increases this year. The software grouped the 23 risks into four groupings that are similar but not the same as the survey’s categories, as shown in Table 3. While each of the five risks under the Economic category are combined, *Retrenchment from globalization* and *Liability regimes/regulatory framework* are also included. The respondents view these as closer to the Economic category than the categories they are assigned. The Environmental category adds *Pandemics/infectious diseases*, *Demographics* and *Chronic diseases* to its cluster. The Geopolitical category is split up, with *Interstate and civil wars*, *Failed and failing states* and *Regional instability* combined in one group. The other Geopolitical risks are combined with the Technology category in the final grouping.



**Table 3: Risk Combination Groupings**

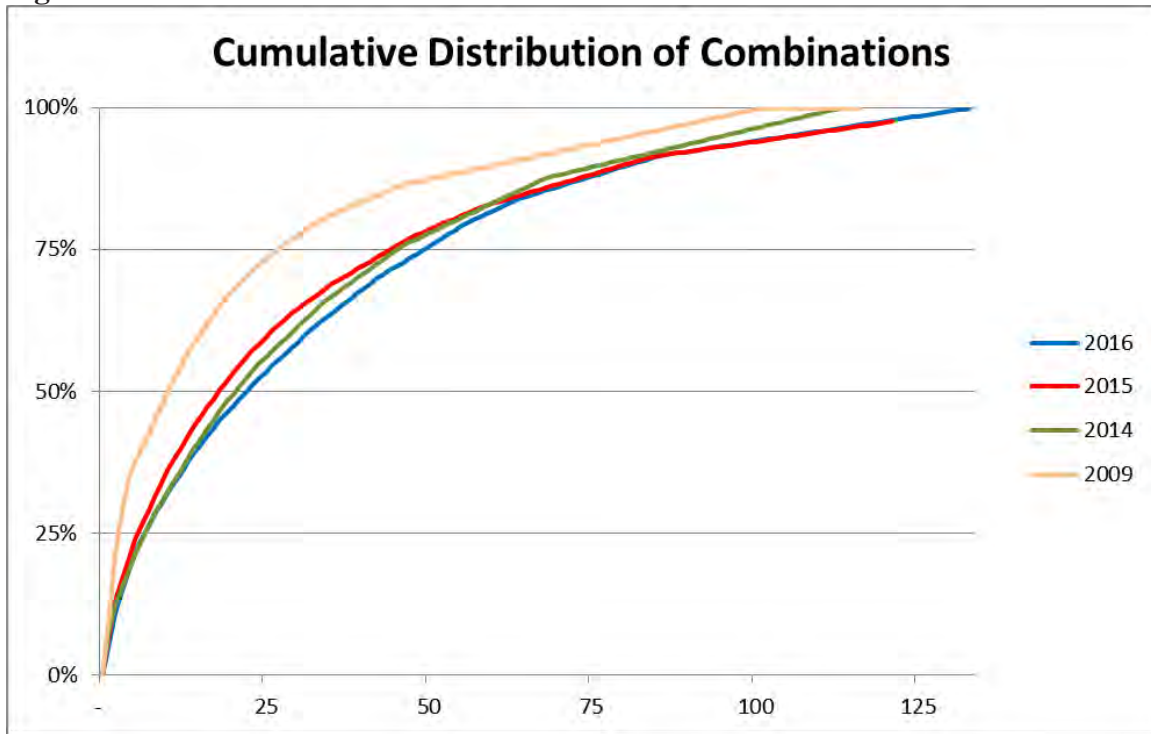
<b>Group 1</b>	<b>Group 2</b>	<b>Group 3</b>	<b>Group 4</b>
<i>Economic</i> 1 Energy price shock 2 Currency shock 3 Chinese economic hard landing 4 Asset price collapse 5 Financial volatility	<i>Environmental</i> 6 Climate change (includes space weather) 7 Loss of freshwater services 8 Natural catastrophes: tropical storms 9 Natural catastrophes: earthquakes 10 Natural catastrophes: severe weather	<i>Geopolitical</i> 13 Interstate and civil wars 14 Failed and failing states 17 Regional instability	<i>Geopolitical</i> 11 Terrorism 12 Weapons of mass destruction 15 Transnational crime and corruption
<i>Geopolitical</i> 16 Retrenchment from globalization	<i>Societal</i> 18 Pandemics/ infectious diseases 19 Chronic diseases 20 Demographic shift		<i>Technological</i> 22 Cyber/ interconnectedness of infrastructure 23 Technology
<i>Societal</i> 21 Liability regimes/regulatory framework			

**Figure 34: Risk Combinations**



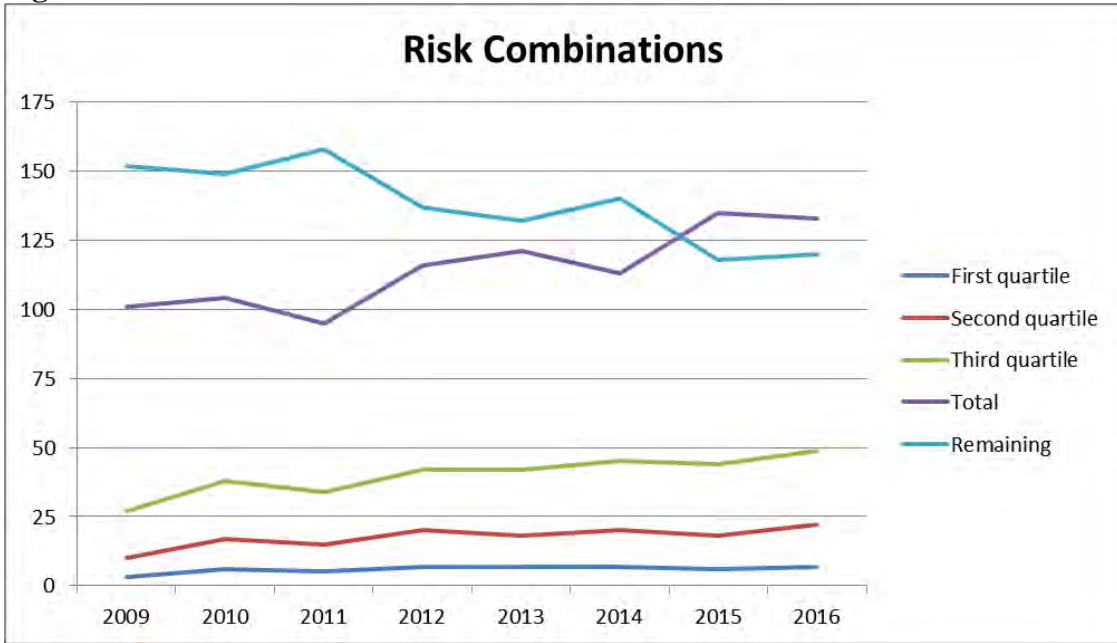
There are 253 possible risk combinations. Following the financial crisis in 2008–2009, the results have moved toward reduced concentration. That trend continued during this survey, especially for the leading 60 combinations, as shown in Figure 35.

Figure 35



With data listed cumulatively and the first quartile representing the most frequent responses, results are presented in Figure 36. A changing trend is present in the past two surveys, especially in the third and fourth quartile results, which will continue to be monitored and analyzed. More than half of the possible combinations were again selected.

**Figure 36**



The broad representation may be an indicator of the current risk environment, with each quartile being considered against the extreme example of 2009. Shown in Figure 37, this year's risk concentration ratio of 48 percent is the lowest recorded to date.

**Figure 37**

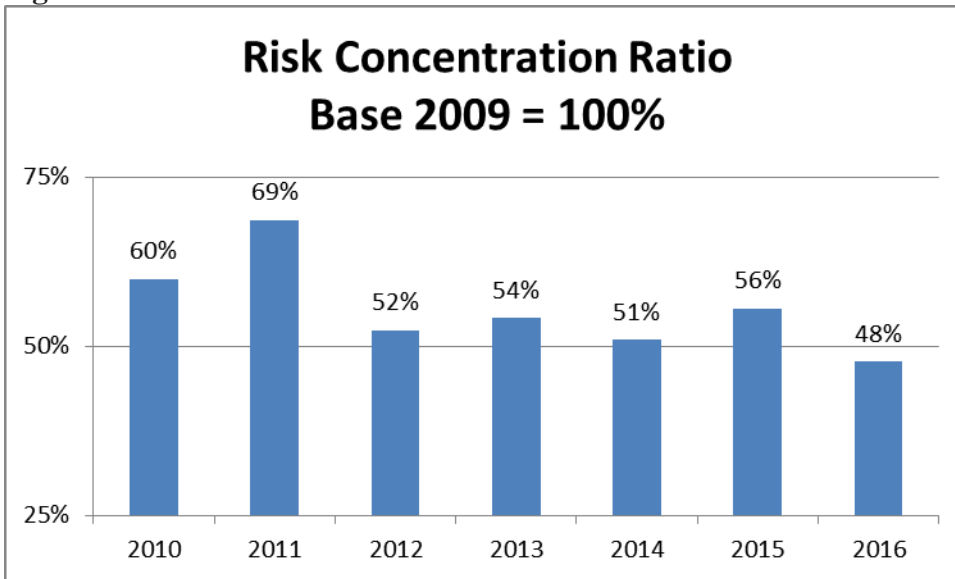


Table 3 shows the responses in the order they were chosen. A follow-up question referred to Combination 1, so it is reasonable to assume that it is the risk manager's top combination choice. The Economic category is more commonly included in the first

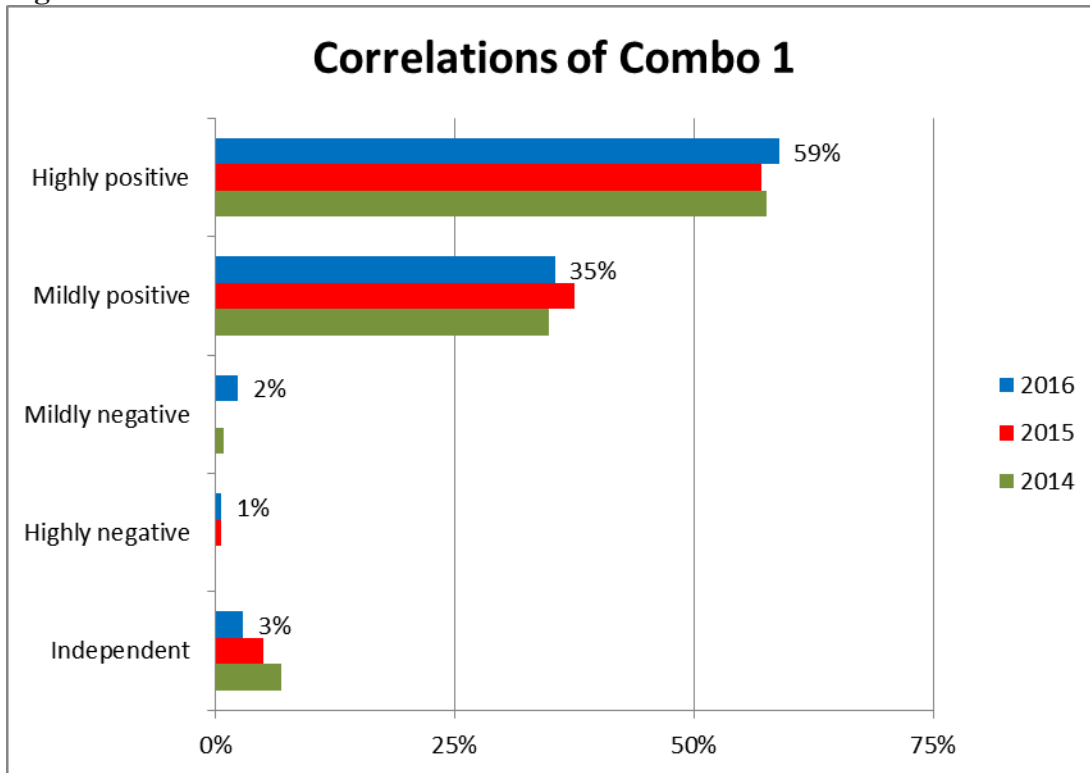
option, and the Environmental and Societal categories are more likely as a second or third option.

**Table 3**

<b>Combination Splits by Category</b>		<b>Combo 1</b>	<b>Combo 2/3</b>	<b>Overall</b>
Economic	Economic	17%	13%	14%
Economic	Environmental	2%	1%	2%
Economic	Geopolitical	19%	13%	15%
Economic	Societal	4%	6%	6%
Economic	Technological	6%	4%	4%
Environmental	Environmental	3%	10%	8%
Environmental	Geopolitical	4%	3%	3%
Environmental	Societal	3%	5%	4%
Environmental	Technological	2%	1%	1%
Geopolitical	Geopolitical	18%	19%	19%
Geopolitical	Societal	2%	2%	2%
Geopolitical	Technological	11%	10%	11%
Societal	Societal	1%	4%	3%
Societal	Technological	5%	3%	4%
Technological	Technological	5%	5%	5%

It is very hard to anticipate unintended consequences when multiple risks are stressed concurrently or in rapid succession. Respondents were asked to describe the type and level of correlation for the risk combination selected first. As shown in Figure 38, nearly all (94 percent) reported either a highly or a mildly positive correlation. These results continue to be intriguing as the risk community evolves its thinking about this issue. A highly positive correlation does not infer causality, but the risk manager may identify the first of correlated risks that are sequential as a leading indicator.

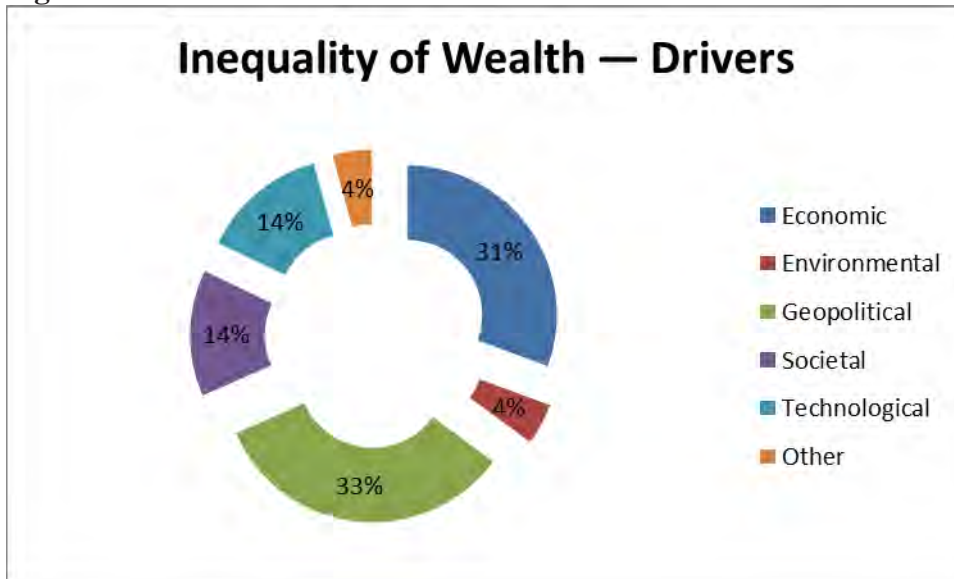
**Figure 38**



This survey includes a rotating question allowing a choice of up to three risks that fit the criteria. In this survey, respondents were asked, “Which of these risks would be your top choices to lead to inequality of wealth?” Not surprisingly, as seen in Figure 39, many of the top results came from the Economic and Geopolitical categories. The top responses were *Financial volatility* and *Technology*. Interestingly, the next two responses were *Retrenchment from globalization* and *Transnational crime and corruption*. One interpretation of this result, combined with the concerns about populism, is that falling back from the world economy could increase inequality despite the stated goal of helping the displaced worker. By eliminating foreign competition and allowing prices (and profits) to rise this seems a natural result. Another, similar, interpretation would be that displaced workers in emerging economies are worse off by more than the newly hired in a developed economy are better off. Automation of the process in the developed economy would lead to greater inequality in both markets. The five leading responses comprise 51 percent of the total.

1. 33% Geopolitical
2. 31% Economic
- 3T. 14% Technological
- 3T. 14% Societal
5. 4% Environmental

Figure 39



### Risk as Opportunity

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 before your competitors can provide an advantage. The survey asked which emerging “opportunities” are being monitored. In this survey, responses evolved beyond seeking out asset class opportunities based on volatility or assuming reversion to the mean. Here are some specific examples:\*

- *Alternative assets, mispricing of illiquidity*
- *I watch the price of gold. If viewed as a foreign exchange, it functions as a global currency without borders.*
- *Technology, demographic shift, financial volatility, currency shock*
- *Do not really understand the question—opportunities? / I understand this question from the point of things being mispriced due to fear (strictly a financial paradigm) but risks/rewards from exploiting does not seem to be healthy—rather trying to help solve these serious issues and challenges (the “reward” should be for the effort trying to solve, mitigate and prevent serious tragedies, not exploit. Often the wrong people bear the cost, conversely would the “risk manager” bear the cost if he/she is wrong. / Diversification and providing insurance and coverage for the benefit of society as a whole seems to be the best opportunity.*
- *Nanotechnology, advances in medical science*
- *We do not approach risk this way.*
- *Technology advancements in robotics and renewable energy sources*
- *Opportunity to benefit from deregulation over next 2 to 4 years in United States*

\* Direct comments from respondents have been slightly edited throughout the paper.

- *Fintech*
- *Clean energy*
- *Demographic trends for investments—e.g., old people are likely to be buyers of prescribed drugs and RVs—also political forecasts, e.g., currently buying defense stocks and selling utilities*

Surprisingly, there are no mentions of a volatile or uncertain mortality assumption. Various forms of technology and clean energy were popular comments, although several noted that they continue to look at risk in the downward direction exclusively. For those struggling with the concept of the upside of risk, it may help to think of a mean reverting process. If you agree that markets are not perfect, then you can look at long-term assumptions relative to current levels and consider whether some will revert to the mean (or cycle beyond it) at some point. The other means of exploiting risk is much harder; recognizing an emerging risk that will occur in a positive fashion before your competitors make the connection. Regarding the rather long comment concerned with exploiting for reward, an example may help. While cyber is a downside risk, providing insurance coverage and mitigation techniques to risk takers is a way to exploit this risk, just as desalinization plants exploit and provide a solution for the loss of freshwater services.

A final question for this section asked for suggestions of risks that are not included in the current 23, which are defined in Appendix I. Each respondent could suggest up to three additional risks. Here are some of the typical suggestions:

- *Medical costs so high big swaths of population can't get care*
- *Progressive Globalization—The exact opposite of the retrenchment risk. There is a happy medium.*
- *Food supply instability*
- *Central Bank Policy*
- *Increased polarization in previously stable democracies—USA, Britain, France*
- *Liability associated with the Internet of Things. E.g., who will be liable for a self-driving car accident?*
- *Populism*
- *Antibiotic resistance*
- *Nontraditional competitors*
- *Deteriorating infrastructures*

## **Section 2: Leading Indicators**

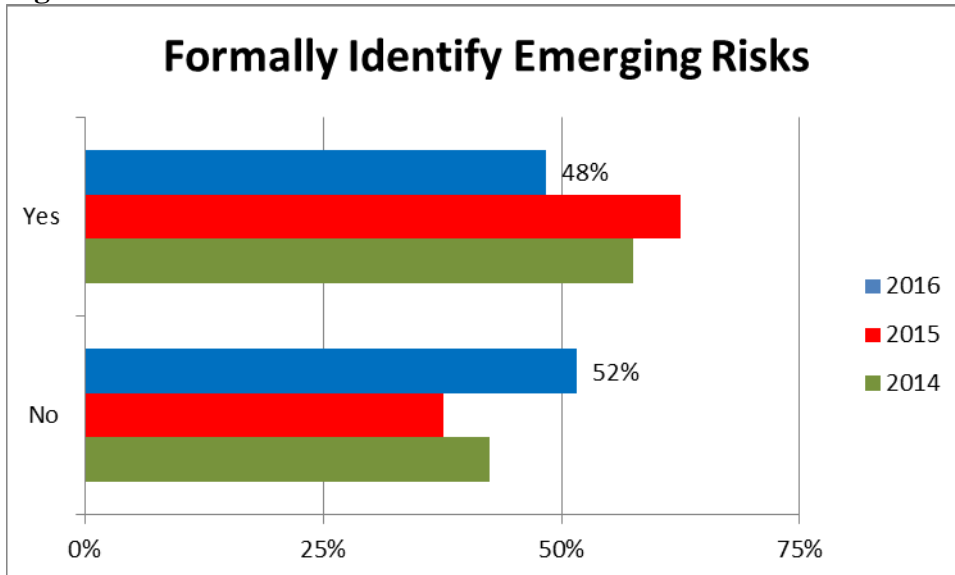
Leading indicators of emerging risks are metrics, or events (e.g., when a new piece of legislation is enacted), indicating that an emerging risk is likely to materialize. This allows actions to be adjusted earlier than they might be otherwise. Key risk indicators (KRIs) provide information about a specific risk. They do not replace metrics that measure value in hindsight but attempt to identify drivers of future performance. Trending indicators like gross domestic product (GDP) or consumer price index (CPI)



can provide macroeconomic KRIs, as can revenue and expenses for a firm. These measure historical results and are lagging indicators. Leading indicators, by contrast, provide information earlier in the process. For example, a lower unemployment rate would drive expectations of higher collected taxes. A leading indicator could be an event that becomes a Boolean indicator, acting as an on/off indicator. An example might be the signing of a star athlete that leads to higher attendance and additional revenues from jersey sales for a sports franchise. The survey asked about the use of leading indicators providing a firm with actionable information.

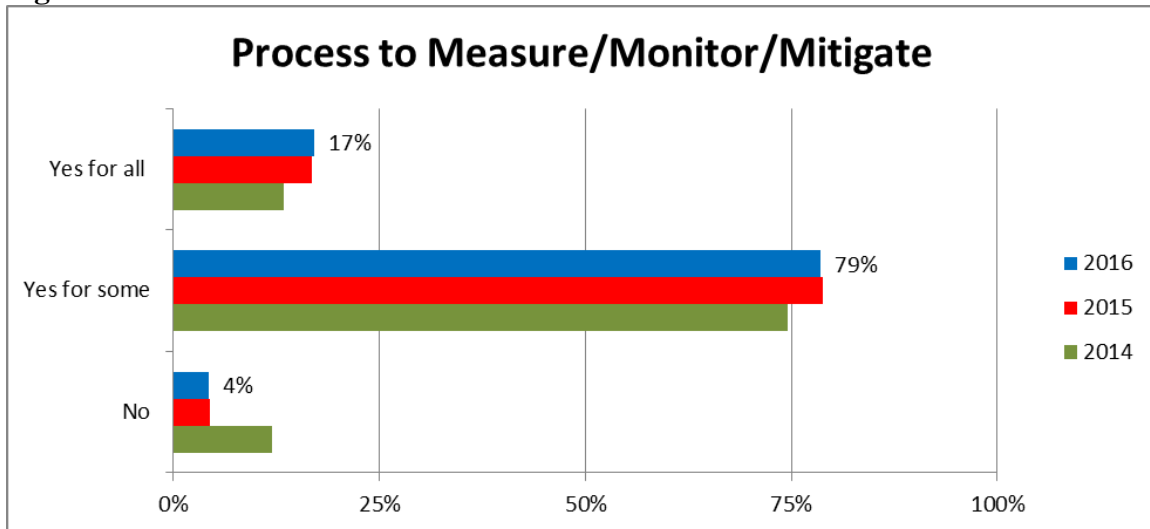
As shown in Figure 40, 48 percent of respondents formally identified emerging risks, decreasing 14 percent from the previous survey. This reverses the previous trend and may reflect that risk managers better understand the question. Working with emerging risks is very challenging, and risk managers never really know if they got it right. It is hard to identify a risk or event that has been avoided.

**Figure 40**



For those with a formal process (those without one did not answer the remaining questions in this section), the survey asked about measuring, monitoring and mitigating an emerging risk once it has been identified. The chart shows that nearly all (96 percent) responded that they did this for some or all of their identified emerging risks. Only 4 percent reported having no process in place, consistent with the prior survey. Developing KRIs is challenging and is expected to be a source of improvement as risk management evolves.

**Figure 41**

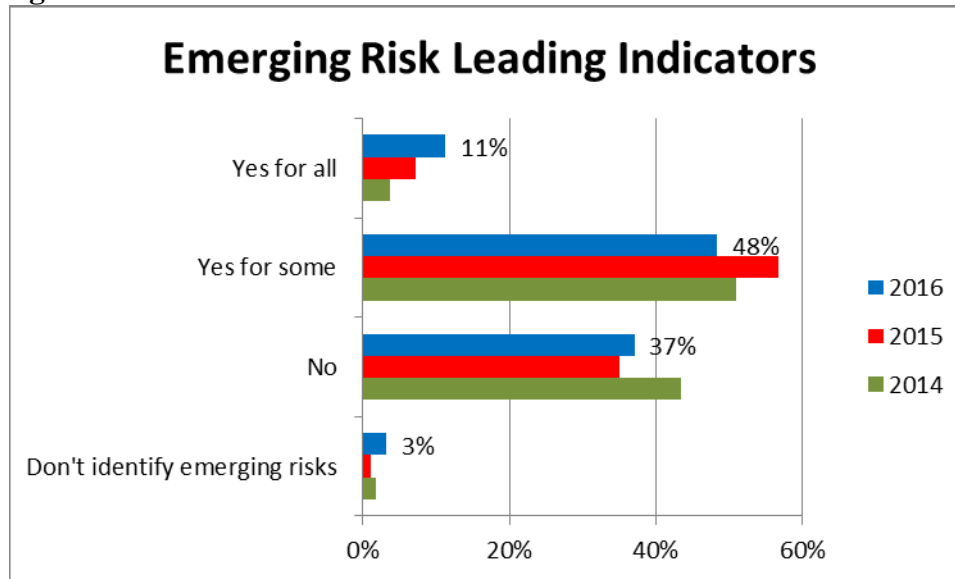


Most of the comments about actual processes talked about their activities to measure, monitor, and mitigate the risk. This shows progress is being made. Here are a few of the risks being followed:

- *Monitoring epidemic/pandemic risk through the WHO and CDC websites*
- *Tracking interest rates effect on pension funding*
- *The top risks are identified and each risk has an executive team risk sponsor. There is also a risk team established with a risk owner. Risk plans are put in place and the process is periodically reported to the BOD.*
- *Regular measurement of mortality improvement (and trends)*
- *Opioid epidemic*
- *We maintain an Emerging Risk Tracker and have biweekly calls to discuss those risks as well as determine if any new risks should be added or if any risks should be removed.*
- *Monitoring rising sea levels over time*
- *Risk of third-party supplier failure: risk management includes identifying areas where contract terms can be strengthened.*

In a follow-up question—“Once an emerging risk is identified, do you select leading indicators to measure changing likelihoods?”—11 percent of respondents noted that they had leading indicators for all identified emerging risks, and 48 percent had them for some. Only 37 percent stated that they had no emerging risk leading indicators, up 2 percent from the prior survey. This is a surprising trend since only those with a formal process for identifying emerging risks would have answered this question.

Figure 42

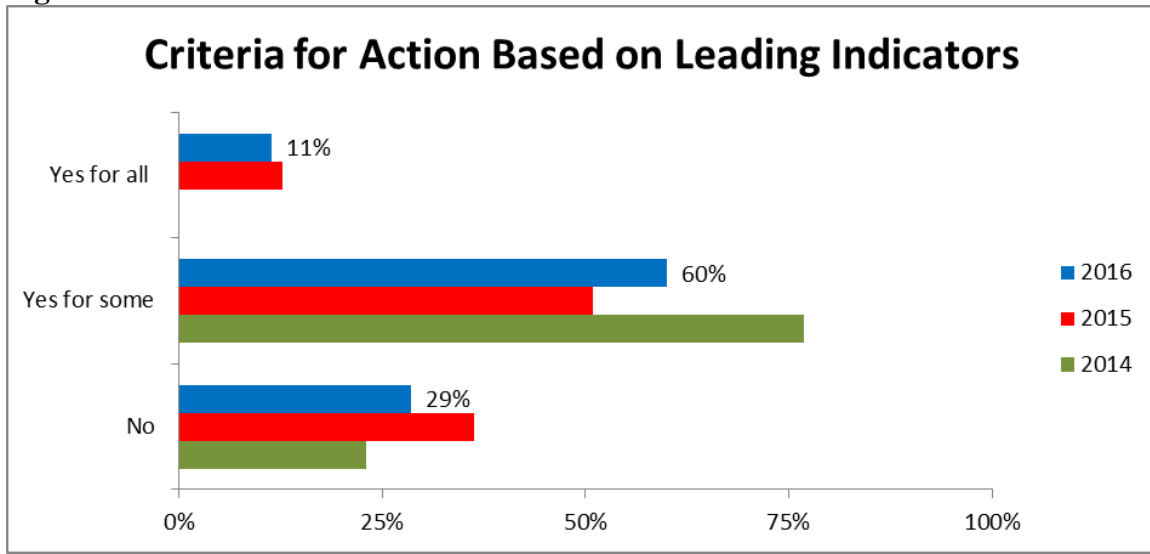


The examples shared about specific leading indicators being collected and monitored are interesting. Standard by-products of the financial reporting process or economic metrics tend to be lagging indicators and are not included here. Here are a few of the responses:

- *E.g., sales trends indicating shift to competitive platforms utilizing superior technology*
- *Yes, it is called indications and warning (I&W) within the Department of Defense. I&W flags the risk for greater collection and analysis.*
- *Methane release*
- *CERT warnings (Cybersecurity)*
- *NOAA global temperature index*
- *Gartner Hype Index for Technology*
- *Storm numbers/severities/tracks*

The survey asked whether these leading indicators included criteria that would lead to an action to mitigate or accept the risk. Over two-thirds (71 percent) stated that criteria exist for some or all of their emerging risks, as seen in Figure 43. This is an evolving practice, but the positive trend is encouraging.

**Figure 43**



When respondents were asked for examples, they shared a more formalized process, additional specific actions and triggers than in previous surveys. Some good examples are as follows:

- *We are able to curtail or modify underwriting.*
- *If anomaly scores increase above a threshold, then action is taken.*
- *The criteria are based upon a much larger perspective that involves diplomatic, informational, military and economic perspectives—that combined define the criteria for mitigation or acceptance.*

Emerging risk analysis will have varying levels of sophistication as a process matures, moving from a heat map to quantitative metrics in some cases. Another evolving concept could lead velocity to join impact/severity and likelihood/probability as a key factor in this type of analysis. This describes how fast a risk can move from benign to critical (e.g., seismic activity can happen quickly, allowing little time to plan, whereas a demographic shift may occur slowly over many years).

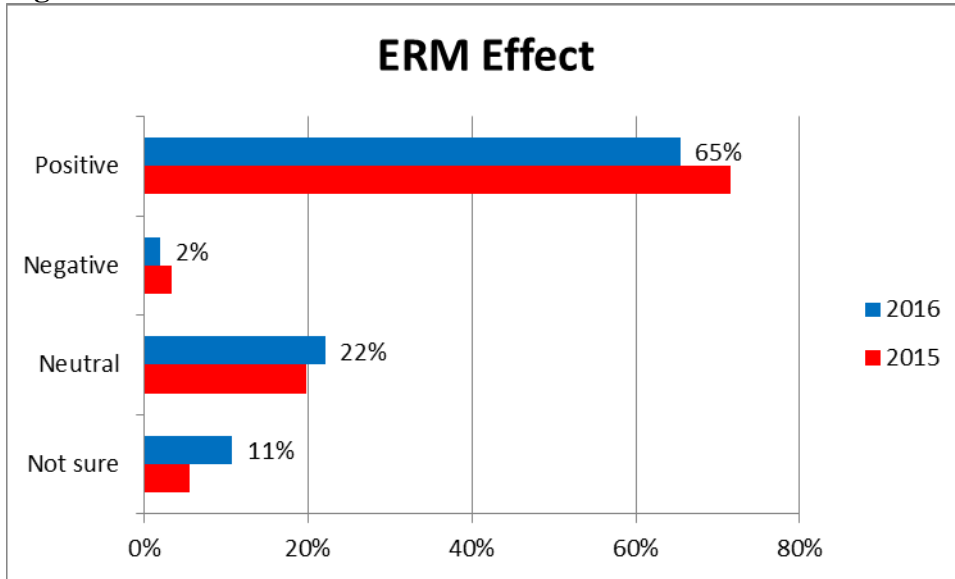
### **Section 3: Methodology**

This section has become almost a separate survey, with very interesting comments about the value of ERM that complements the emerging risk trends asked about in Section 1. Each risk management program is at a unique point on a maturity scale. The reader’s experience will differ from the researcher, so will pick out and interpret comments in unique ways. The reader is encouraged to at least scan all of the comments made in Appendix II. This will suggest possible future development paths of an ERM process.

The first question in this section asked respondents whether “enterprise risk management had a positive, negative or neutral effect in your company/industry.” As Figure 44 shows,

very few (2 percent) said it had a negative effect, and a majority (65 percent) responded that the effect was positive. The high number of *Neutral* or *Not sure* responses is also telling. An ERM process can fall victim to a poor risk culture, and bureaucracies and politics sometimes get in the way.

**Figure 44**



Not surprisingly, there were a lot of comments supporting the responses. For those who said ERM had a positive effect, some of the comments included such common topics and thought-provoking insights as the following:

- *It has enabled us to identify where we can take additional risk prudently, and we have been rewarded for this additional risk.*
- *When ERM works well, communication and understanding within management teams improves.*
- *More proactive measuring and monitoring; increased discussion*
- *More transparency regarding risk-taking activities*
- *Expectations around analysis supporting key strategic decisions*
- *ERM requires answers to difficult questions*
- *Has led to an organized way to identify and assess risks and set in place plans to mitigate*
- *Awareness and education*
- *ERM attitudes lead to consideration of risk at the enterprise-level, which aids asset allocation.*
- *Allows Company to evaluate strategic and business plans based on risk-adjusted decision making*
- *More thorough evaluations of opportunities*

- *Monitoring of risks, recognizing the correlation of various risks, and recognizing both risk and risk appetite has been beneficial*
- *It has forced a broader perspective than many actuaries have.*
- *Once more are aware of risks (know more about what you don't know you don't know), they can make better short- and long-term decisions.*
- *It helps management think longer term.*
- *Better awareness of risk culture*
- *Just common sense*
- *Our ERM committee provides a second review of our new products and the financial and regulatory trends going on. They help to identify risks that may be missed early on in projects.*
- *Proactive instead of reactive*
- *Permits the U.S. military to remain a credible force regardless of the specific global threat*

Those who reported that the effect was negative tended to describe a growing bureaucracy at the top of the list of reasons:

- *Complete regulatory compliance orientation, intended to satisfy regulators, giving false sense of security but without really effectively addressing risks*
- *It's an expensive extra layer of middle-management who repeatedly spend time conducting deep dives into counting the number of angels that can dance on the head of a pin.*

Those who reported neutral or uncertain effects so far tended to be too early in the process to know, were part of an already strong risk culture, allowed the process to become bureaucratic (or have a weak leader), or have seen others fall in love with their models and forget to include common sense.

- *No effect. Our risk officer is ineffective.*
- *ERM has offered additional perspective; however, management has not tended to implement any initiatives that appear dampening in an upward/positive environment, particularly if negatively impacting personal incentive compensation outcomes.*
- *Difficult to measure success, but easy to identify failure*
- *Company has always acted risk averse; ERM not fully integrated yet, still some way to go; Solvency II introduced more focus on risk and more discussion, which is good, but also had a significant price—so all in all neutral.*
- *Our company has a program, but it's a bureaucratic process, not an attempt to really understand and manage our risks.*
- *While we have an ERM program with quarterly updates, I don't think Senior management and the Board take it seriously enough.*
- *Had already been doing it but not called by this name—good management*

- *Comes with added bureaucracy that creates its own risks and can be manipulated for political purposes rather than for “pure” risk management and mitigation*
- *It depends on what is meant by “enterprise risk management.” If this means a strong risk management framework and strong culture of risk identification, assessment, measurement and mitigation, then ERM has had a positive impact. If this means having a dedicated ERM department running complex economic capital models, then ERM has had no impact. Our company believes that ERM assessments should be simple and easily understood by all.*

In the next part of the survey, respondents were asked to share instances where quantitative, qualitative and combined efforts have enabled better decision making.

The quantitative responses included some common themes. Many reflected modeling improvements that led to actionable responses and a better understanding of risk exposures. Some reflected the benefits of a common measurement system across risks. Specific uses of quantitative methods were shared, and the comments are illustrative:

- *Quantification efforts have increased understanding of risk and how it changes in different environments, allowing for more robust discussion about risk tolerances.*
- *In understanding trends in results and taken a much more proactive stance*
- *Actuaries are forced to consider the tail of the distribution when pricing and reserving.*
- *Taking earlier action*
- *They make a problem easier to show that it exists.*
- *Primarily by avoiding actions which would worsen risks to which the organization is already more exposed.*
- *Able to better frame an exposure relative to another exposure when using the same methodologies to quantify*
- *Giving a clear hierarchy of the relative importance of major risks*
- *Decision whether to write a large case is conditioned in part on potential impact to risk profile; costing of the case uses bespoke risk capital assumption based on complementarity to existing portfolio.*
- *Provides for a common “currency” of risk taking across various risk types and informs capitalization decisions*
- *In determining when new concept/capability/doctrine/organizations need to be incorporated into the U.S. military’s force structure*

Qualitative analysis reflects the importance of brainstorming, with more collaboration across business units. As risks (e.g., cyber) move from emerging risks to something that needs to be managed, and although historical data are lacking, this gets the risks on the radar screen. Sometimes qualitative analysis is a stopgap while model strategy is developed, and it often provides a baseline for more complex methods, allowing experience to be part of the process. The following comments stand on their own:

- *Identifying operational risk concerns, prioritization of dealing with such concerns*
- *Challenging managers to think about emerging risks is beneficial.*
- *Some risks are hard to quantify—qualitative analysis focused on understanding the risk and our action under various scenarios allows for better understanding of our preparedness for the risk, any gaps in management or opportunities to exploit.*
- *Critical assessment of risks related to novel financial instruments, coupled with skepticism about risks as represented by originators and intermediaries, has allowed companies to avoid mistakes made by other, less skeptical companies.*
- *Not everything can be reduced to numbers, and there are a lot of unknowns. So qualitative assessment should always be used to adjust the quantitative.*
- *Generates awareness and conversation*
- *People are aware of cognitive biases.*
- *Behavioral Economics—lapse rate considerations, etc.*
- *I'm not aware of effective qualitative analysis that did not include an overabundant amount of hubris, e.g., "the qualitative analysis that we did enabled better decision making because we're smart," rather than "the qualitative analysis that we did was a horrible mistake and we learned a lot from the process, enabling us to make better decisions in the future."*
- *Getting a sense on how management is thinking about risk (Low, Mid, High)*
- *When uncertainty is high*
- *By understanding the biases of models like stochastic interest rate generators that don't create negative rates and mean revert*

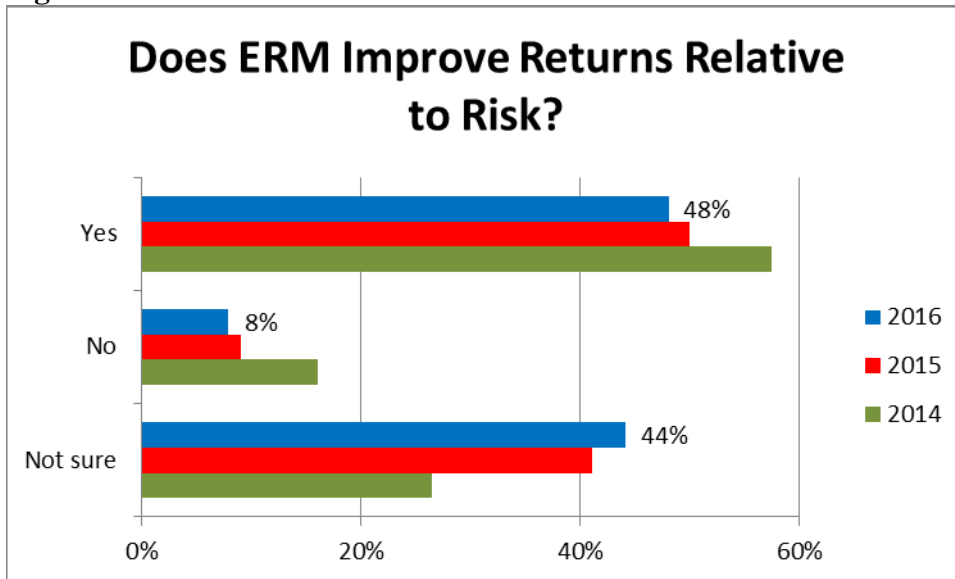
Respondents also shared instances where a combination of qualitative and quantitative analysis enabled better decision-making. The responses reflected best-case ERM and included examples where experienced risk managers could critique models and provide initial analysis for new products, emerging risks and other risks with limited data available. Here are some representative comments:

- *If things are too complex to quantitatively capture or too much noise, "qualitative analysis" may explain and provide better analysis for a decision maker.*
- *Overcoming cognitive biases about quantitative data*
- *At an enterprise level, both have benefits. A qualitative review enables a high-level view of risk that can drive appropriate action (easy to react to a high vs. low rating). A quantitative analysis enables a comparison of two risks for prioritizing (high vs. VERY high). Quantification also helps in the evaluation of risk mitigation costs (i.e., are we comfortable paying \$x to mitigate a \$y risk?).*
- *For risks with little to no data, qualitative methods offer a baseline from which to begin to frame out how to approach a quantitative view.*
- *Use of predictive modeling combined with underwriting expertise. Focus efforts on exception underwriting.*
- *Increased volatility is quantitative after the fact and qualitative before.*



As a risk manager it is important to strive toward putting a firm in a better place relative to risk. The survey asked, “Does implementing ERM improve company returns relative to the amount of risk?” The results varied from the previous survey, with *Not sure* responses (44 percent) continuing to take votes from both *Yes* (48 percent) and *No* (8 percent) responses. This will be interesting to trend in future surveys and see if the responses to the two questions stabilize.

**Figure 45**



Among those stating that ERM does improve returns relative to risk, comments included having a better discussion about risk taking, better collaboration and a focus on proactive analysis.

- *Results from poor ERM have been disastrous, as seen in 2008. Short-term returns are reduced by effective ERM but so-called tail scenarios, which occur every 10-15 years, are avoided. There is a net benefit to solvency and viability, but discipline is needed to stay the course during “normal” years.*
- *Not everything can be prevented and mistakes are made, but ERM provides a framework and structured thought process to make and change a risk/decision-making model.*
- *A company can be proactive rather than reactive, which generally results in less expenditure in time, talent and resources to confront.*
- *Because if you understand more about risks, you can better see if the amount of return matches something that is high risk versus low risk. Sometimes people in our business do not see the huge amount of risk (likelihood of error) and only see the revenues.*

- *Appreciation of diversification—opportunities to take on more risk in areas where we are underweighted while trying to limit the amount of additional risk we take in areas that are overweighted.*
- *Quantifying the risk the organization is undertaking is essential to understanding whether one use of capital is better than another.*
- *KPIs can help identify common risks and exposure so fewer surprises. Moved from intuitive to factual.*(Ed. Note: KPI is a common abbreviation for key performance indicators)
- *You can only improve what you measure. Measuring risk might mean getting out of lines of business that are too risky for the return.*

Cultural issues drove the comments of those who said ERM does not improve returns relative to risk or who were not sure. Comments also reflected skepticism about cost relative to benefit and the long-time horizon necessary to determine success. Some questioned the question due to lack of time horizon specificity. Many who wondered how to measure the success of ERM made comments similar to the following:

- *Absolute dollar, likely not. As a percentage of the risk exposure, yes. When involved in writing new business, ERM favors great business and stands in the way of writing good business. So margins go up, but absolute dollars go down.*
- *ERM is often implemented as "red-tape." The theory of ERM is excellent (i.e., take the risks you want and diversify away the rest). However, the application becomes cumbersome.*
- *ERM is one of many tools used by management, but it only affects, or determines, what shouldn't be done. Just as a negative can't be proven, nor can its effect be measured.*
- *ERM as a compliance work*
- *The cost is too high.*
- *ERM can go crazy in its specificity. If policies are reasonable and reasonably implemented, ERM should improve returns. With too much specificity, the costs can well exceed the risk.*
- *ERM is usually required due to regulatory reasons, so is this question even relevant?*
- *We have not formally quantified the impact—right now it is more about making sure the risks are top-of-mind and less about quantifiable analysis.*
- ***Hard to prove a negative***
- *Ill-defined question—depends on decision and measurement horizon (many short-term impacts are not well correlated with long-term impacts). Further, implementing ERM has generally immediate need for investments (in money, people, procedures, etc.) and is short-term disruptive, so that the actual benefits will only emerge in the long term.*
- *Depends on whether company will follow through on all findings, or just go through the motions*

- *In theory there is no difference between theory and practice.*
- *No evidence that it is any better than historical methods of managing risk and return*

The final question of this section is extremely open-ended, asking what the respondents would like to share with future risk managers. You are encouraged to review all the responses found in Appendix II, Section 3, Question 8. Many of them refer to the importance of culture, communications, getting buy-in from at least one champion, iteratively moving forward in a prioritized fashion rather than trying to do everything at once and involving the business units. Companies should design an ERM process that works for their specific needs and try not to be too exact. These comments reflect some of the best ideas shared:

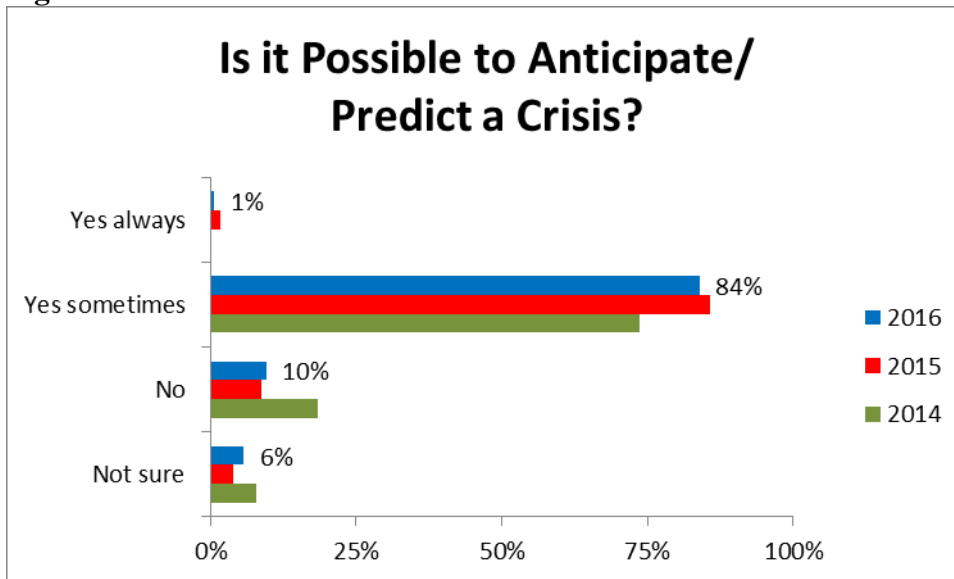
- *It's a long road to travel!*
- *Keep it simple. Deliver consistent, timely and actionable MI to decision makers using a push-based technology OTHER THAN EMAIL (i.e., on demand real-time dashboards).*
- *Getting insights from individuals with key knowledge of the industry and business is valuable.*
- *ERM cannot be standalone. The framework needs to be fully integrated within business processes. A key element is business area ownership of risk management, so an ERM framework and tools cannot feel like a "compliance" exercise. The role of risk oversight is to help the business make their own decisions, not impose limits that are not understood.*
- *Do not fall in love with your models. Look around you and understand what is going on.*
- *Try to step back from the weeds and keep the process as simple and understandable as possible. It can become too overwhelming and daunting if you don't.*
- *Leverage existing models and frameworks, and look to integrate them and reconcile them. Do not assume that you can build a better model from scratch (sometimes you can, but oftentimes you can't).*
- *Don't overbuild the process. Don't get caught up in the technical beauty of risk assessment and become meaningless to the decision makers.*
- *Involving a lot of the operation helps with Culture and input for defining a Framework. This process though does break down in a run state as "everyone" still believes that they can have an impact on the final say of what Risks to take/not to take. Having more independence from the actual operations will enable more effectiveness when big change "needs" to occur.*
- *Collaboration internally leads to better buy-in over time. Sometimes, you need to pursue 2 to 3 failed attempts until you have enterprise buy-in on the final approach.*
- *Bring lots of people to the table in developing. Focus on communication and change management.*

- *Develop and report regularly without expecting instant buy-in. Promote the ERM view, teach about ERM and listen to questions and concerns. Be persistent. Don't let quantification eliminate judgment.*
- *Sell it to everyone.*
- *It is imperfect and requires a diversity of folks to do it properly. Second, you just aren't going to convince or force some people to adopt. They have to learn the hard way.*
- *It must evolve over time to become part of the culture, and it must be supported/promoted/required by top management.*
- *Each organization has to find what works for them. Risk managers are advised to know their audience/constituents.*
- *Establish routine reports you know are meaningful to management*
- *(1) Risk education and culture should be at the foundation; don't discount this effort. / (2) Senior management involvement is very important from the beginning. / (3) Start small and solicit business unit buy-in as program expands to derive the most value from their insight.*
- *Just having a risk list is worthless. You need to do something with that risk list and tie it into strategy and financial planning.*
- *Make it part of the business.*
- *Tone at the top is essential. Board and CEO must buy in and (depending on the size of the firm) appoint a CRO. From there, partnering with the business, building on the momentum of the tone at the top, communicating the value of risk-based decision-making promoted by the framework and gaining buy-in from the business through risk champions (appointed by the business) helps to build a strong ERM culture.*
- *When ERM is perceived as a "compliance exercise" only, the business will see ERM as a necessary cost—the work will get done, but much of the value-add will be eroded.*
- *Always remember that nature reserves the right to surprise us.*
- *Create a hit parade of risks and reduce the blind spots (i.e., uncover the unknown unknowns).*
- *Make sure the role of contrarian is spread around—if only one person has it, then they are viewed as not being a team player.*

## **Section 4: Predictions**

Risk managers are becoming increasingly involved with the planning process, and a part of that is developing scenarios. Consistent with past surveys, developing a range of outcomes is considered more important than getting a single scenario correct. As risk managers become more aware of cognitive biases, they become more aware of potential bubbles and underpriced cash flow streams. When asked whether it is possible to anticipate/predict a crisis, most respondents (84 percent) stated that it was possible at least sometimes, as seen in Figure 46. Comments reflect the benefits of identifying vulnerabilities and being proactive.

**Figure 46**



This question, like others in the survey, is designed to make the respondent think and tends to elicit well-thought-out comments. For those who answered *Yes always* or *Yes sometimes*:

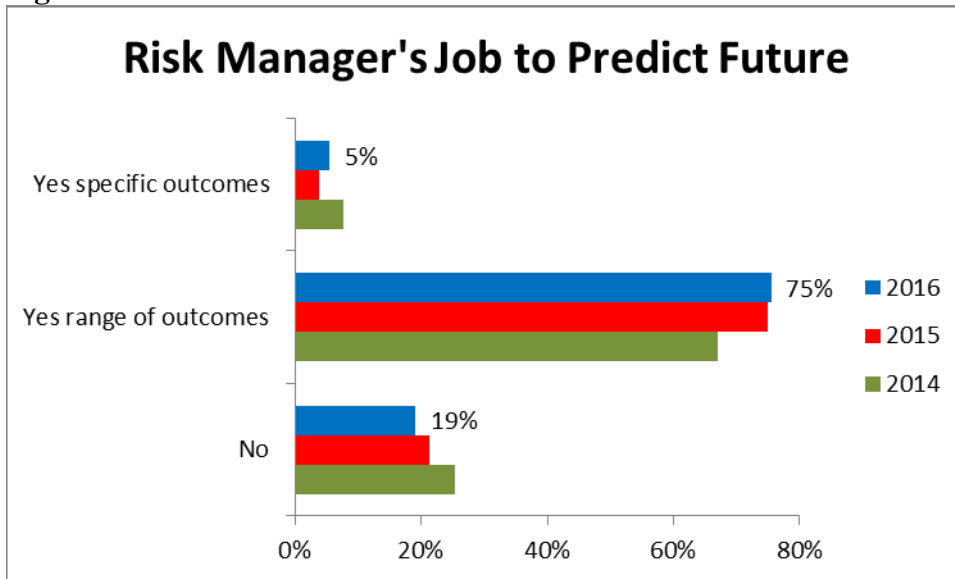
- *Anything can be predicted. The real question is whether any one person/organization can consistently predict crises.*
- *The problem isn't that you can't identify, it's that you have trouble acting on it.*
- *Investment bubbles are visible to at least some folks in advance*
- *But getting the timing right can be tricky. Being too early could be the same as being wrong.*
- *If you predict it continuously—you'll probably be right someday—but how often are you wrong?*
- *The Twain quote . . . history rhymes (maybe not every pattern is identical, differences emerge)*
- *Need to have forward-looking vision to try and anticipate what is coming up or at you*
- *If lemmings are all going one way, look into why instead of following.*
- *The dilemma is how a person knows what he/she doesn't know.*
- *While a crisis may be predicted, the level of conviction to take necessary action is extraordinary and the penalty relative to competitors if you are wrong is quite large.*
- *There are many gray rhinos that are inevitable, just the time and place are unknown.*

For those who answered *No* or *Not sure* the comments are fairly similar to those already considered:

- *Some leading indicators will point to an increased likelihood of a crisis, but the complex nature of crises prohibits anything close to an actual prediction until it's practically upon us.*
- *Crises tend to appear when you do not anticipate them; once you've anticipated a crisis, it's less of a crisis and more of a scenario to address. (Yes, it's just terminology, but there's some truth in there.)*
- *But it's possible to be prepared for one.*
- *If the crisis is a true Black Swan event then no, but depending on the data being analyzed, there are certain events that can be avoided if you are analyzing the data correctly.*
- *Depends on the severity of it. Usually, no.*

As shown in Figure 47, a majority (75 percent) felt it was part of their job to predict a range of outcomes, with 5 percent saying they were asked to predict specific outcomes.

**Figure 47**



Some of the comments from those answering *Yes—range of outcomes* included these:

- *Goal is not to predict but to prepare.*
- *While one side of risk management is about accurate predictions, the other piece is monitoring and mitigation. By actively monitoring risks and having mitigation strategies prepared should a risk move in one direction or another.*
- *The future that can be predicted is when history is repeated.*

- *Making guesses about things that may happen is equivalent to being lost in a garden of forking paths.*
- *My job is to make my clients think about scenarios they have not previously considered—mostly plausible ones, but also extreme ones.*

Each person has a unique read on questions. Comments from those who answered *No* to this question are no different. The comments show the deep thinking that occurs on both sides of this topic; for example:

- *All you can do in my opinion is identify the relative sizes of risks and discuss what you can live with and what you can live without.*
- *My role is to understand the sensitivity of company results to potential events, but not to predict when they might occur. The goal is to put tools in place to allow for good decision making if an event occurs and to reduce the likelihood/impact of a potential event within a reasonable cost.*
- *It is the communication of the possibilities, not the predicting of the future that is critical.*
- *I help the company fathom a future that is different from their “expectation.”*

A new question was added in 2016 to solicit respondents’ thoughts about current bubbles. It was a conscious decision not to define “bubble” and to apply it as broadly as possible. Noticeable in the responses were the high number of CIA members (Canadians) who noted a potential housing bubble in parts of Canada.

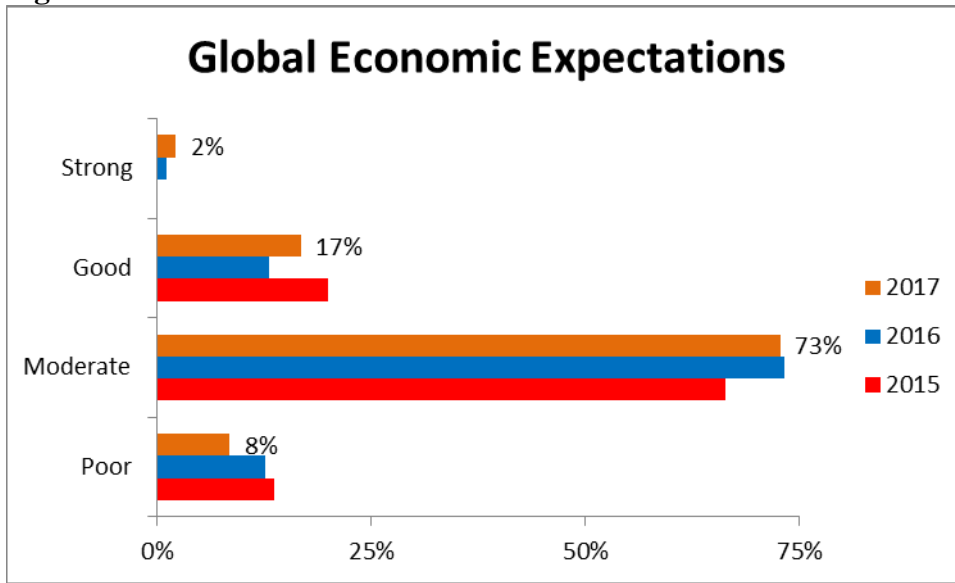
- *Real estate is nearing bubble status.*
- *Currencies themselves are in a bubble. There will be a coming reset, which will go back to a pseudo-gold standard.*
- *I’m concerned that loose monetary policy will eventually lead to inflation. I expect that when the tide turns, it will do so more quickly than most expect.*
- *Student loans and health care. Too much government money is being pumped into the system.*
- *No. Skeptical of the whole concept of bubbles . . .*
- *Pockets of the Canadian housing market*
- *In short, everything bought up by the European Central Bank is too expensive.*
- *Student loans*
- *Index life/annuity products*

## **Section 5: Current Topics**

The 10th survey in this series allows reflection on all that has transpired during this period. The Current Topics section reflects this, showing how expectations have evolved and risk projects and staffing have changed over time. Some questions have been posed for trending purposes.

Global economic expectations have been volatile during past surveys, but this year was more of an evolution. As shown in Figure 48, respondents were slightly more positive for 2017, with 73 percent having a moderate and 17 percent a good outlook (2 percent had strong economic expectations). Another 8 percent (down from 13 percent) had poor expectations.

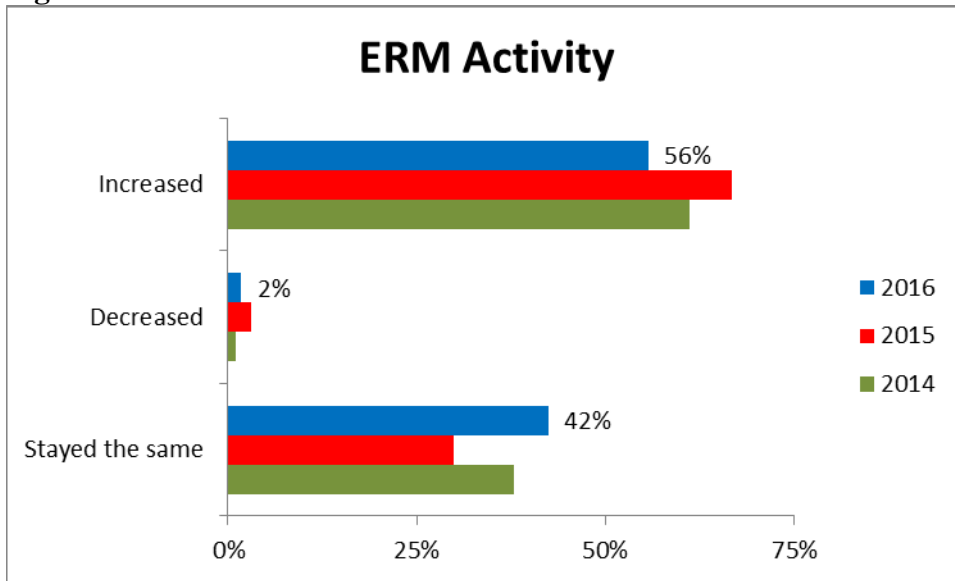
**Figure 48**



Risk managers continued to see increased ERM activity (56 percent) in 2016, while only 2 percent saw decreased activity, as shown in Figure 49. The increasing trend stalled this year, likely due to the relative calm surrounding the long period between recessions and completion of various regulatory initiatives.



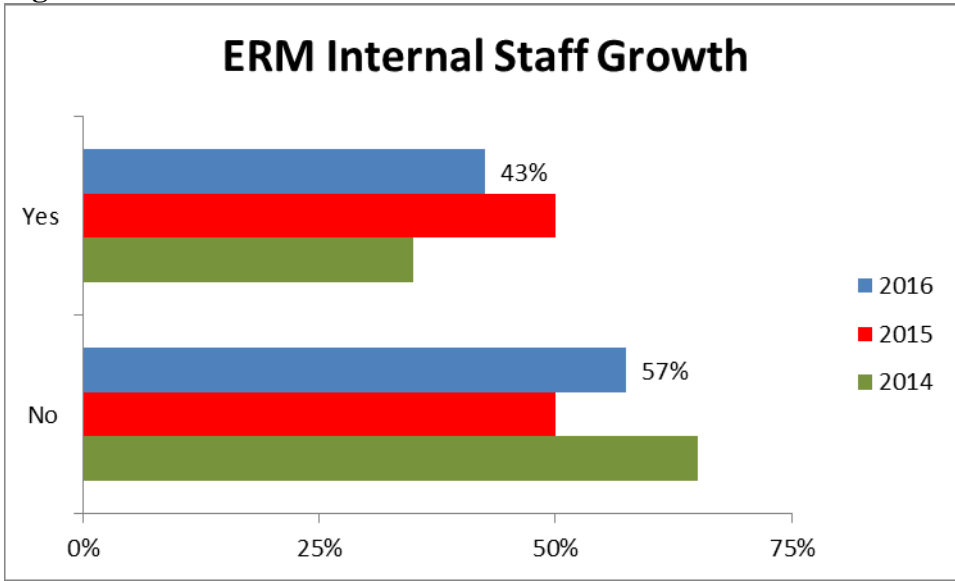
**Figure 49**



In an effort to determine what types of activities were being added, the survey asked just that question. While some referred to insurance regulatory requirements like ORSA and PBR, others talked about data science approaches and deeper dives into business units and risk categories. Other common activities looked across complex organizations and model governance issues.

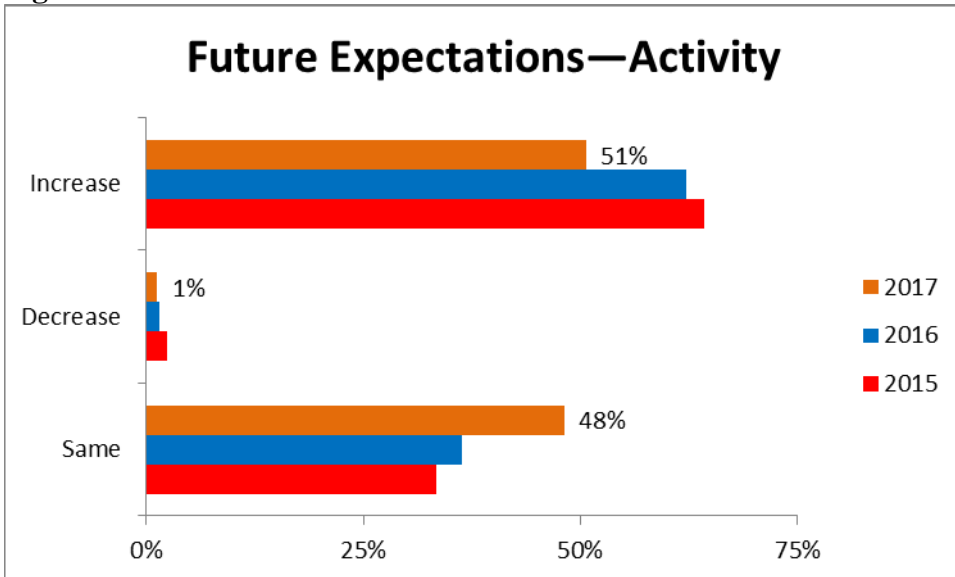
Higher ERM activity led to internal staff growth for less than half the respondents in 2016, as shown in Figure 50. These results trended down together, providing credibility. This is likely driven by the same perceptions of lower regulatory activity that drove a sharp reduction in *Liability regimes/regulatory framework* in Section 1.

**Figure 50**



The three-year trends in Figures 51 and 52 show continued expectations of activity stabilizing, with 48 percent of respondents expecting the same activity level and 67 percent the same funding in 2017. This may differ between large companies and small companies as smaller firms are often exempted from burdensome regulatory initiatives, but at the same time are being pressured by rating agencies to adopt additional ERM activities.

**Figure 51**



**Figure 52**

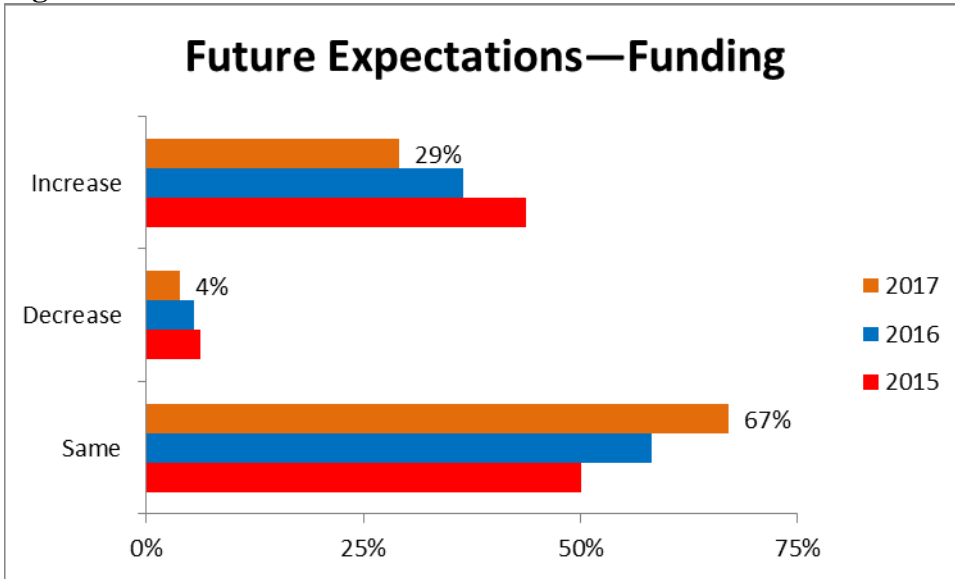
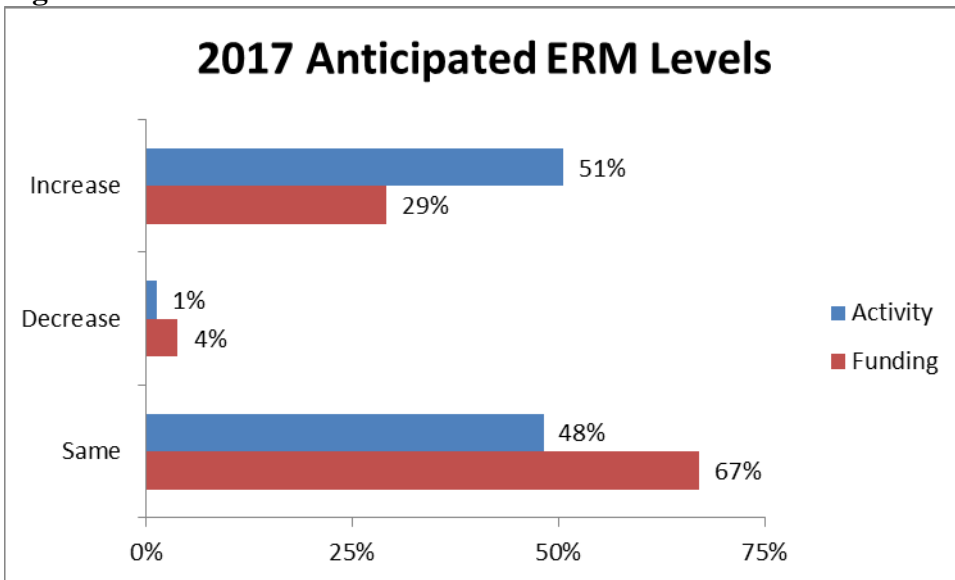


Figure 53 combines the activity and funding responses for the next year.

**Figure 53**



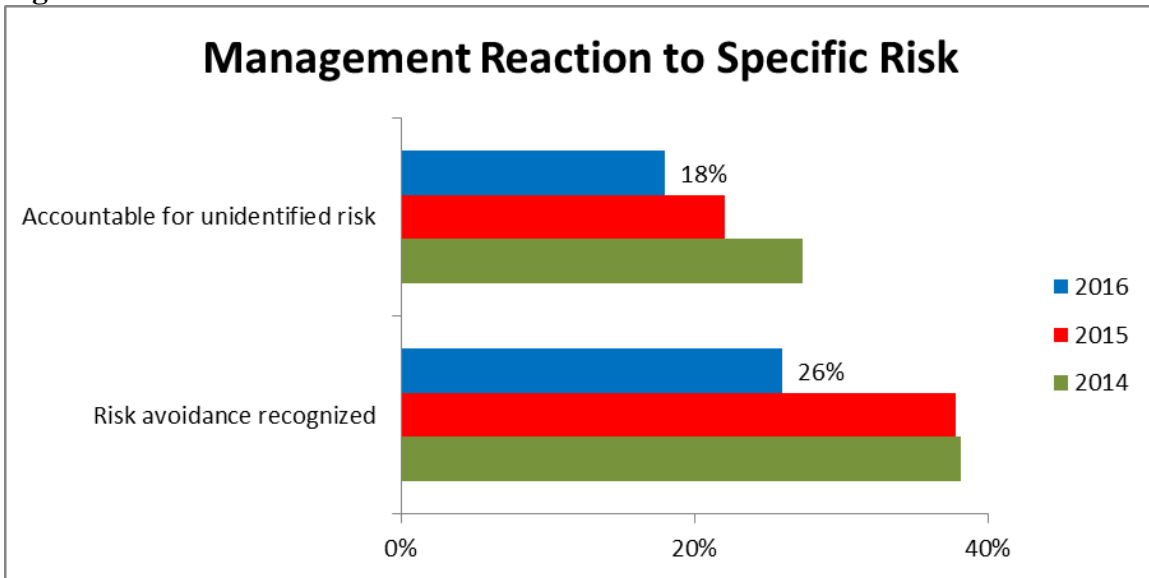
The survey asked how the ERM team is used when a strategic opportunity is presented to a firm. As illustrated in Figure 54, while 94 percent (including overlap) of respondents could either say no to a strategic opportunity (16 percent) and/or had input (88 percent), 6 percent still had no input. Companies are still trying to figure out the proper role of the risk manager, and it will likely vary based on the manager’s skill set and the risk culture.

**Figure 54**



As shown in Figure 55, only 26 percent of respondents expected to be recognized for avoiding a risk, and 18 percent (down from prior surveys) said they would be held accountable if they failed to identify a risk that materialized.

**Figure 55**

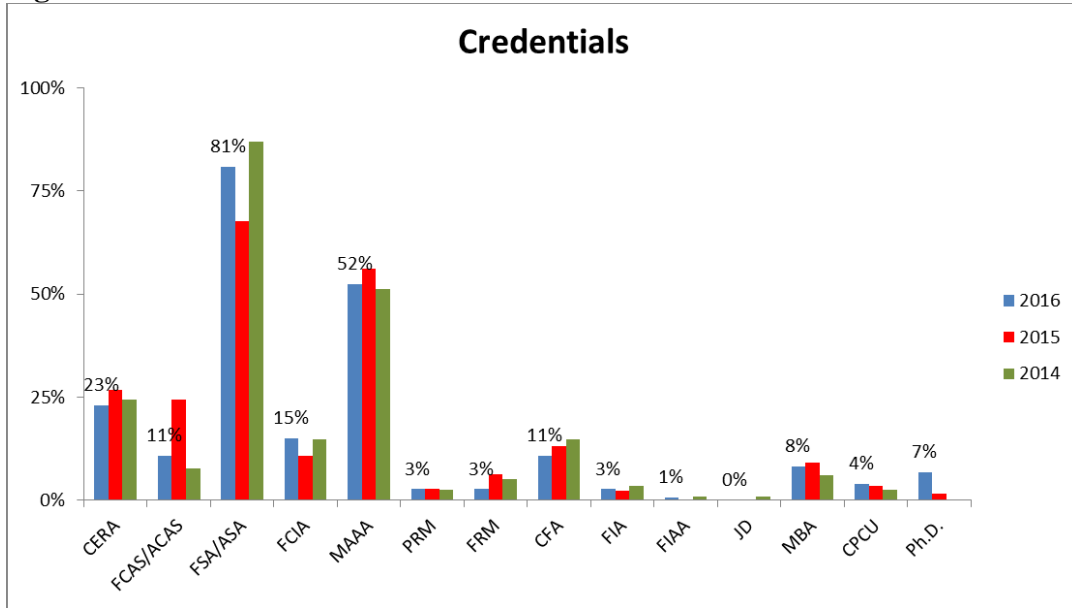


### **Section 6: Demographics**

Each year the *Survey of Emerging Risks* is distributed using targeted emails and social media. For this survey, 38 percent reported filling out the survey in the past. The sponsoring organization, the Joint Risk Management Section, was well represented in the survey, with 81 percent of respondents holding a credential from the Society of

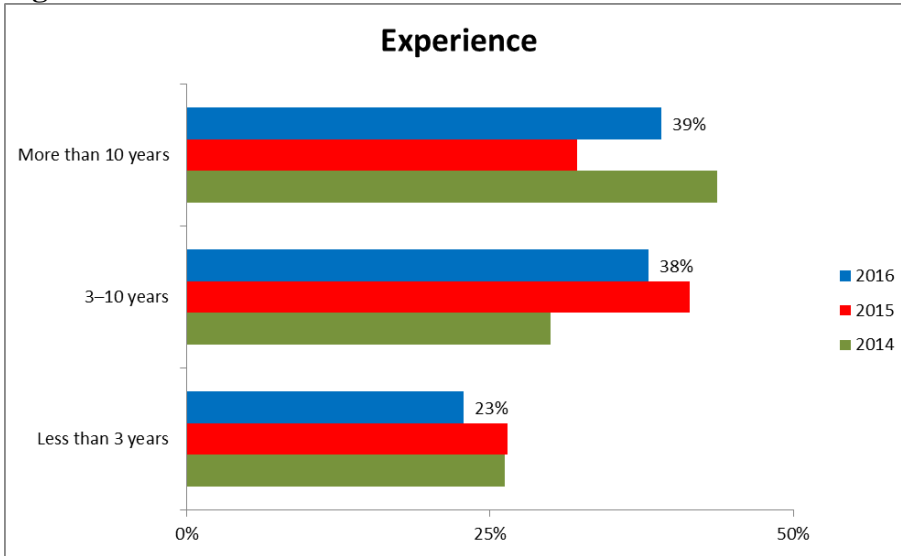
Actuaries, 11 percent from the Casualty Actuarial Society and 15 percent from the Canadian Institute of Actuaries. Other groups strongly represented were CFA charter holders (11 percent), those with a master’s degree in business administration (8 percent) and those with a Ph.D. (7 percent). Many respondents held multiple credentials, as shown in Figure 56.

**Figure 56**



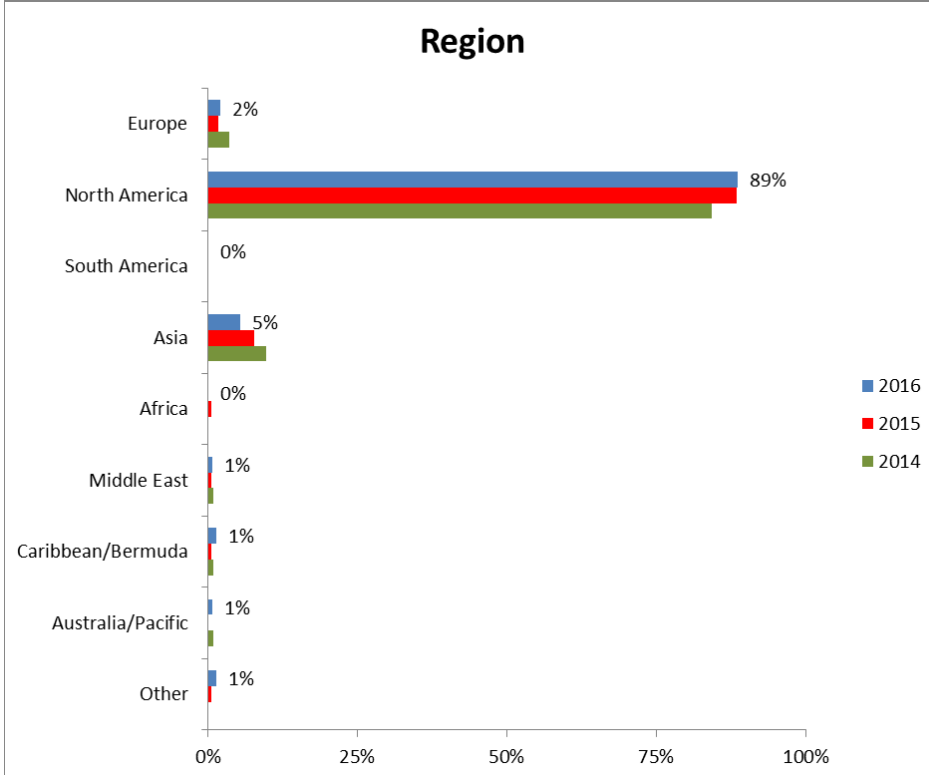
This year’s survey was completed by more experienced practitioners, with 39 percent having more than 10 years of experience as risk managers (see Figure 57). The researcher again is in the debt to respondents who have shared their experience with fellow risk managers. Most respondents work at an insurer/reinsurer (61 percent) or consulting firm (16 percent).

**Figure 57**



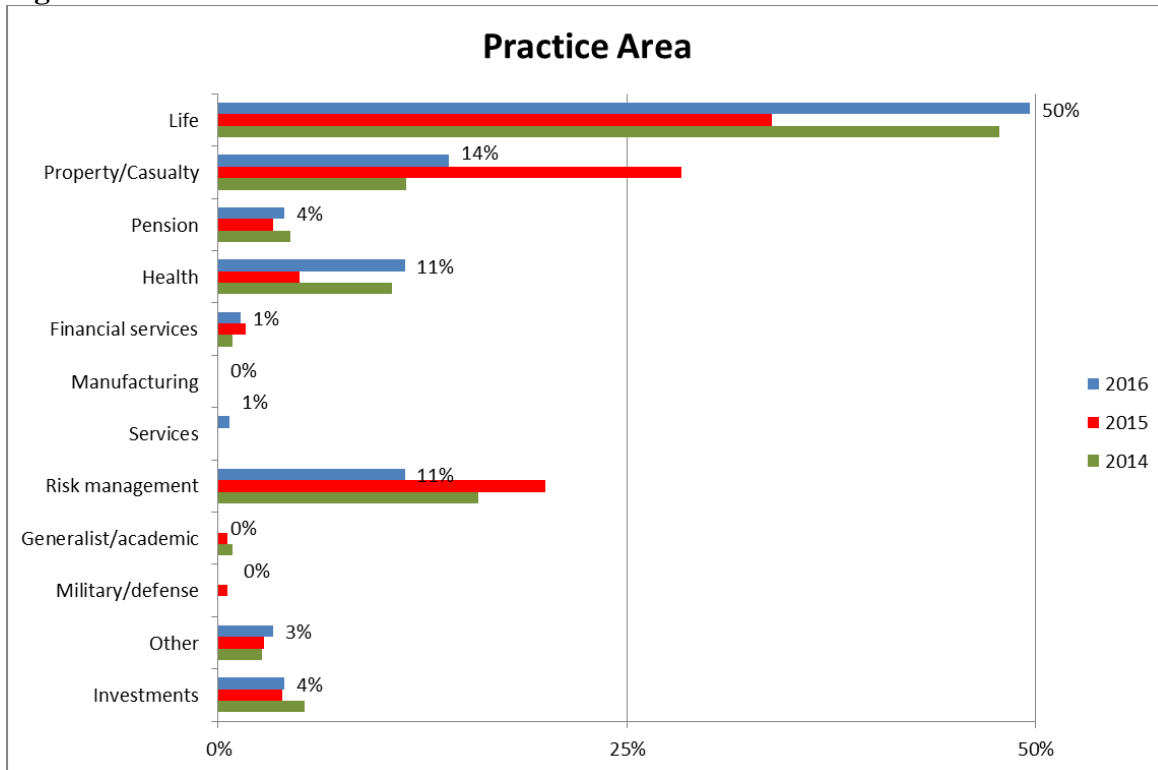
As shown in Figure 58, the survey continued to be dominated by North Americans (89 percent), with a significant minority coming from Asia. This year surveys were also completed by risk managers in the Middle East, Europe, Australia/Pacific and Caribbean/Bermuda regions.

**Figure 58**



As illustrated in Figure 59, the primary areas of practice this year varied from the previous survey with greater life insurance (50 percent) and fewer property/casualty insurance (14 percent), followed by health (11 percent), risk management (11 percent), pension (4 percent) and investment (4 percent) practitioners.

**Figure 59**



The survey was sent directly to all JRMS and INARM members, as well as some targeted social media groups on LinkedIn and Twitter. A final survey question asked for sources used to scan for emerging risks. While you are encouraged to read all of the responses for personal interest, many shared business newspapers/magazines, scientific magazines, reinsurer and consultant publications, rating agency reports, seminars, blogs, professional actuarial organizations (e.g., CAS, SOA, CIA) and the Risk Management Society (RIMS). Some of the most interesting comments reflected reading science fiction and daily briefings from The Hill. The syllabus used to certify the CERA designation was also seen as useful (note that each organization may have a separate syllabus with unique material).

## ***WEF Global Risks Report 2017***

Numerous emerging risk surveys are being published. One of the longest running is *The Global Risks Report 2017*, now in its twelfth edition. Its respondents are less financially focused than are those for this survey, with more analysis led by the authors. This makes it a nice companion piece to our survey, although the WEF survey is completed in the first quarter of one year and published in January of the following year, thus providing a different time stamp. It is a thought-provoking survey, providing potential solutions and scenarios, but does not trend results.

The current WEF paper provides several highlights that are useful for risk managers to consider. Here are a few:

- The WEF survey is presented in three sections; one reflecting the survey, one considering social and political challenges due to inequality and polarization, and one focused on emerging technologies.
- Risk interconnections are increasingly considered a key component of emerging risks. Leaders there included unemployment, social instability, migration, state collapse and climate change. In particular they point out concerns for a combination of water scarcity, climate change, extreme weather events and involuntary migration. They refer to it as a risk multiplier, especially when environmental and political frameworks are fragile.
- Polarization and inequality are enhanced by social media/internet communities that do not interact and echo their own ideas and the gig economy that lessens stable earnings and does not align with previous safety nets.
- Some companies are introducing policies designed by aging demographics around the concept of flexisecurity, with flexible labor markets and a safety net for employees.

The Fourth Industrial Revolution (4IR) focuses on infrastructure networks: transport, energy, digital communications, water, and solid waste. They drive systemic risks going forward, coming from risks such as cyber attacks, software glitches, solar storms or a rapidly changing environment. Severity and unintended consequences are hard to estimate but important to think about and consider mitigation plans.



## 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 expand distribution beyond North America and outside the insurance industry. Partnerships with U.K. and Australian actuarial risk managers, along with risk organizations, should be sought out. Here are specific suggestions made by respondents:

- Add a question in section 2 that asks what terms are being used—frequency/severity/likelihood/impact/velocity.
- *Can we make it so all of the 23 risks appear on one screen? Can we show a progress bar?*
- *Differentiate between short- and medium-term risks. (Ed. Note: it's not obvious how to do this without lengthening the survey.)*
- *Share examples where the second/third lines of defense identified a risk missed by the first line and resulted in better decision/risk.*
- *Change Earthquake to Seismic?*
- *Define migration as demographic shift.*
- *When asking about risks not included, reference the glossary—many of the suggestions are already included.*

From a reviewer:

- *Add a section where you compare experience for the year against the top risks from the prior year. Need to develop a KRI for each top risk to do that.*
- *Use Gini coefficient for concentration risk of risk combinations.*
- *Use Word tables rather than copying a picture from Excel.*

In each survey, the current 23 risks should be reviewed. The WEF list of emerging risks continues to evolve, and those in this survey should as well, while still maintaining consistency for trending.

- “Yes, rarely” should have been an option. Or the question should have been, “Is it possible to accurately anticipate/predict a crisis and appropriately plan for its impacts?” in which case the answer would definitely be “No.” On the other-hand, the question could have been, “Is it possible to anticipate/predict a crisis and adequately plan for its impacts?” in which case I keep my “Yes, rarely” answer.
- In Section 5 ask for examples of risk avoidance.
- Section 5 Question 5, ask for new projects split between external requests and internal requests.
- Section 5 Question 7 split into multiple questions.
- Add reference to antibiotic resistance to infectious disease risk.

- When comparing across three or four questions, back out the “Other” category.
- Review Section 1 Question 9 for medical costs and medical advances, tying in mortality and morbidity.
- Risks to consider: race inequality, antibiotic resistance, low interest rates.
- Add question – How has your ERM process changed based on events in the past year? And how has it evolved?
- Consider adding graph – current risk by individual risk.

## Appendix I—Glossary of Risks

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

### **Economic Risks**

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

### **Environmental Risks**

- 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.)
- Loss of freshwater services—Water shortages impact agriculture, businesses and human lives.
- Natural catastrophe: tropical storms—A hurricane or typhoon leads to disruption, catastrophic economic losses, and/or high human loss of life.
- Natural catastrophe: earthquakes—Strong earthquake(s)/volcanic eruptions lead to disruption, catastrophic economic losses, and/or high human loss of life.
- Natural catastrophe: severe weather (except tropical storms)—Meteorological phenomena lead to disruption, catastrophic economic losses, and/or high human loss of life. Includes inland flooding, tornados, thunderstorms, drought, wildfires, high winds, snowstorms and dust storms.

### **Geopolitical Risks**

- Terrorism—Attacks lead to disruption, catastrophic economic losses, and/or high human loss of life.
- Weapons of mass destruction—nuclear, biological, radiological and chemical technologies are held by unstable groups, leading to disruption, catastrophic economic losses, and/or high human loss of life.
- Interstate and civil wars—Major interstate or civil wars erupt.

- Failed and failing states—The trend of a widening gap between order and disorder.
- Transnational crime and corruption—Corruption continues to be endemic, and organized crime successfully penetrates the global economy.
- Retrenchment from globalization—Rising concerns about cheap imports and immigration sharpen protectionism in developed countries. Countries become more nationalistic and state-oriented.
- 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.
- Chronic diseases—Obesity, diabetes and cardiovascular diseases become widespread.
- Demographic shift—Evolving populations (e.g., age, size, migration trends) drive economic stagnation and government interventions.
- Liability regimes/regulatory framework—Costs increase faster than GDP, with the spread of litigiousness and speed of regulatory revisions.

### ***Technological Risks***

- 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.
- Technology—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.

### ***Evolution of Risks***

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

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

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

2009—No changes

2010—Some definitional changes

- Changed *Oil price shock/energy supply interruptions* to *Oil price shock*
- Changed *US current account deficit/fall in US dollar* to *Fall in value of US\$*

- Changed *Blow up in asset prices/excessive indebtedness* to *Blow up in asset prices*
- Changed *Middle East instability—The Israel–Palestine conflict and Iraqi civil war continue* to *Regional instability* (A variety of hot spots are prevalent around the world. These include the Middle East and the Korean Peninsula.)
- Changed *Infectious diseases in the developing world* to *Infectious diseases*
- Changed *Chronic disease in the developed world* to *Chronic disease*
- Changed *Emergence of risks associated with nanotechnology* to *Nanotechnology*

2011—More substantive changes but attempt made to maintain trends and simplify

- Moved *Fiscal crises caused by demographic shift* from Economic to Societal category and renamed *Demographic shift*. Updated trend data to make consistent going forward.
- Added *Financial volatility—price instability of core products such as commodities, energy or currency* to Economic category
- Combined *Pandemic* and *Infectious diseases* to make *Pandemics/infectious disease* (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 updated the definitions of eight risks, mainly to adopt a consistent method of describing the negative results of a risk. Definition changes were meant to add clarity. Specifically, *Demographic shift* added migration as a specific factor.

- Changed definition of *Natural catastrophe: tropical storms* from “A hurricane or typhoon passes over heavily populated areas, leading to catastrophic economic losses and/or high human death tolls,” to “A hurricane or typhoon leads to disruption, catastrophic economic losses, and/or high human loss of life.”
- Changed *Natural catastrophe: earthquakes* from “Strong earthquake(s) occurs in heavily populated areas,” to “Strong earthquake(s)/volcanic eruptions lead to disruption, catastrophic economic losses and/or high human loss of life.”
- Changed *Natural catastrophe: severe weather (except tropical storms)* from “Meteorological phenomena with the potential to cause significant economic losses, fatalities and disruption. Includes inland flooding from all causes, tornados, thunderstorms, drought, wildfires, high winds, snowstorms and dust storms,” to “Meteorological phenomena lead to disruption, catastrophic economic losses, and/or high human loss of life. Includes inland flooding, tornados, thunderstorms, drought, wildfires, high winds, snowstorms and dust storms.”
- Changed *Terrorism* from “Attacks disrupt economic activity, causing major human and economic losses,” to “Attacks lead to disruption, catastrophic economic losses, and/or high human loss of life.”
- Changed both name and definition—from *Proliferation of weapons of mass destruction (WMD)*—“Treaty on the Nonproliferation of Nuclear Weapons is no

- longer effective, leading to the spread of nuclear technologies,” to *Weapons of mass destruction*—“nuclear, biological, radiological and chemical technologies are held by unstable groups, leading to disruption, catastrophic economic losses, and/or high human loss of life.”
- Changed *Demographic shift* from “Aging populations in developed economies drive economic stagnation by forcing governments to raise taxes or borrow,” to “Evolving populations (e.g., age, size, migration trends) drive economic stagnation and government interventions.”
  - Changed both name and definition from *Cybersecurity/interconnectedness of infrastructure*—“A major disruption of the availability, reliability and resilience of a critical information infrastructure caused by cybercrime, terrorist attack or technical failure. Results are felt in the major infrastructure: power distribution, water supply, transportation, telecommunication, emergency services and finance,” to *Cyber/interconnectedness of infrastructure*—“A major disruption of the availability, reliability and resilience of critical information infrastructure caused by cyber risks, terrorist attack or technical failure. Results are felt in major infrastructure: power distribution, water supply, transportation, telecommunication, emergency services, and finance.” Previous surveys had noted that cybersecurity did not cover all cyber risks.
  - Changed *Technology* from “Health is impaired due to exposure to nanoparticles or unintended consequences of technology,” to “Includes drones, self-driving cars, additive manufacturing (3-D printing), the internet of things, exposure to nanoparticles, or other unintended consequences of technology that lead to disruption and/or catastrophic economic losses.”

## Appendix II—Survey Results 2016

This appendix includes the survey as well as the responses. There were 223 respondents. Not all respondents answered every question. The percentages given 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. Note that open-ended questions have been mildly edited, but original intent is unchanged.

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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. These risks often seem obvious after they occur but are not considered in advance. Many risk managers are trying to be better prepared by identifying potential emerging risks and prioritizing those that might have the greatest potential impact on society. 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 on the Section webpage at [www.soa.org](http://www.soa.org). A summary article is also expected to be published in an upcoming JRMS newsletter.

Keep in mind that you cannot press the “back” button in your browser to review prior answers. Please use the “Previous” button at the bottom of each page to navigate back to already answered questions. If you want to save your responses for later, it is suggested to print each page before pressing the “Continue” button.

Please respond no later than December 14, 2016.

For a glossary of terms, please click here (see Appendix I) and then click on the link in the Related Links box on the right of the page.

Thanks for participating!

Note: Occasionally a comment is **highlighted** to reflect those the researcher found particularly thought provoking. Comments have been very lightly edited in Appendix II, and are identified using *italics*. When a respondent leaves multiple comments for the same question they are separated by //.



## Macroeconomic Trends

		S&P 500	Oil (per barrel)	USD/Euro
	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

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 (according to Yahoo Finance), the price of a barrel of oil was \$113.70 (Energy Information Administration at <http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D>) and one euro cost \$1.56 ([http://www.federalreserve.gov/releases/h10/Hist/dat00\\_eu.htm](http://www.federalreserve.gov/releases/h10/Hist/dat00_eu.htm)). Oil was priced relatively high, the stock markets were at record levels and the dollar had trended down. The table had been set for the financial crisis that was soon to follow.

### 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 impact currently and also over the next few years.

The original list of risks was developed by the World Economic Forum (WEF) for their inaugural Global Risks Survey. There is a balance required between keeping the list current and being able to show trends. The WEF has aggressively updated its list of risks, even with a stated time horizon of 10 years, and the current report includes 30 risks. The Emerging Risks Survey has tried to maintain stability for trending purposes, although the list has evolved over time.

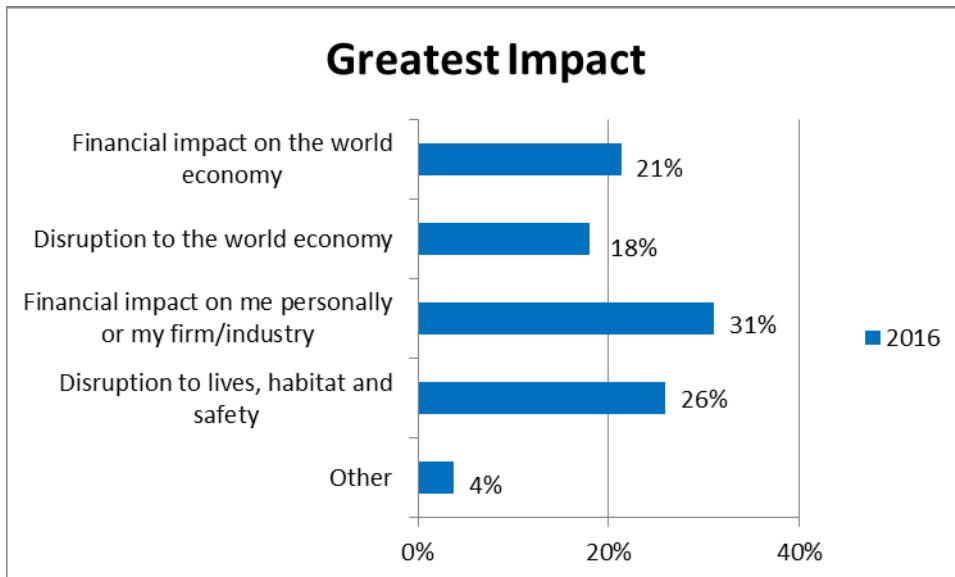
**Question 1.** Greatest impact related to risk can have various meanings. How do you define it?

## 216 total responses

- 46 responses 21% Financial impact on the world economy
- 39 responses 18% Disruption to the world economy
- 67 responses 31% Financial impact on me personally or my firm/industry
- 56 responses 26% Disruption to lives, habitat and safety
- 14 responses 4% Other

(Ed. Note: text responses incorporate minimal editing for readability)

- *Disruption to the world economy*
- *Disruption to lives, habitat safety and/or world economy*
- *All of the above—look at it from a micro-perspective (self-centered financial) and macro (a global—good neighbor—help brother/sister)*
- *My response relates to the public, rather than the individual or his close environment; that excludes #3 above. Risk is closely related to disruption, rather than just impact—that excludes #1. So my response is a combination of #2 & #4; Disruption to societies, lives, habitat, safety and economy*
- *Political Change*
- *Disruption to national infrastructure*
- *Uncovering unknown unknowns*



**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. [Editor's note: Detailed definitions of these risks can be found in Appendix I, along with how the definitions have evolved over time.]\*

**217 total responses**

**Economic—58 responses 27% (33%/39%)**

- 4 responses (2%/4%/4%)<sup>†</sup> *Energy price shock*
- 1 response (0%/2%/1%) *Currency shock*
- 4 responses (2%/4%/4%) *Chinese economic hard landing*
- 22 responses (10%/10%/17%) 3 Asset price collapse
- 27 responses (12%/12%/14%) 1 Financial volatility

**Environmental—28 responses 13% (15%/10%)**

- 21 responses (10%/8%/6%) 4 Climate change (includes space weather)
- 3 responses (1%/2%/1%) Loss of freshwater services
- 1 response (0%/1%/1%) Natural catastrophe: tropical storms
- 0 responses (0%/1%/1%) Natural catastrophe: earthquakes
- 3 responses (1%/3%/2%) *Natural catastrophe: severe weather*

**Geopolitical—64 responses 29% (19%/24%)**

- 13 responses (6%/6%/8%) Terrorism
- **9 responses (4%/2%/1%)** **Weapons of mass destruction**
- 9 responses (4%/4%/2%) Interstate and civil wars
- **11 responses (5%/2%/5%)** **Failed and failing states**
- 3 responses (1%/0%/0%) Transnational crime and corruption
- **18 responses (8%/1%/1%)** 5 **Retrenchment from globalization**
- 1 response (0%/4%/7%) *Regional instability*

**Societal—20 responses 9% (12%/15%)**

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

**Technological—32 responses 15% (18%/6%)**

- 23 responses (11%/15%/6%) 2 Cyber/interconnectedness of infrastructure

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\* When previous results are above 2 percent, bold corresponds to a 5 percent increase or doubling, italics indicate a 5 percent decrease or halving. The leading responses are identified in a column prior to listing the risks.

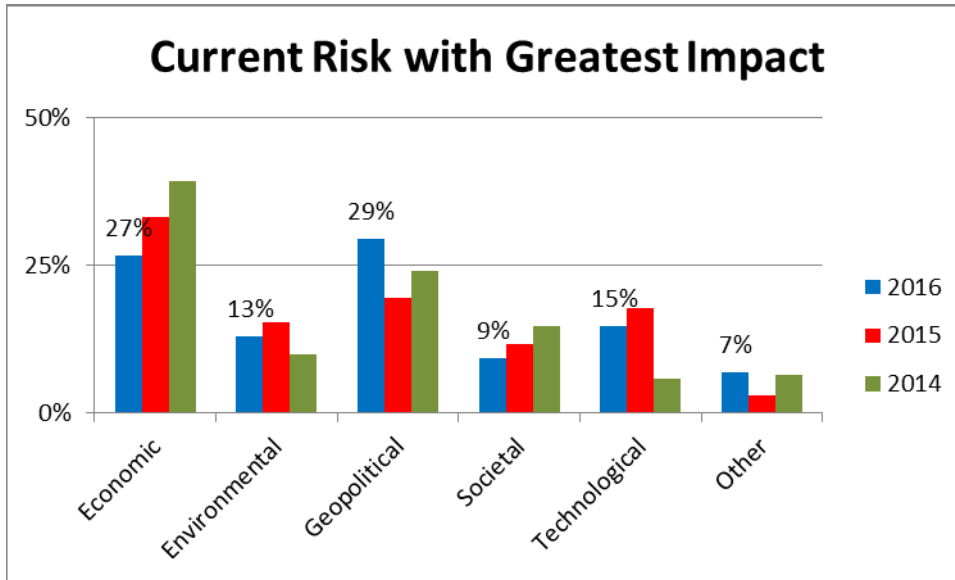
† In Appendix II results are often provided for past surveys as well as the current one. They consistently show the current survey first, then prior surveys are listed with most recent first.

• 9 responses (4%/3%/0%)

Technology

**Other—15 responses 7% (3%/6%)**

- *Other*
- *Donald Trump*
- *Central bank policy*
- *Deterioration and regression of race relations*
- *My problem is the meaning of “current”—it can be today, a year, the near future (say 5 years) or even mid-length (10 years). Each has a different response. In the 5–10 years I tend to consider all major sources of instability that can lead to disaster (including terror and stupid political behaviour by various countries and leaders). Natural (random occurring) events are always present risks but not current, so that excludes things like natural catastrophes and pandemics. So there in 5–10 years I include weapons of mass destruction, climate change, etc. Financial and economics are always there—but they are not the most critical, though their crises are very disruptive. Personally, I believe the greatest risk is technology (including IT, AI, robotics, big data, etc.) and its ability to eliminate jobs and completely destroy past cultures and beliefs and expectations, and make many if not most people effectively “useless” and a load on national economics—this is an existing danger that is ever increasing.*
- *Corruption of political leader*
- *EURO-breakup with consequences on states and banks*
- *Trump*
- *Impact of low interest rates on pension solvency and retirement adequacy*
- *Medical & scientific trends*
- *Trump presidency*
- *Nontraditional competitors & irrelevance of our industry*
- *Geopolitical*
- *Low interest rates*



The categories of risks chosen as those having the current greatest impact were

- Economic 27%/33%/39% in 2016/2015/2014
- Environmental 13%/15%/10%
- Geopolitical 29%/19%/24%
- Societal 9%/12%/15%
- Technological 15%/18%/6%
- Other 7%/3%/6%

### **Section 1: Emerging Risks**

**Question 1.** Please choose up to five (5) emerging risks that you feel will have the greatest impact over the next few years.

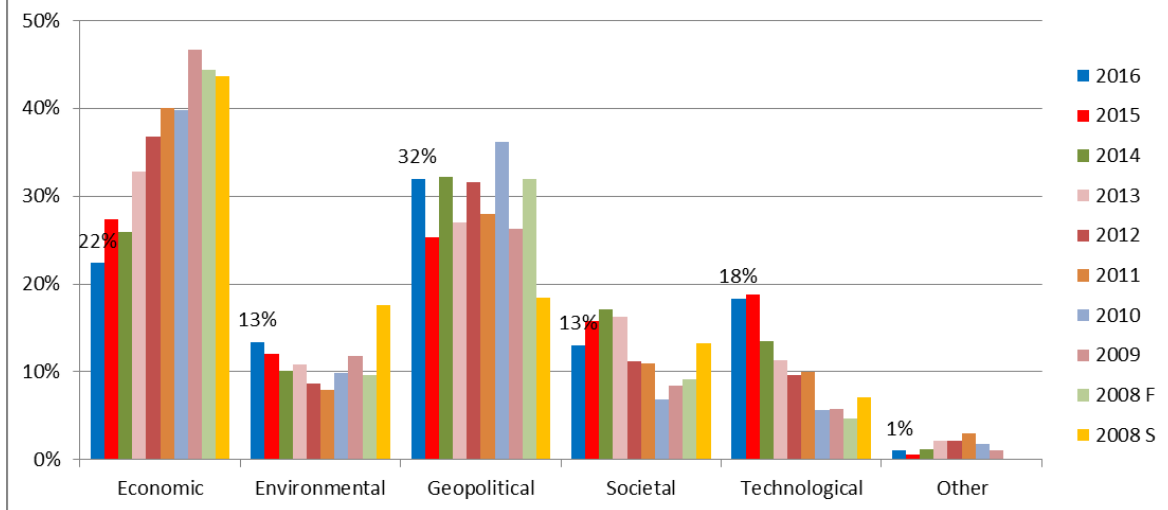
**979 total responses from 207 surveys—average 4.73 (4.72 in 2015)**

**Divisor in percentages for major categories is 979—for individual risks it is 207.**

Number of responses (up to 5)

- 1–3 surveys 1%
- 2–2 survey 1%
- 3–5 surveys 2%
- 4–28 surveys 14%
- 5–169 surveys 82%

## Emerging Risks by Category (Up to Five Risks Chosen per Survey)



### **Economic—219 responses 22% (27%/26%/33%/37%/40%/40%/47%/44%/44% in 2016/2015/2014/2013/2012/2011/2010/2009/F2008/S2008)**

- 21 responses (10%/14%/13%/7%/31%/32%/40%/45%) Energy price shock
- 21 responses (10%/14%/7%/27%/26%/25%/49%/66%) Currency shock
- 35 responses (17%/25%/27%/28%/31%/32%/41%/33%) Chinese economic hard landing
- 53 responses (26%/31%/31%/30%/24%/22%/31%/49%) Asset price collapse
- 89 responses (43%/45%/44%/59%/62%/68%) 2 Financial volatility

### **Environmental—131 responses 13% (12%/10%/11%/9%/8%/10%/12%/10%/18%)**

- 58 responses (28%/26%/19%/16%/20%/14%/25%/27%) Climate change (includes space weather)
- 19 responses (9%/8%/8%/9%/11%/6%/9%/10%) Loss of freshwater services
- 17 responses (8%/6%/5%/8%/6%/5%/4%/8%) Natural catastrophe: tropical storms
- 18 responses (9%/7%/5%/6%/2%/6%/5%/7%) Natural catastrophe: earthquakes
- 19 responses (9%/10%/11%/11%/1%/4%/2%/5%) Natural catastrophe: severe weather

### **Geopolitical—313 responses 32% (25%/32%/27%/32%/28%/36%/26%/32%/18%)**

- 81 responses (39%/37%/41%/27%/28%/20%/43%/30%) 3 Terrorism
- 18 responses (9%/8%/9%/5%/14%/9%/18%/14%) Weapons of mass destruction

- 34 responses (16%/19%/19%/13%/14%/10%/10%/9%) Interstate and civil wars
- 43 responses (21%/18%/28%/29%/33%/42%/38%/18%) Failed and failing states
- **21 responses(10%/5%/10%/8%/5%/3%/12%/7%)** **Transnational crime and corruption**
- **63 responses(30%/6%/8%/13%/13%/11%/25%/18%)** **5 Retrenchment from globalization**
- 53 responses (26%/26%/37%/29%/42%/32%/25%/28%) Regional instability

- Societal—127 responses 13% (16%/17%/16%/11%/11%/7%/8%/9%/13%)**
- 33 responses (16%/17%/30%/19%/12%/13%/22%/30%) Pandemics/infectious diseases
  - 13 responses (6%/8%/5%/3%/3%/2%/4%/4%) Chronic diseases
  - 50 responses (24%/26%/23%/30%/30%/30%/26%/27%) Demographic shift
  - *31 responses (15%/24%/22%/23%/8%/7%/6%/6%)* *Liability regimes/regulatory framework*

- Technological—179 responses 18% (19%/14%/11%/10%/10%/6%/6%/5%/7%)**
- *109 responses (53%/65%/58%/47%/40%/38%/23%/21%)* *1 Cyber/interconnectedness of infrastructure*
  - **70 responses(34%/24%/5%/5%/6%/5%/4%/7%)** **4 Technology**

**Other—10 responses 1% (1%/1%/2%/2%/3%/2%/1%/4%/4%)**

- *Donald Trump*
- *Central bank policy*
- *Deterioration and regression of race relations*
- *Negative interest rates*
- *Political Environment*
- *Trump*
- *Medical & scientific trends*
- *Trump presidency*
- *Transition to a low carbon economy*
- *Nontraditional competitors*

Another way to review this data is as a percentage of the total responses. For example, *Climate change* had 58 responses in this survey. In the previous analysis just shared,  $58/203 = 29\%$ . In the next section we will look at  $58/979 = 6\%$  and compare the results with the average from previous 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.

**Economic (36% average—22%/27%/26%/33%/37%/40%/40%/47%/43%/42% in November 2016, November 2015, October 2014, October 2013, October 2012, October 2011, November 2010, December 2009, November 2008, April 2008)**

- 6%—2%/3%/3%/2%/6%/7%/9%/10%/8%/13% *Energy price shock*
- 7%—2%/3%/1%/6%/5%/6%/10%/14%/10%/9% *Currency shock*
- 7%—4%/5%/6%/6%/7%/7%/9%/7%/6%/9% *Chinese economic hard landing*
- 7%—5%/6%/7%/7%/5%/5%/6%/10%/14%/5% *Asset price collapse*
- 12%—9%/9%/9%/13%/13%/15% *Financial volatility*

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

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

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

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

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

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

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

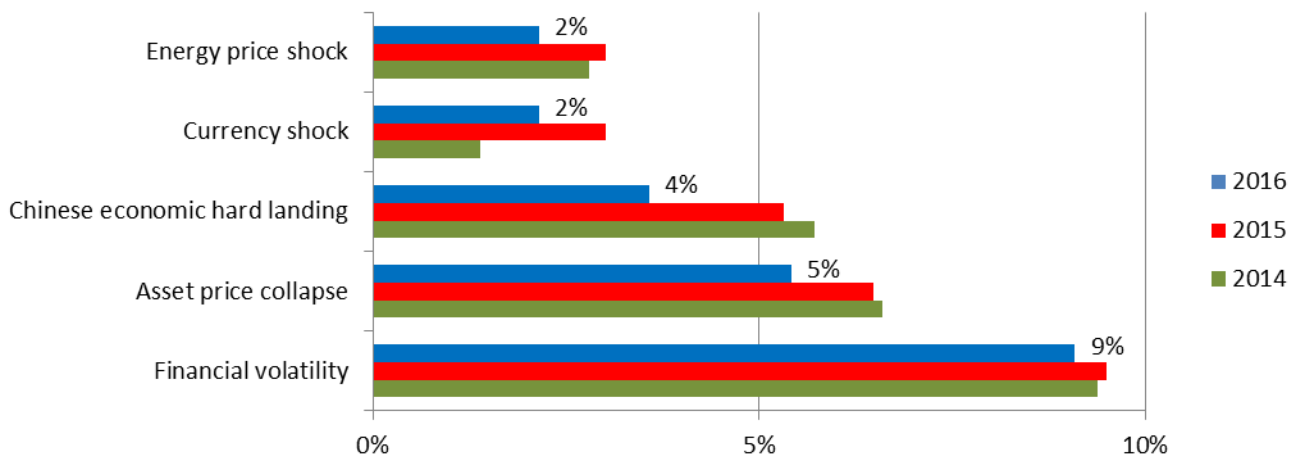
- 8%—11%/14%/12%/10%/8%/8%/5%/4%/3%/5% **Cyber/interconnectedness of infrastructure**
- 2%—7%/5%/1%/1%/1%/1%/1%/1%/1%/2% **Technology\***

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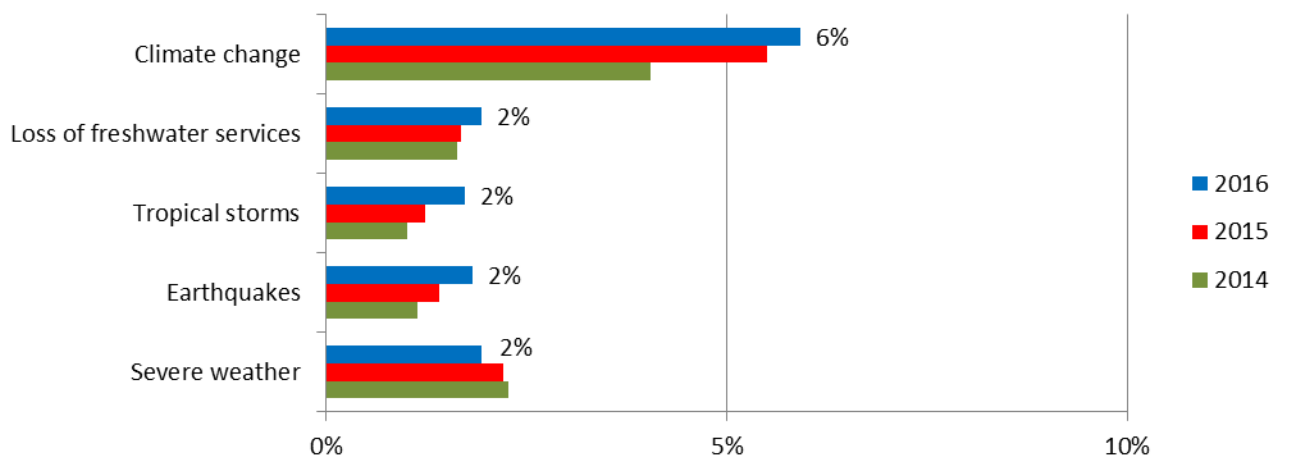
\* Note that charts show actual results, while labels are rounded to the near percentage point. In some instances the bar in the graph has length but the label says 0%.



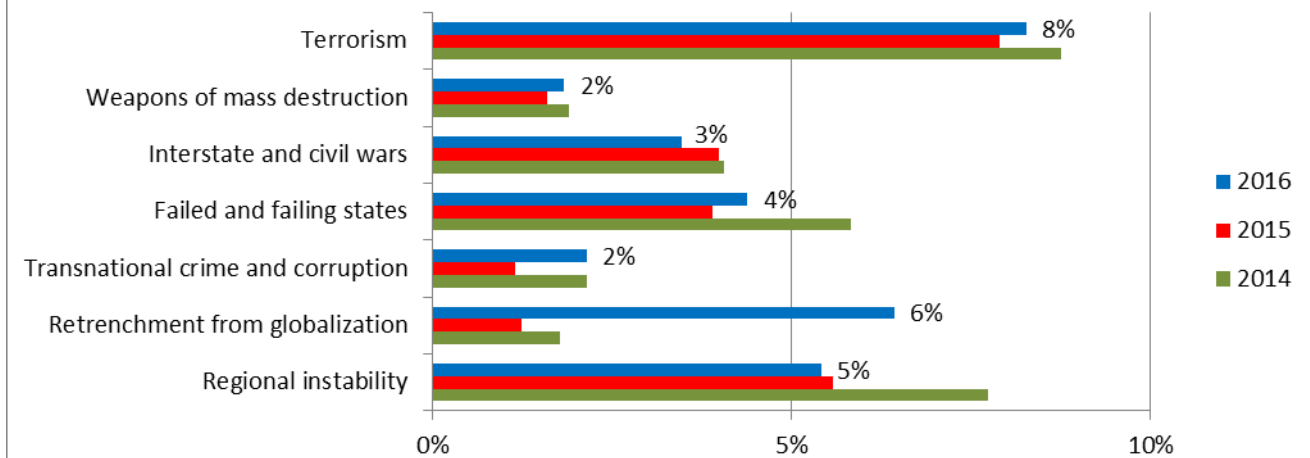
## Emerging Risk Trends—Economic (% of total)



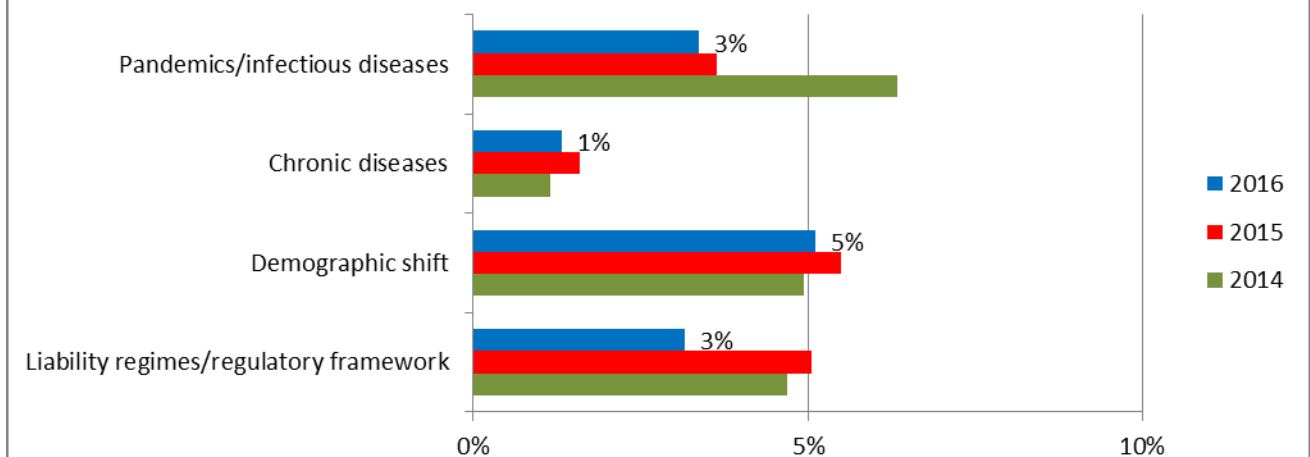
## Emerging Risk Trends—Environmental (% of total)



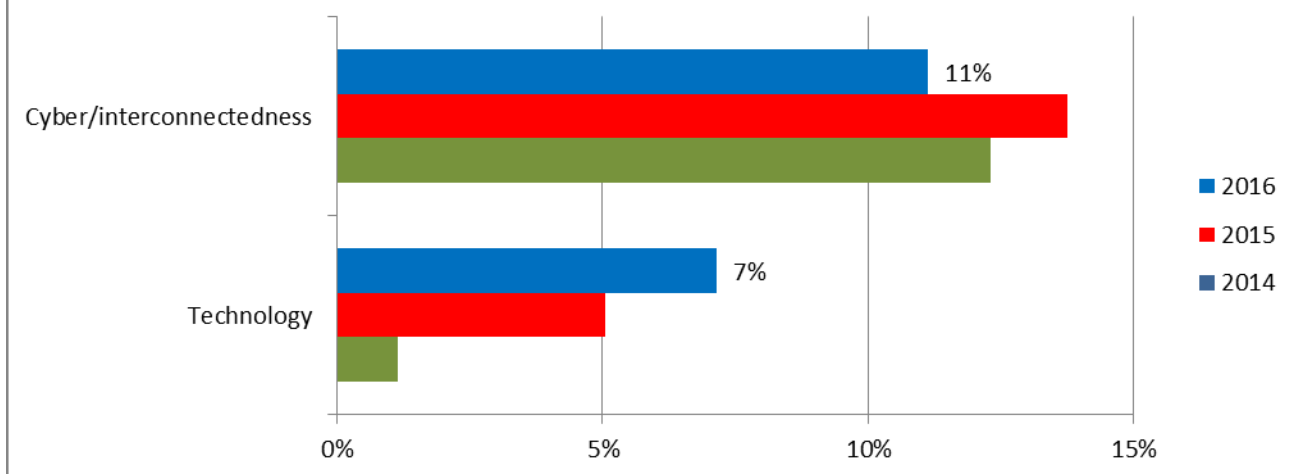
## Emerging Risk Trends—Geopolitical (% of total)



## Emerging Risk Trends—Societal (% of total)

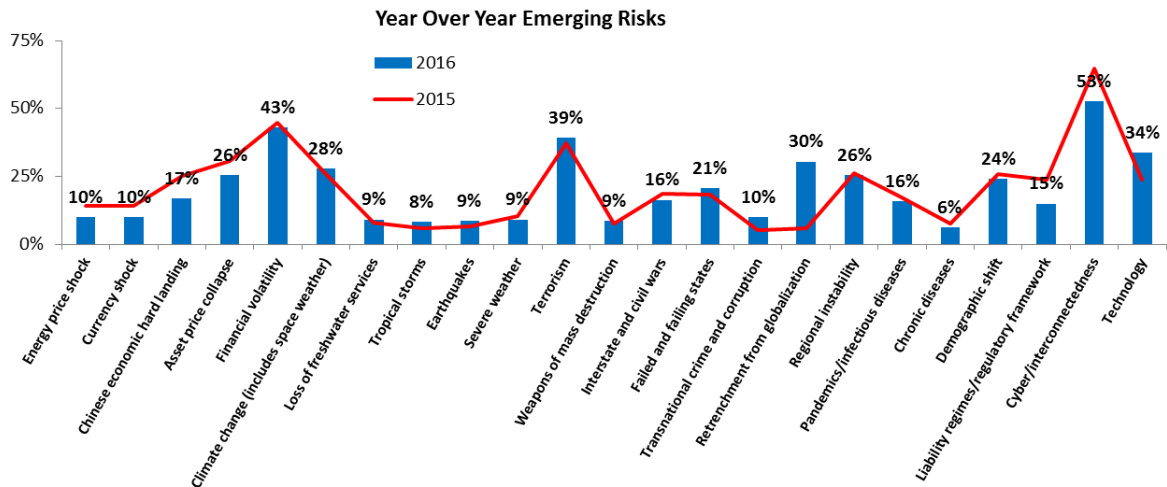
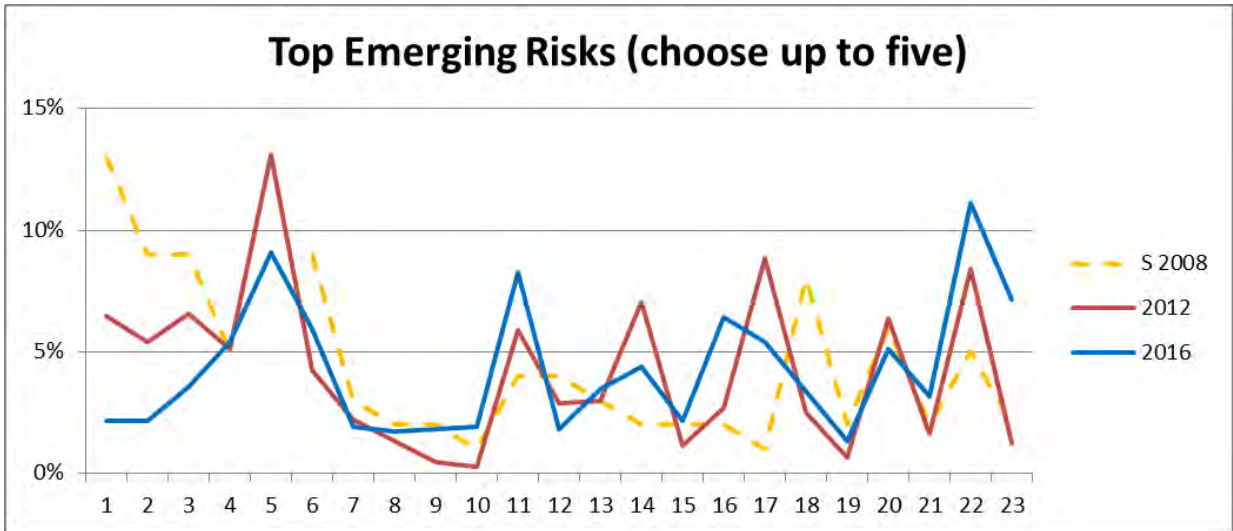


## Emerging Risk Trends—Technological (% of total)



Five Top Emerging Risks as percentage of total (not by number of surveys)

	2016	2015	2014	2013	2012	2011	2010	2009	F 2008	S 2008	Average
1 Energy price shock	2%	3%	3%	2%	6%	7%	9%	10%	8%	13%	6%
2 Currency shock	2%	3%	1%	6%	5%	6%	10%	14%	10%	9%	7%
3 Chinese economic hard landing	4%	5%	6%	6%	7%	7%	9%	7%	6%	9%	7%
4 Asset price collapse	5%	6%	7%	7%	5%	5%	6%	10%	14%	5%	7%
5 Financial volatility	9%	9%	9%	13%	13%	15%					12%
6 Climate change	6%	6%	4%	4%	4%	3%	5%	6%	5%	9%	5%
7 Loss of freshwater services	2%	2%	2%	2%	2%	1%	2%	2%	2%	3%	2%
8 Tropical storms	2%	1%	1%	2%	1%	1%	1%	2%	1%	2%	1%
9 Earthquakes	2%	1%	1%	1%	0%	1%	1%	1%	1%	2%	1%
10 Severe weather	2%	2%	2%	2%	0%	1%	0%	1%	0%	1%	1%
11 Terrorism	8%	8%	9%	6%	6%	4%	9%	6%	6%	4%	7%
12 Proliferation of WMD	2%	2%	2%	1%	3%	2%	4%	3%	3%	4%	3%
13 Interstate and civil wars	3%	4%	4%	3%	3%	2%	2%	2%	2%	3%	3%
14 Failed and failing states	4%	4%	6%	6%	7%	9%	8%	4%	6%	2%	6%
15 Transnational crime and corruption	2%	1%	2%	2%	1%	1%	3%	2%	2%	2%	2%
16 Retrenchment from globalization	6%	1%	2%	3%	3%	2%	5%	4%	5%	2%	3%
17 Regional instability	5%	6%	8%	6%	9%	7%	5%	6%	7%	1%	6%
18 Pandemics/infectious diseases	3%	4%	6%	4%	3%	3%	5%	6%	7%	8%	5%
19 Chronic diseases	1%	2%	1%	1%	1%	2%	1%	1%	1%	2%	1%
20 Demographic shift	5%	6%	5%	6%	6%	7%	6%	6%	5%	6%	6%
21 Liability regimes/regulatory framework	3%	5%	5%	5%	2%	2%	1%	1%	1%	2%	3%
22 Cyber/interconnectedness	11%	14%	12%	10%	8%	8%	5%	4%	3%	5%	8%
23 Technology	7%	5%	1%	1%	1%	1%	1%	1%	1%	2%	2%
24 Other	1%	1%	1%	2%	2%	3%	2%	1%	4%	4%	2%



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

**206 total responses**

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

- 2 responses (1%/3%/2%/1%/5%) Energy price shock
- 1 response (0%/2%/1%/5%/7%) Currency shock
- 4 responses (2%/7%/5%/6%/5%) Chinese economic hard landing
- **22 responses (11%/5%/10%/8%/9%) 3 Asset price collapse**
- 27 responses (13%/13%/14%/24%/28%) 2 Financial volatility

**Environmental—17 responses (8%/8%/5%/6%/6%/4%/7%/12%/4%)**

- 12 responses (6%/6%/3%/4%/5%) Climate change (includes space weather)
- 0 responses (0%/0%/0%/0%/0%) Loss of freshwater services
- 1 response (0%/0%/1%/0%/1%) Natural catastrophe: tropical storms
- 1 response (0%/0%/0%/0%/0%) Natural catastrophe: earthquakes
- 3 responses (1%/1%/1%/1%/0%) Natural catastrophe: severe weather

**Geopolitical—60 responses (29%/22%/31%/17%/23%/22%/28%/14%/18%)**

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

**Societal—17 responses (8%/10%/16%/13%/6%/5%/4%/2%/2%)**

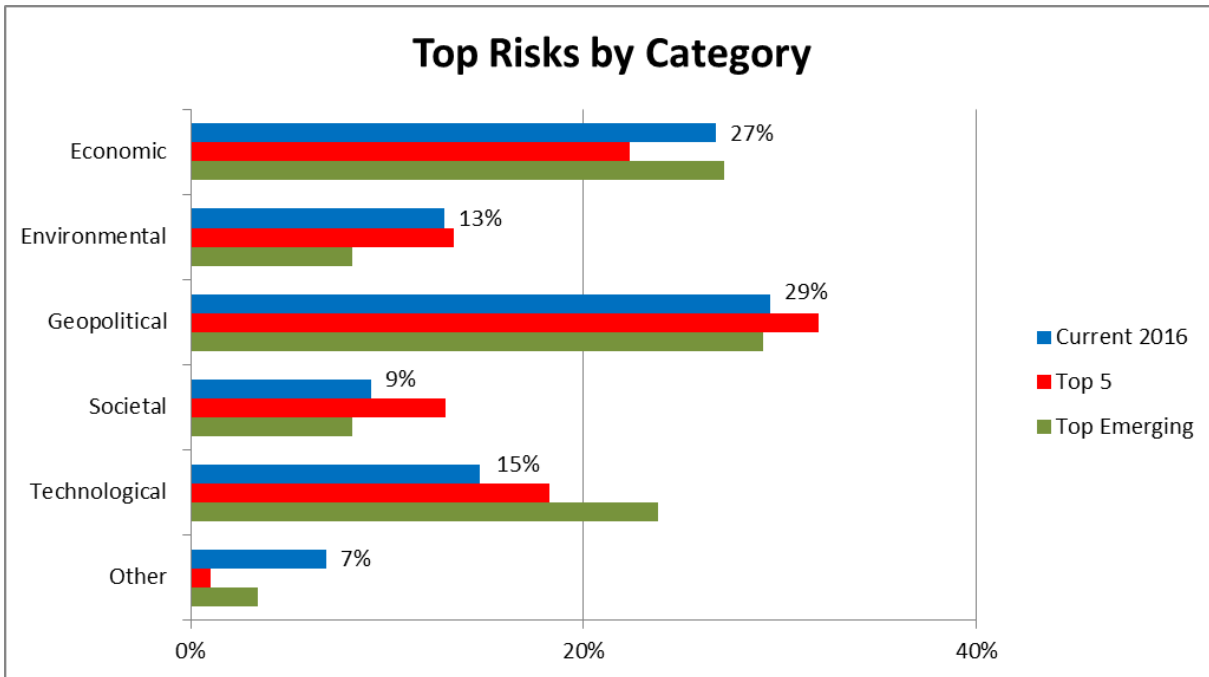
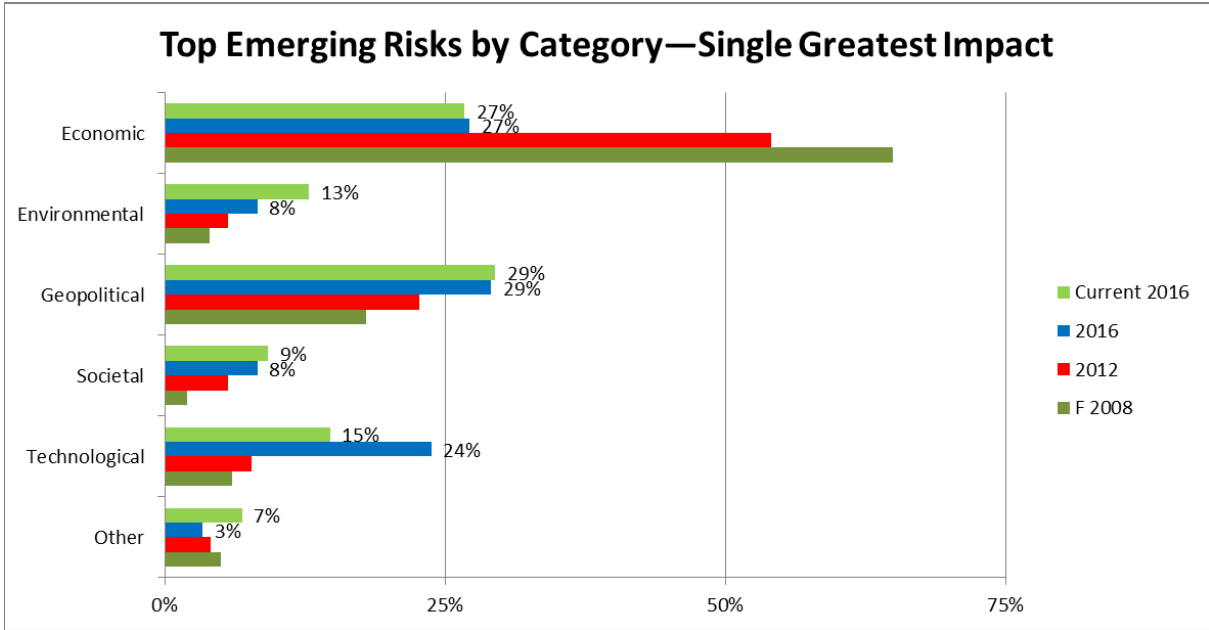
- 4 responses (2%/1%/3%/1%/1%) Pandemics/infectious diseases
- 1 response (0%/0%/0%/0%/1%) Chronic diseases
- 6 responses (3%/1%/4%/3%/2%) **Demographic shift**
- 6 responses (3%/7%/9%/10%/2%) *Liability regimes/regulatory framework*

**Technological—49 responses (24%/28%/15%/15%/8%/8%/9%/6%/6%)**

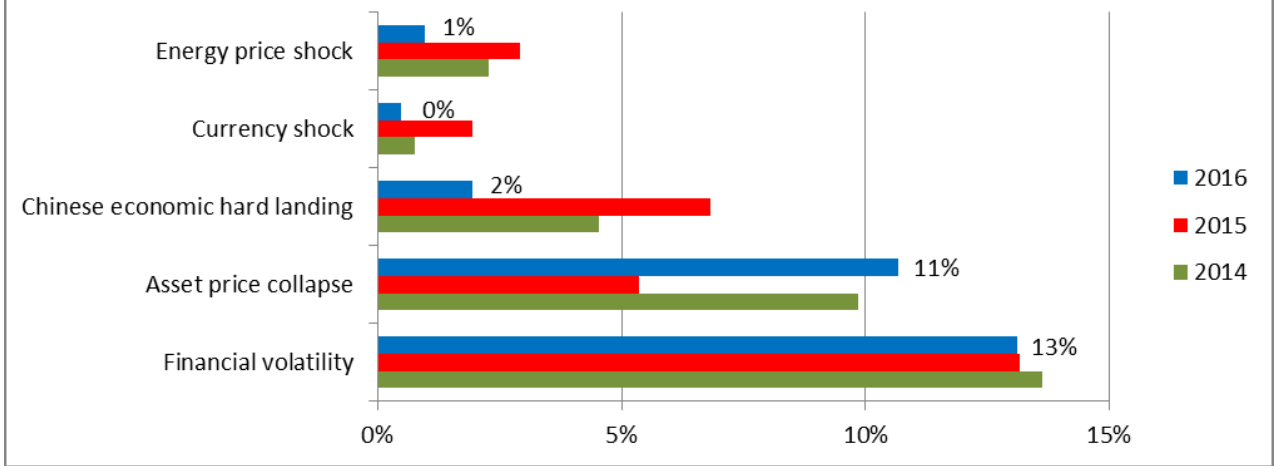
- 34 responses (17%/23%/14%/14%/7%) 1 *Cyber/interconnectedness of infrastructure*
- 15 response (7%/5%/1%/1%/1%) 5 *Technology*

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

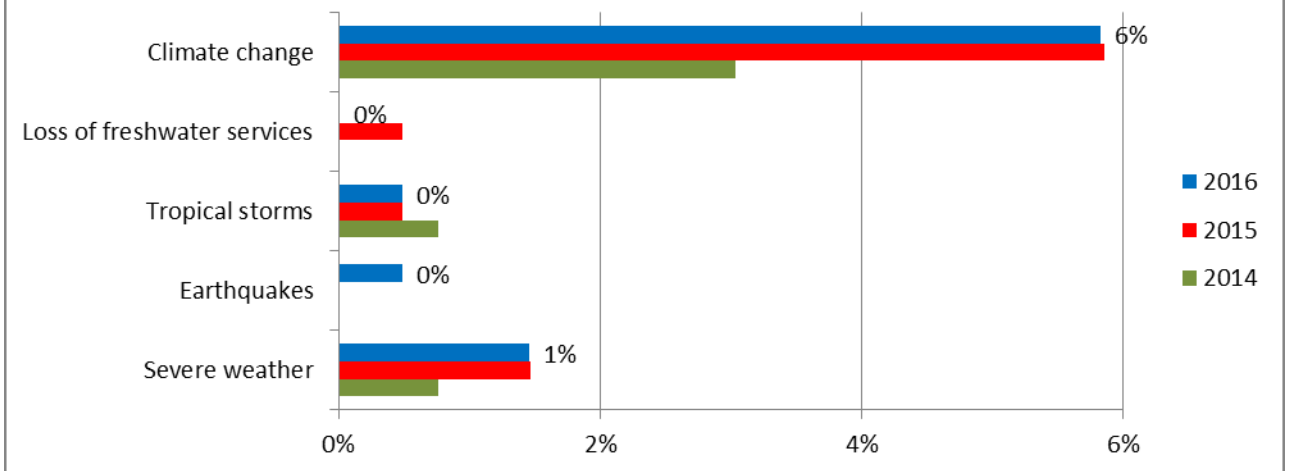
- *Donald Trump*
- *Central bank policy*
- *Deterioration and regression of race relations*
- *Negative interest rates*
- *Trump*
- *Trump presidency*
- *Nontraditional competitors*



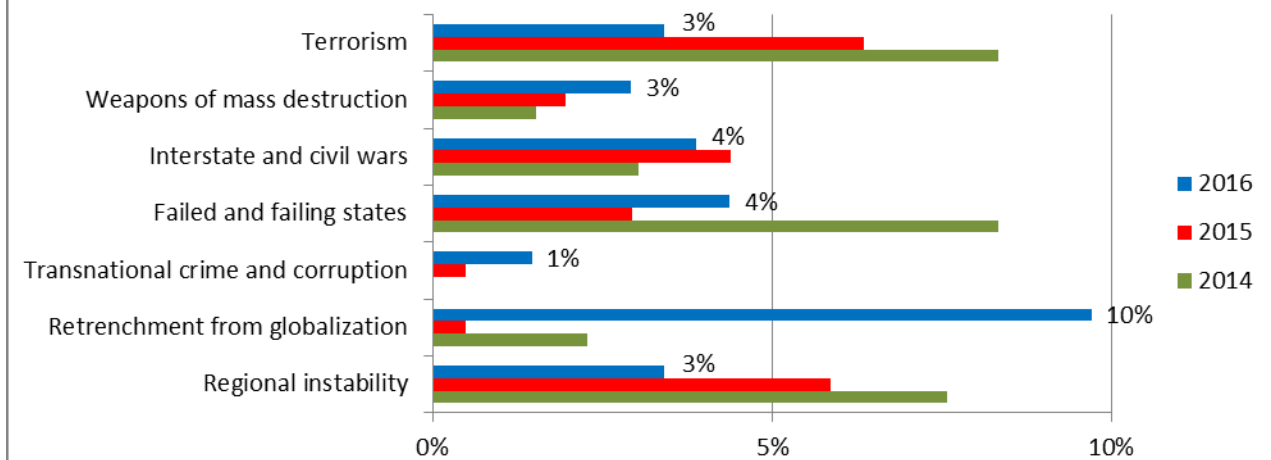
### Top Emerging Risks—Economic (% of total)



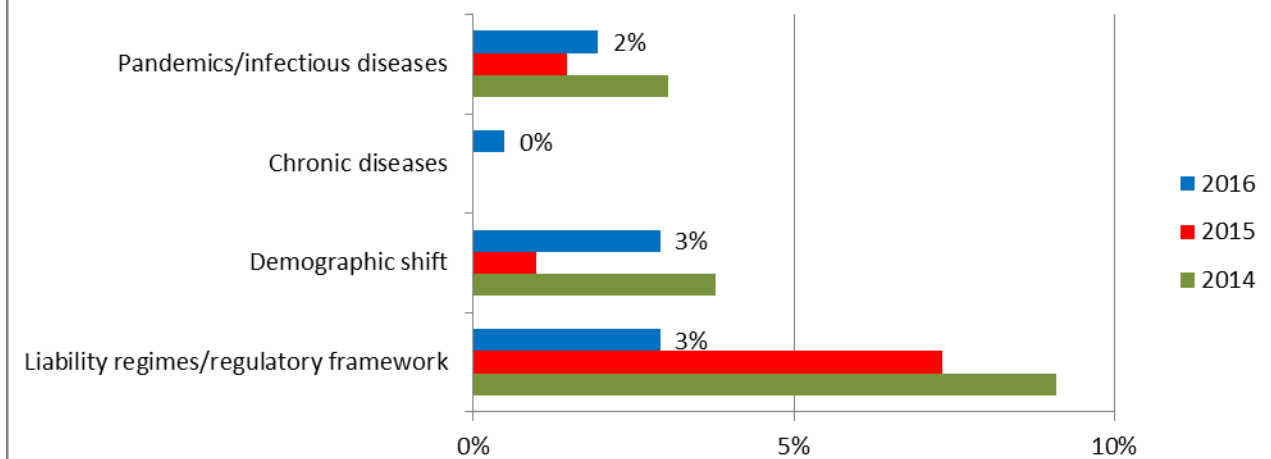
### Top Emerging Risks—Environmental (% of total)



## Top Emerging Risks—Geopolitical (% of total)

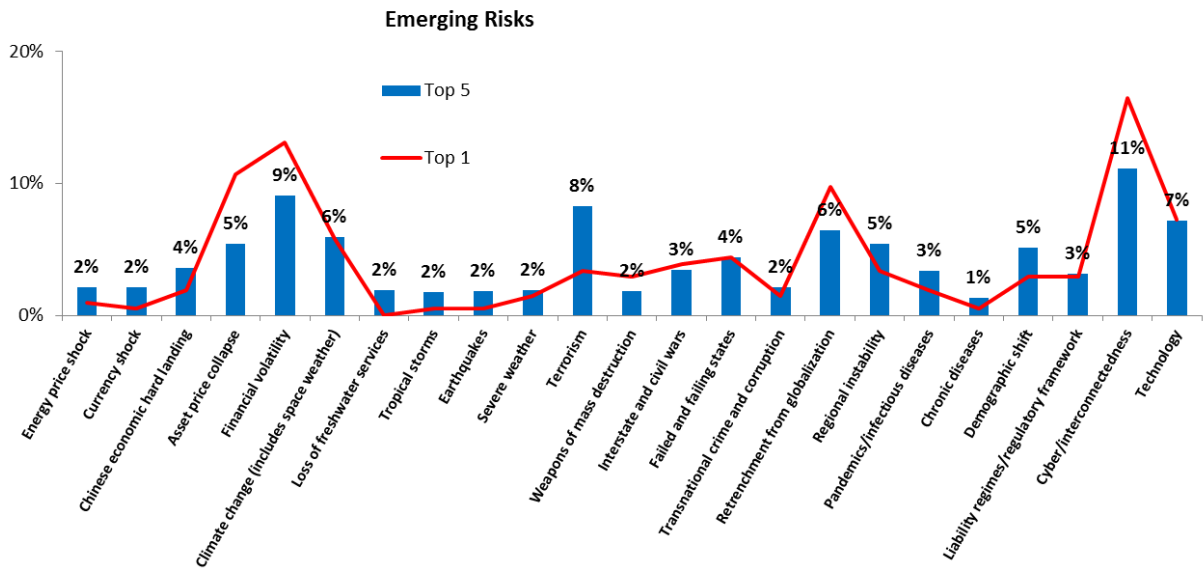
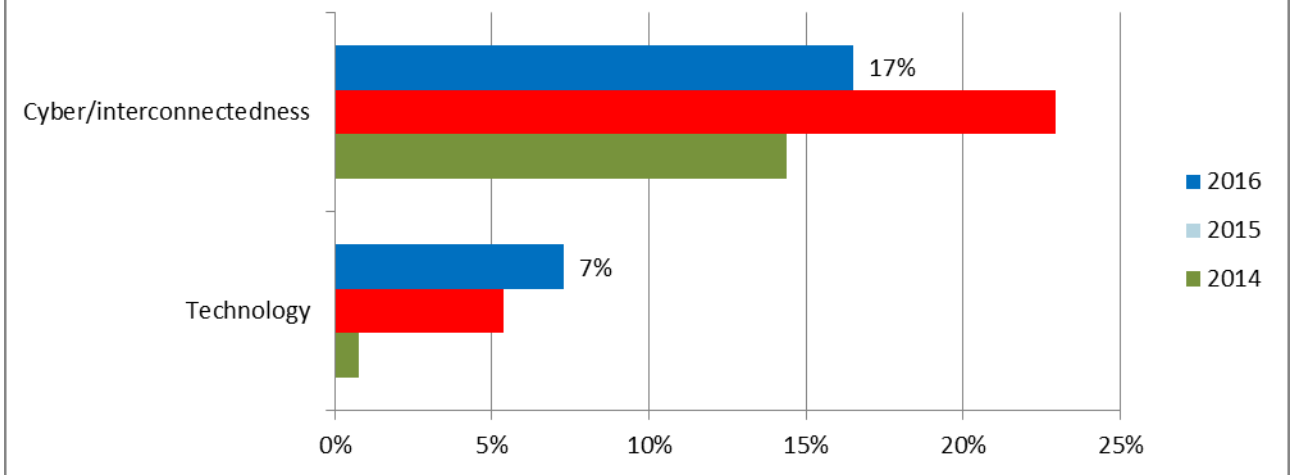


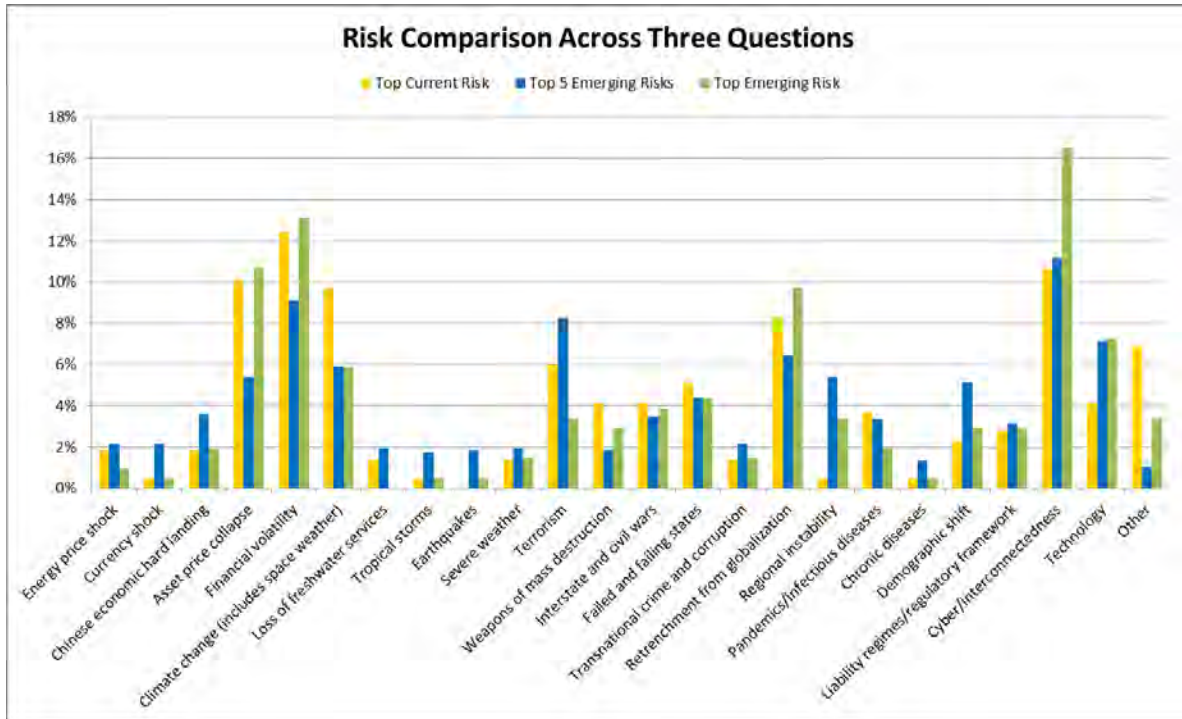
## Top Emerging Risks—Societal (% of total)





## Top Emerging Risks—Technological (% of total)





**Questions 3, 4, and 5.** 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). Select up to three combinations of two risks each. A follow-up question applies to the first combination listed so make that the one you think will have the largest impact.

**Two risk combinations—566 total responses**

**Economic—(28%/33%/35%/40%/46%/48%/45%/53%/49% in previous surveys)**

- (2%/4%/4%/3%/9%) 1 Energy price shock
- (3%/4%/2%/8%/6%) 2 Currency shock
- (4%/5%/5%/6%/7%) 3 Chinese economic hard landing
- (7%/8%/10%/7%/8%) 4 (4) Asset price collapse
- (11%/12%/13%/16%/15%) 5 (1) Financial volatility

**Environmental—(12%/12%/10%/11%/9%/7%/11%/13%/9%)**

- (5%/4%/4%/4%/4%) 6 Climate change (includes space weather)
- (2%/2%/2%/2%/2%) 7 Loss of freshwater services
- (2%/2%/1%/2%/1%) 8 Natural catastrophe: tropical storms
- (1%/1%/0.4%/0.2%/1%) 9 Natural catastrophe: earthquakes
- (2%/2%/2%/3%/1%) 10 Natural catastrophe: severe weather

**Geopolitical—(34%/28%/35%/32%/32%/32%/35%/25%/32%)**

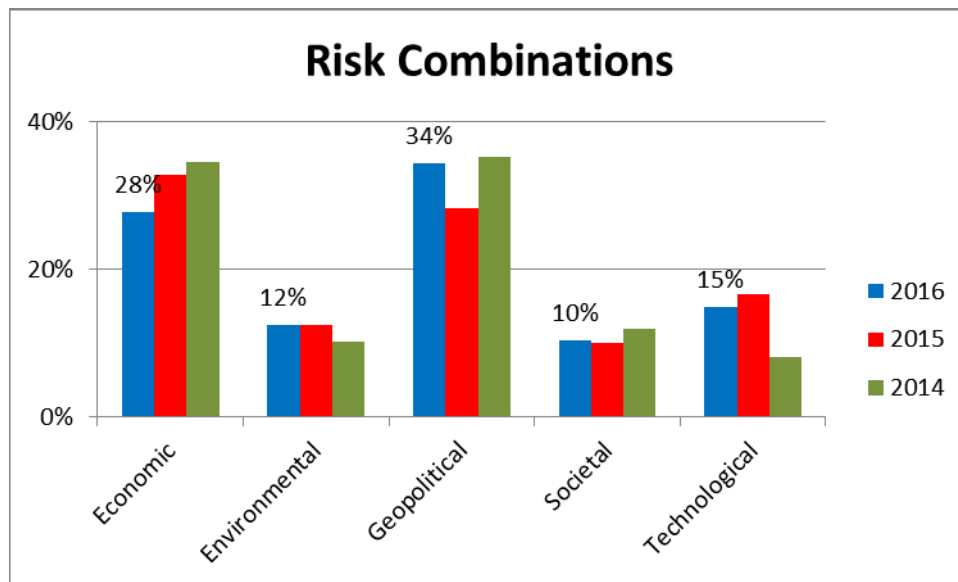
- (9%/8%/9%/6%/6%) 11 (3) Terrorism
- (2%/2%/2%/4%/4%) 12 Weapons of mass destruction
- (4%/4%/4%/4%/4%) 13 Interstate and civil wars
- (5%/5%/7%/6%/8%) 14 Failed and failing states
- (3%/2%/2%/4%/1%) 15 Transnational crime and corruption
- **(6%/1%/3%/3%/3%)** **16 (5T) Retrenchment from globalization**
- (6%/5%/7%/6%/7%) 17 (5T) Regional instability

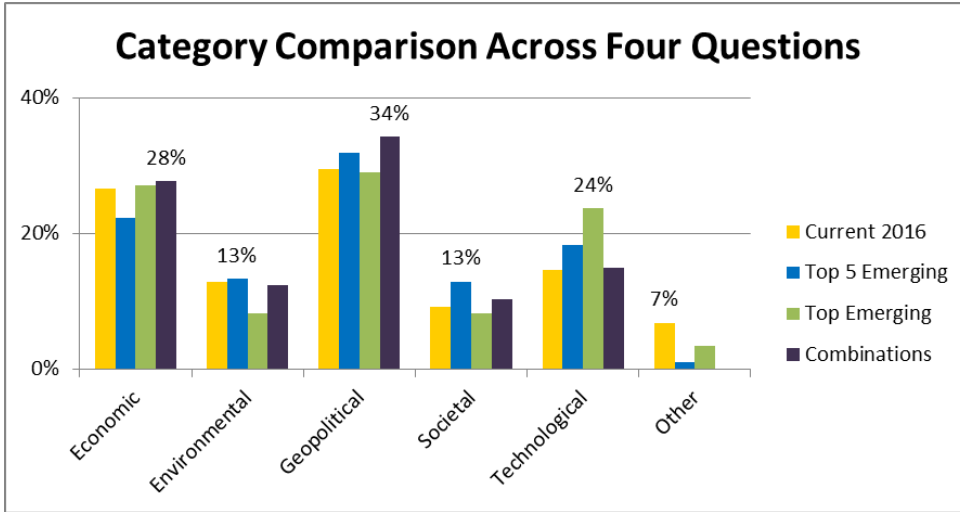
**Societal—(10%/10%/12%/9%/7%/6%/5%/5%/8%)**

- (3%/3%/4%/2%/2%) 18 Pandemics/infectious diseases
- (1%/1%/1%/0.4%/1%) 19 Chronic disease
- (4%/3%/4%/3%/3%) 20 Demographic shift
- (2%/3%/3%4%/1%) 21 Liability regimes/regulatory framework

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

- (10%/12%/7%/7%/5%) 22 (2) Cyber/interconnectedness of infrastructure
- (5%/5%/1%/1%/1%) 23 Technology

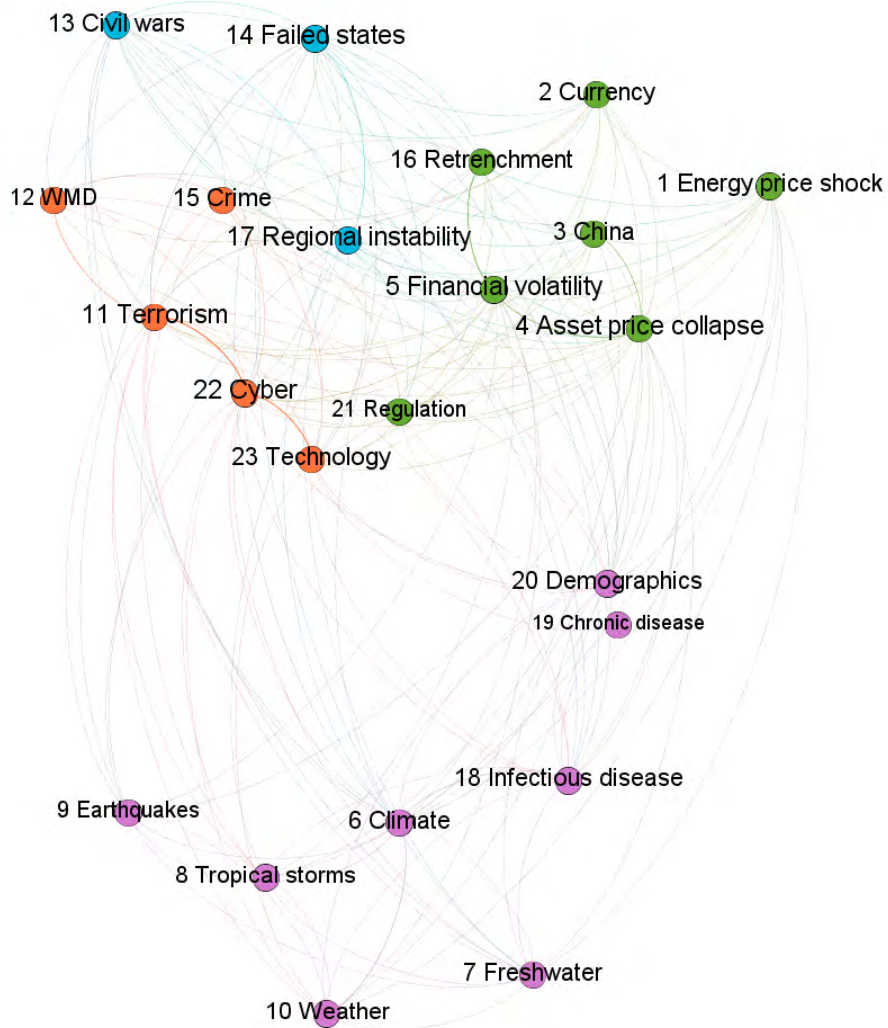




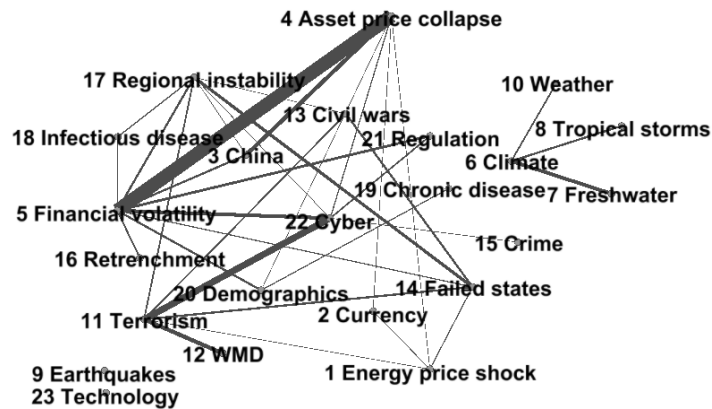
### Combinations

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

The following graphical representation, created with the open-source Gephi graphing software, provides an interesting visual analysis of the combination data. Each node represents a single risk, and the edges between nodes represent the number of combinations reported between the two connected risks. A thicker edge represents a more popular combination. The graph makes intuitive sense, somewhat validating the results for other parts of the survey. All edges are shown. The groupings for combinations are similar to the previously defined categories, yet are developed independently.



Here is the comparable chart from the prior survey. The primary change is the strength of the *Technology* risk and the integration of *Retrenchment from globalization*.



This type of analysis is not as sophisticated as one might guess from the graphic, but it provides a useful visual representation of the results.

Leading combinations were

- 33 responses (6%/9%/4%), No. 1 in previous survey  
*Terrorism*  
*Cyber/interconnectedness of infrastructure*
- 29 responses (5%/9%/1%), No. 2  
*Cyber/interconnectedness of infrastructure*  
*Technology*
- 23 responses (4%/0.5%/1.3%), NR  
*Financial volatility*  
*Retrenchment from globalization*
- 20 responses (4%/7%/8%), No. 3  
*Asset price collapse*  
*Financial volatility*
- 17 responses (3%/5%/3%), No. 4  
*Chinese economic hard landing*  
*Asset price collapse*
- 15 responses (3%/3%/3%), No. 9  
*Terrorism*  
*Weapons of mass destruction*
- 13 responses (2%/2%/1%), No. 10  
*Climate change (includes space weather)*  
*Natural catastrophe: severe weather*

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

*Financial volatility*

*Cyber/interconnectedness of infrastructure*

11 responses (2%), NR

*Climate change*

*Pandemics/infectious diseases*

Leading combinations in 2015 not in the top 10 in the current survey were

8 responses (1%/5%/2%)

*Financial volatility*

*Liability regimes and regulatory framework*

7 responses (1%/4%/2%)

*Chinese economic hard landing*

*Financial volatility*

7 responses (1%/3%)

*Currency shock*

*Financial volatility*

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

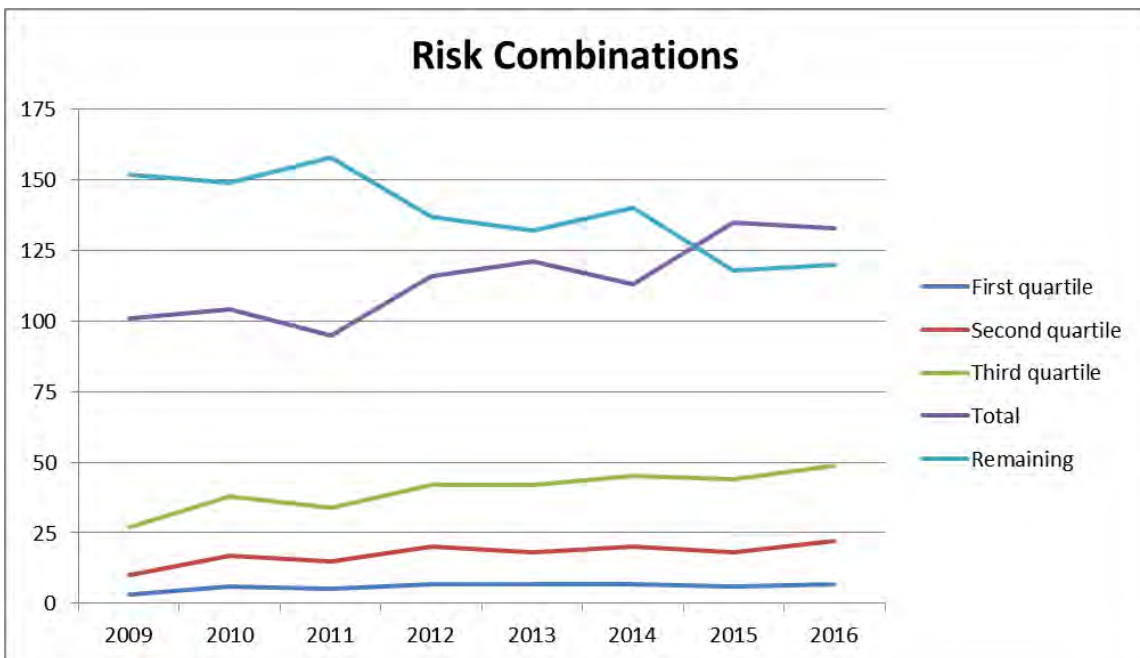
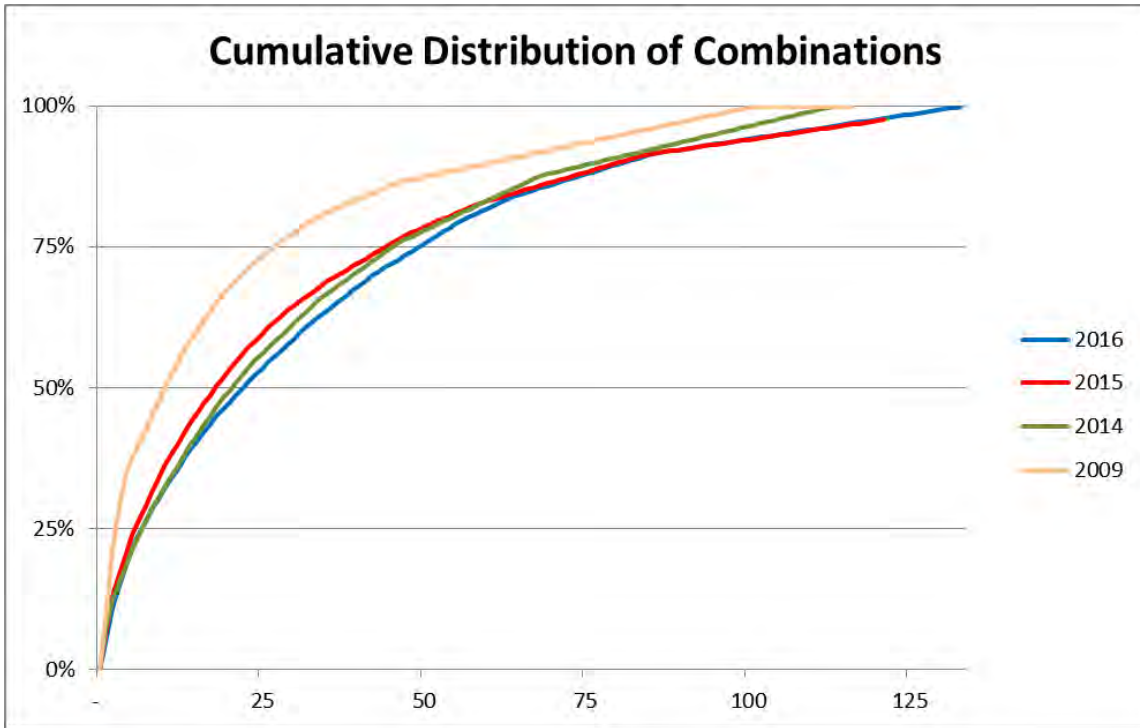
### 2016 Mix by Primary Versus Secondary Combination

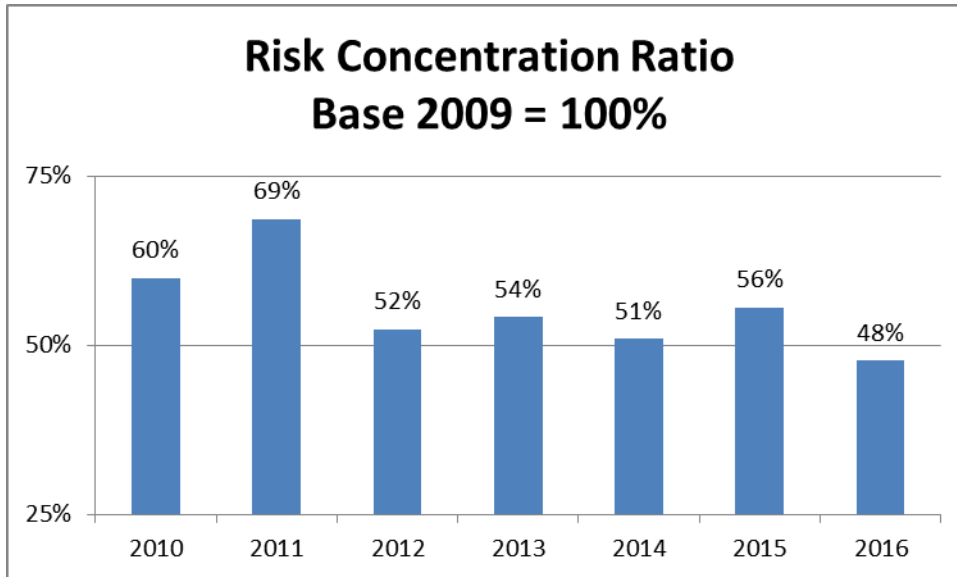
Combination Splits by Category		Combo 1	Combo 2/3	Overall
Economic	Economic	17%	13%	14%
Economic	Environmental	2%	1%	2%
Economic	Geopolitical	19%	13%	15%
Economic	Societal	4%	6%	6%
Economic	Technological	6%	4%	4%
Environmental	Environmental	3%	10%	8%
Environmental	Geopolitical	4%	3%	3%
Environmental	Societal	3%	5%	4%
Environmental	Technological	2%	1%	1%
Geopolitical	Geopolitical	18%	19%	19%
Geopolitical	Societal	2%	2%	2%
Geopolitical	Technological	11%	10%	11%
Societal	Societal	1%	4%	3%
Societal	Technological	5%	3%	4%
Technological	Technological	5%	5%	5%

### 2015 for comparison

		Combo 1	Combo 2/3
Economic	Economic	27%	15%
Economic	Environmental	5%	1%
Economic	Geopolitical	12%	17%
Economic	Societal	11%	8%
Economic	Technological	4%	5%
Environmental	Environmental	6%	8%
Environmental	Geopolitical	1%	3%
Environmental	Societal	1%	1%
Environmental	Technological	1%	0%
Geopolitical	Geopolitical	15%	21%
Geopolitical	Societal	4%	9%
Geopolitical	Technological	9%	7%
Societal	Societal	2%	2%
Societal	Technological	3%	2%
Technological	Technological	1%	0%

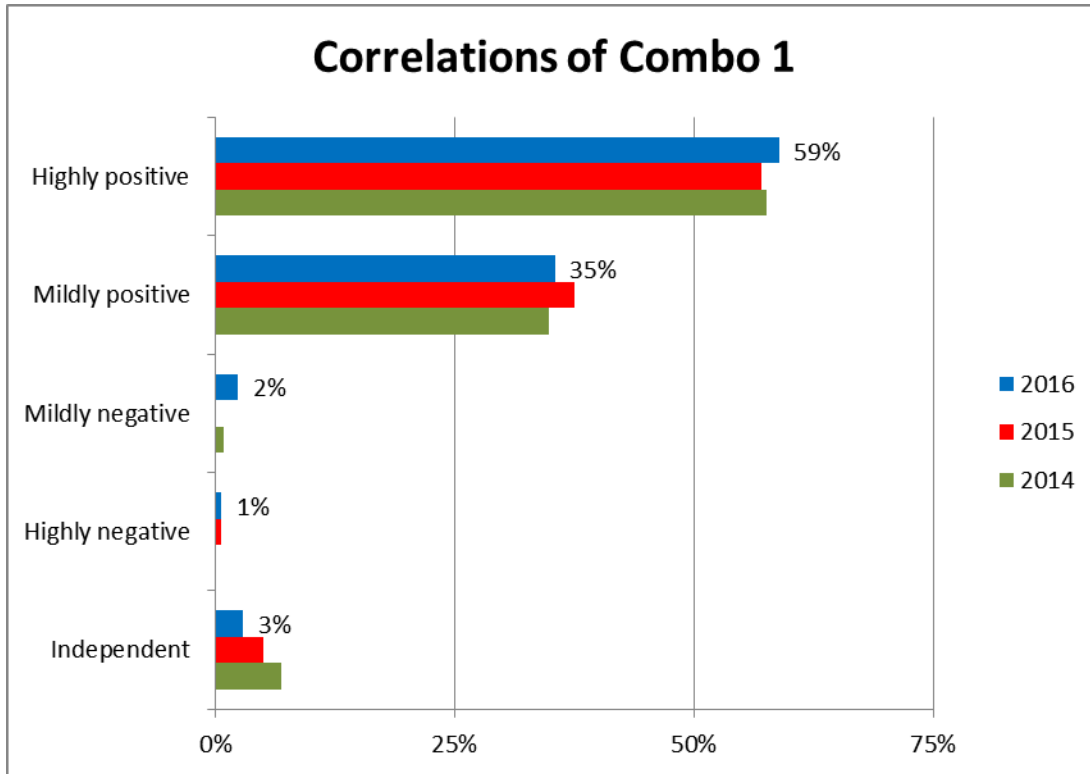






**Question 6.** For the first combination listed in Question 3, do you feel that the risks chosen will operate independently or be correlated?

- 103 responses 59%/57%/58%      Highly positively correlated
- 62 responses 35%/38%/35%      Mildly positively correlated
- 4 response 2%/0%/1%      Mildly negatively correlated
- 1 response 1%/1%/0%      Highly negatively correlated
- 5 responses 3%/5%/7%      Independent



Each year a specialty question is asked, with the anticipation that the question will not be repeated in the future.

**Question 7.** In his book *Capital in the Twenty-First Century*, Thomas Piketty argues that wealth concentration hinders economic growth. Which of these risks would be your top choices to lead to inequality of wealth? (please select no more than three.)

**172 respondents chose at least one for a total of 402 responses (2.3 average).**

**Economic—31%**

- 4% *Energy price shock*
- 3% *Currency shock*
- 1% *Chinese economic hard landing*
- 8% *Asset price collapse*
- 14% *Financial volatility*

**Environmental—4%**

- 1% *Climate change (includes space weather)*
- 2% *Loss of freshwater services*
- 0% *Natural catastrophe: tropical storms*
- 0% *Natural catastrophe: earthquakes*
- 0% *Natural catastrophe: severe weather*

**Geopolitical—33%**

- 1% *Terrorism*
- 0% *Weapons of mass destruction (WMD)*
- 2% *Interstate and civil wars*
- 7% *Failed and failing states*
- 9% 3T *Transnational crime and corruption*
- 9% 3T *Retrenchment from globalization*
- 5% *Regional instability*

**Societal—14%**

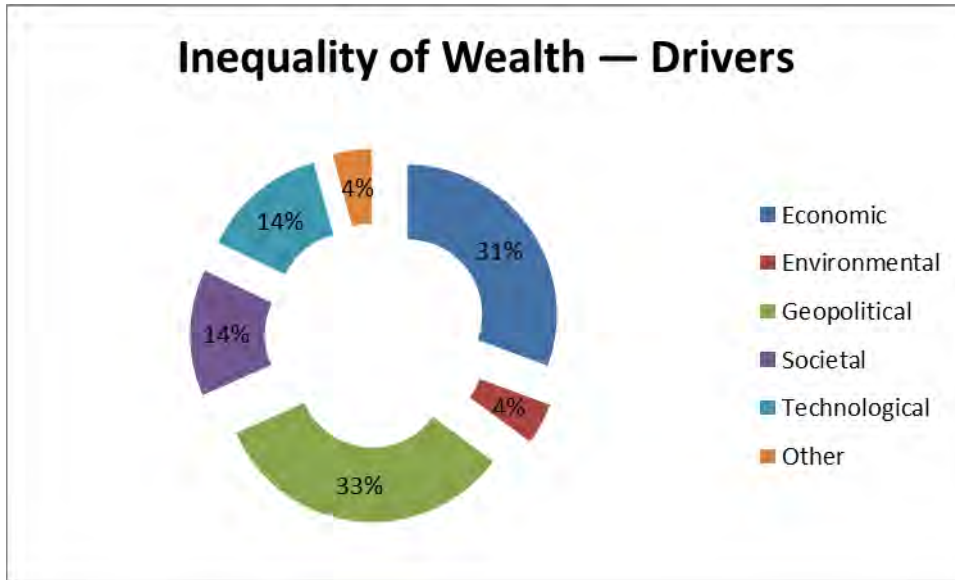
- 1% *Pandemics/infectious diseases*
- 0% *Chronic diseases*
- 7% *Demographic shift*
- 5% *Liability regimes/regulatory framework*

**Technological—14%**

- 2% *Cyber/interconnectedness of infrastructure*
- 12% 2 *Technology*

**Other—4%**

- *Thomas Piketty shills garbage to feeble-minded globalists. Wealth concentration is a by-product of technology, and it is a problem. Piketty is wrong, but masterfully selling books.*
- *Piketty is full of it.*
- *Political corruption in developed western nations that privilege the upper class through lobbying and self-centered legislation*
- *Donald Trump*
- *Trump presidency*
- *Not actually a risk, just a thinly veiled expression of political views*
- *Government capture by plutocracy*
- *This is a bad question.*
- *Tax laws*
- *Political environment*
- *Continued globalization*
- *Trump presidency*
- *Lack of wealth redistribution*
- *U.S. Tax Code*
- *Question is based on a hypothesis presented as a fact, so no answer.*
- *Tax Policy*
- *Insufficient regulation or disclosure to counteract greed*



**Question 8.** Some risk managers seek ways to exploit risk by finding opportunities to add those that are mispriced or provide diversification. Which, if any, emerging “opportunities” do you monitor, and why?\* (Ed. Note: it is surprising that there is no mention of mortality trends among the responses.)

- *Monitor climate*
- *Alternative assets, mispricing of illiquidity*
- *x*
- *None*
- *None*
- *Underpriced assets*
- *I watch the price of gold. If viewed as a foreign exchange, it functions as a global currency without borders.*
- *Technology, demographic shift, financial volatility, currency shock*
- *Technology, liability regimes & regulatory framework*
- *Technology, algorithms, big data, bioengineering*
- *Asset bubbles, financial assets and real estate*
- *Asset mispricing*
- *Geopolitical threats, macroeconomic risks*
- *Demographic shift*
- *None*
- *None*
- *None*
- *None*

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\* Some responses throughout the survey are highlighted using bold font to recognize them as particularly thought provoking to the researcher.

- *None*
- *Do not really understand the question—opportunities? / I understand this question from the point of things being mispriced due to fear (strictly a financial paradigm) but risks / rewards from exploiting does not seem to be healthy—rather trying to help solve these serious issues and challenges (the “reward” should be for the effort trying to solve, mitigate and prevent serious tragedies not exploit. Often the wrong people bear the cost; conversely would the “risk manager” bear the cost if he/she is wrong? / Diversification and providing insurance and coverage for the benefit of society as a whole seems to be the best opportunity.*
- ***Nanotechnology, advances in medical science***
- *Demographic shift, terrorism, failing states, financial volatility*
- *Inappropriate capital charges on particular asset classes for insurance companies (e.g., Solvency II/US RBC)*
- ***We do not approach risk this way.***
- *We don't really look at emerging opportunities.*
- *Technology advancements in robotics and renewable energy sources*
- *None*
- *Technology—Autonomous Cars*
- *Regulatory reforms*
- *Technological*
- *None*
- ***Opportunity to benefit from deregulation over next 2 to 4 years in United States.***
- *Fintech*
- *Liability regimes and regulatory framework*
- *Asset price (over)valuation*
- *Pandemics, chronic diseases, natural disasters*
- *We monitor all risks and emerging situations looking for upside opportunities and competitive advantages.*
- *Not authorized to disclose*
- *None*
- *Technology, Demographic shifts*
- *None*
- *Competitive landscape; innovation*
- *Technology*
- *None*
- *None*
- *None*
- *Energy Prices*
- *Medical & scientific advances*
- *Disruptive business models based on technology*
- *Pandemics*
- *None and all. It all gets reported and comes together, but specifics ????*

- *Technology, cyber infrastructure*
- *Political situations in the United States and globally*
- *Changes in regulations*
- *None*
- *Demographic shift; Technology; Cyber/interconnectedness of infrastructure; Financial volatility; Liability regimes & regulatory framework*
- *Changes in regulatory environment*
- *Retrenchment from globalization*
- *Clean energy*
- *Greater diversification of assets*
- *Currency exchange fluctuations, global asset value instability, law and regulation change*
- *Securitization*
- *Interest rate and economic environment metrics, cyber-security, pandemic, organizational, competitor and others*
- *None*
- *Novel insurance products will protect against emerging risks.*
- *Over the past several years, my personal trading account has benefited from mispricing in the derivatives market.*
- *Complex risks such as securitized vehicles*
- *Regulatory changes*
- *None*
- *Asset prices, financial volatility, China, currency shock, technology*
- ***Demographic trends for investments—e.g., old people are likely to be buyers of prescribed drugs and RVs—also political forecasts, e.g., currently buying defense stocks and selling utilities***
- *None*
- ***In the energy risk arena, alternative energy. In the cyber risk arena, new cyber security innovations and return to non-cyber commerce.***
- *Cyber*
- *National security, technology*

**Question 9.** No list of risks is ever complete. Are there other emerging risks that you feel are significant that should be considered for future surveys?

### **Option 1**

- *Suggestion one*
- *Political Risks*
- *US monetary policy shift*
- ***Medical costs so high big swaths of population can't get care***
- *Weapons of mass destruction*

- ***Progressive globalization—The exact opposite of the retrenchment risk. There is a happy medium.***
- ***Food supply instability***
- *Currency manipulation*
- *Impact of Trump*
- *Societal risks: educational shortfalls—adults ill-prepared to handle a new world, resulting in countries unable to maintain their competitive economic positions within the world.*
- *Political corruption in the West*
- *Electromagnetic pulse risk—either from the sun or manmade*
- *Tax changes*
- *Congestion*
- *United States withdrawal from world community*
- *Longevity risk*
- *Contagion*
- *Diseases that affect food supplies e.g., foot and mouth*
- *Donald Trump*
- *Pandemic (Zika)*
- *Collapse of U.S. democracy*
- *Inflation*
- *Central bank policy*
- *Deterioration and regression of race relations*
- *Eurozone collapse*
- *Technology*
- *U.S. political instability*
- *Rollback of freedom of choice within the United States*
- *Negative interest rates*
- *Increased polarization in previously stable democracies—United States, Britain, France*
- *Social media*
- *Political risk (developed nations)*
- *Inequality leads to internal strife*
- *Income/wealth inequality*
- *Civil/societal unrest or upheaval*
- *Growing prejudices*
- *Poverty risk—Increase in frequency and severity of poverty*
- *Technology—Blockchain*
- *Central bank interest rate manipulation*
- ***Antibiotic resistant disease (not sure that is covered by the preceding list)***
- *Loss of freedom of speech, religion in western democracies*



- *Governmental policy risk (excluding retrenchment from globalization)—Rising concerns about competition compels governments to protect the elite, i.e., proliferation of oligarchies*
- *Medical & scientific advances*
- *Collapse of the “city center” as people work remote*
- *Amazon effect—no more cashiers!*
- *None that come to mind at this moment*
- *Industrial change, insurance banking financial market with new definitions of consumer needs*
- *Rise of demagogues in the United States*
- *Liability associated with the Internet of Things. Ex: who will be liable for a self-driving car accident?*
- *Populism*
- *Antibiotic resistance*
- *Changing consumer preferences regarding sales and customer service practices*
- *Changes in distribution*
- *U.S. government corruption*
- *Changing nature of work: as technology enhances rapidly to give machines the ability to perform more blue-collar jobs, there will be a shift in the workforce resulting in pressure on social services and tax base; move to “gig” economy has potential to redefine tax system.*
- *Increasing government control/interference in markets*
- *Nontraditional competitors*
- *Economic collapse of the western economies*
- *Failure to uncover unknown unknowns*
- *Antibiotic resistant virus*
- *Climate change*
- *Overreaching controls on pharma industry or other industries*
- *Cybernetic—merging biology and technology*

## **Option 2**

- *Monopolistic and oligopolistic behaviors*
- *Global Wealth Concentration*
- *Technology*
- *Failing to MAGA. ;-)* (Ed. Note: *Make America Great Again*)
- *Sustained slowing of local and global economies*
- *Market Manipulation*
- *Impact of privatization of public services*
- *Societal/geopolitical risks: urban-rural divide leading to polarized political decision-making*
- *Trade wars*
- *Loss of Border Control—Anarchy*

- *Complete dissolution of European Union*
- *Long-Term Care*
- *Agricultural/Food Shortage*
- *Shifting demographics (poverty in old age) overreliance on Social Security/Medicare [government not fulfilling promises]—too much intergenerational risk*
- *Economic depression worldwide*
- *Tax policy*
- *Regional instability*
- *Mass migration (in response to war, climate change, economic dislocation or other factors)*
- *Low interest rates for a long time*
- *Longevity*
- *Rise of extreme nationalism*
- *Cubs winning the World Series*
- *Isolationism*
- *Governmental debt*
- *Breakdown of law & order or military/authoritarian governments*
- *Ignorance—the tendency of ignorant people to mass together and do dumb things, e.g., Brexit, the U.S. presidential election of Donald Trump, the rise of al-Dawlah al-Islam<sup>?</sup>yah f? al-<sup>?</sup>Ir<sup>?</sup>q wa-al-Sh<sup>?</sup>m (Daesh, or Da'ish (????)), etc. (Ed. Note: comment is reprinted as entered.)*
- *Deteriorating infrastructures*
- *Trump Effect (presidential)*
- *Misplaced populism in the United States and around the world*
- *Trade protectionism*
- *Religious Fundamentalism and Ignorance*
- *Civil unrest*
- *Decline in education—misinformation, innumeracy, demagoguery*
- *Failure to make risks transparent*
- *Blockchain*
- *Technology*
- *Artificial intelligence*

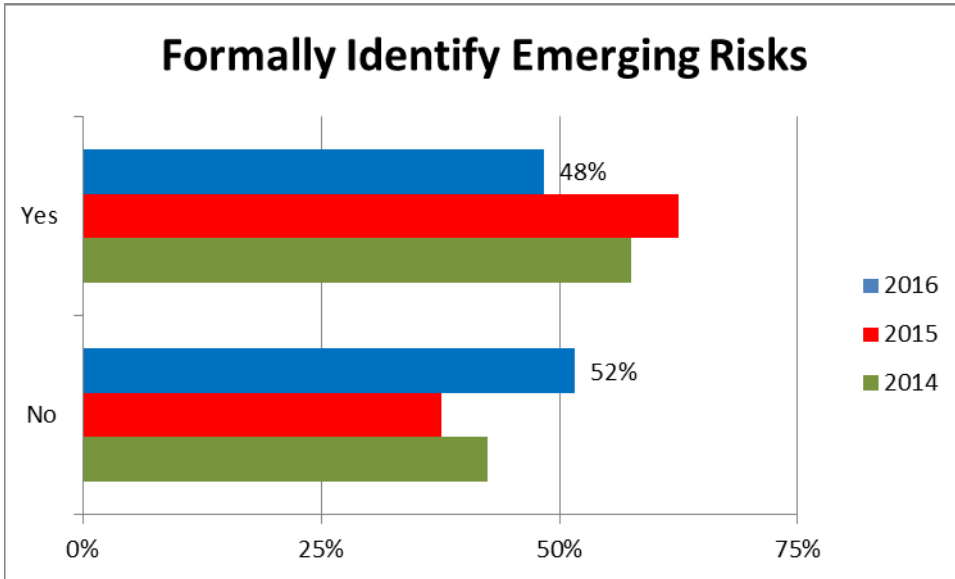
## **Section 2: Leading Indicators**

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

**Question 1.** Do you formally identify emerging risks?

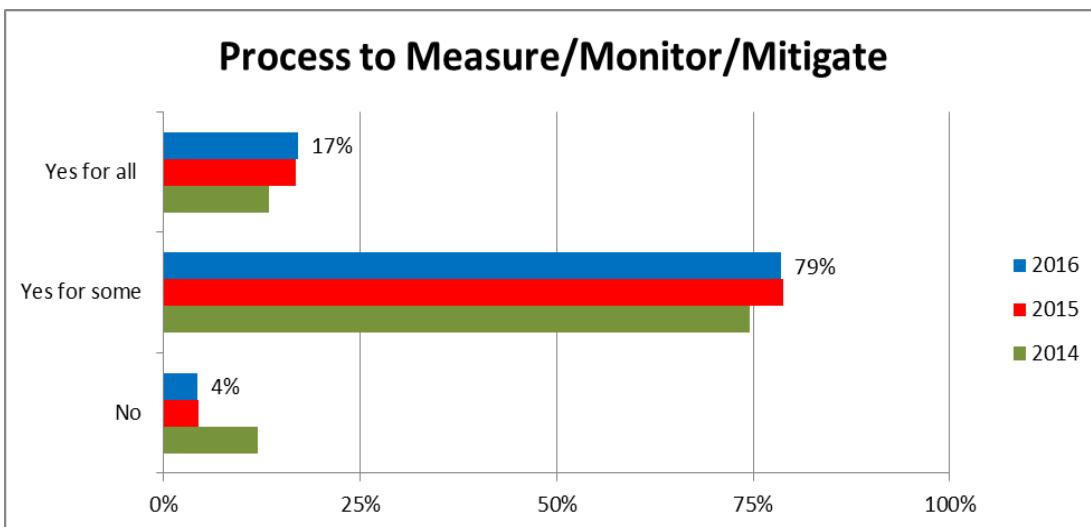
Percentages back out responses stating that the question is not applicable to them.

- 48%/62%/58%      Yes
- 52%/38%/43%      No



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

- 17%/17%/13%      Yes for all
- 79%/79%/75%      Yes for some
- 4%/4%/12%      No



**Question 3.** If yes, please provide examples.

From those who responded *Yes for all*:

- ***Emerging risks are monitored via the business plan process, with regular updates throughout the year.***
- *Monitoring and mitigation from corporate tax changes*
- ***Identified risks are reviewed by specialized committee, detailed analysis and assessments performed, prioritized based on impact severity and likelihood to materialize, continuously monitored and regularly reported on (to management and Board).***
- *Not authorized to disclose*
- *Monitoring epidemic/pandemic risk through the WHO and CDC websites*
- *Management discusses emerging risks annually, and this process includes reviewing the current status of all emerging risks identified the previous year.*
- *Modeling and simulation of impacts*
- ***Risk in the form of global threats to the U.S. military. It involves evaluating/comparison of concepts, capabilities, organizations and doctrine between the threat and the United States' similar and counter-capabilities.***

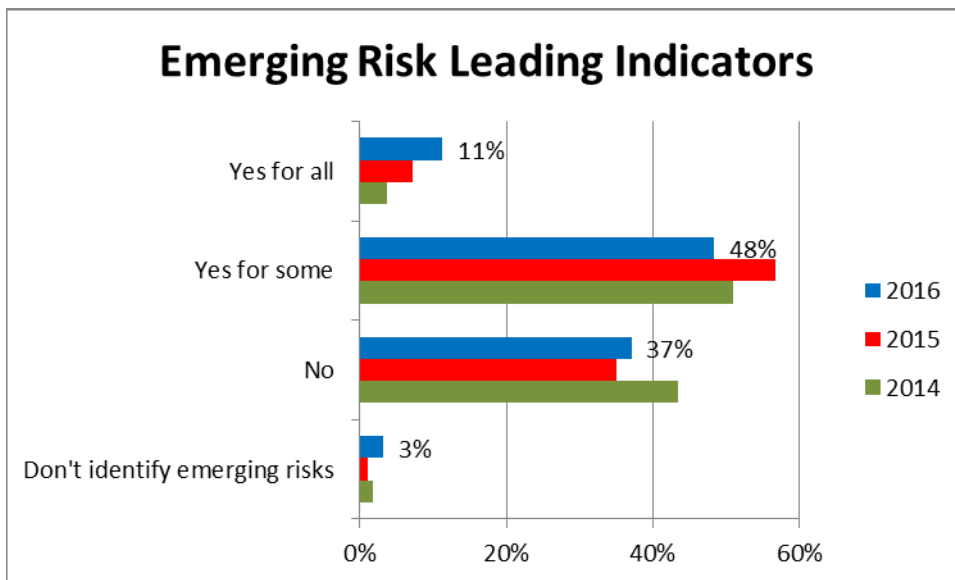
From those who responded *Yes for some*:

- *Stock market move, Currency move*
- ***E.g., Keeping up with fast-changing technological advancements: monitoring of competitor actions, and progress against roadmap for modernizing organization's technology***
- ***Debt sustainability, income inequality, climate change***
- *Stock Market Crash*
- *Tracking interest rates' effect on pension funding*
- ***Hints at coming inflation***
- *The top risks are identified and each risk has an executive team risk sponsor. There is also a risk team established with a risk owner. Risk plans are put in place and the process is periodically reported to the BOD.*
- *KRI reports address economic and pandemic risks.*
- *Regular measurement of mortality improvement (and trends)*
- *Just like if international market of steel fluctuates. It shall obviously fluctuate in our country too.*
- ***Cyber threats / Opioid epidemic***
- *Cyber—scenarios, coordination of established working group, etc.*
- *For health care (this is a past example), we identified years ago cyber and regulatory risks as this is addressed through state and federal laws (ex. notification laws). As we have monitored this, it now creates significant costs for notification that were previously difficult to quantify.*

- ***Expected regulatory changes are tracked and monitored and potential impacts to products and product strategies are determined.***
- *Monitor disease (flu) trends*
- *We maintain an Emerging Risk Tracker and have biweekly calls to discuss those risks as well as determine if any new risks should be added or if any risks should be removed. Other risks are more specific regulations affecting our industry. Other risks include those related to sustainability.*
- *Monitoring rising sea levels over time*
- *Table of experts within the company responsible to monitor evolution*
- *Cybersecurity risk—we apply a risk management framework.*
- *Formal report to the BOD on the list of top emerging risks*
- *Monitor legal and research developments. Most emerging risks on our list are things that cannot be easily mitigated, but definitely need to be watched.*
- *Meetings with the financial institutions to discuss emerging risks*
- *Estimating the impact of the Internet of Things (IOT) and the complete lack of any sort of security. Will allow for massive internet outage attacks utilizing things like people's stoves, cars, refrigerators, etc., in addition to computers.*
- *Regulatory frameworks*
- *Political risk for health insurance*
- *News, research, quantification of potential impact*
- *Internal action plan*
- *Monitoring legislation and regulation as they develop / Anticipating proposed legislation*
- *Regulatory activity, flu activity*
- *Monitor valuation levels of publicly traded securities*
- *We have a mature emerging risk program integrated into our Own Risk and Solvency Assessment.*
- *Primary focus is financial market instability. Monitor daily and monthly movements in swaps, U.S. Treasuries and corporate bond spreads.*
- ***Risk of third-party supplier failure: risk management includes identifying areas where contract terms can be strengthened.***
- *Teams assigned to track and perform “what if” calculations to assess probable and potential maximum impact to the Group*
- ***Using Anomaly Detection tools to identify unknown unknowns***
- *Brexit was an example last year where we reviewed the potential impact and assess using mitigants to reduce our potential exposure.*
- *Financial volatility, currency, China hard landing*
- *Changing demographics for my industry could create reduced revenue, more service demand. Financial instability is a major risk for my industry as well as climate, terror and other natural catastrophes. All are monitored, all are mitigated to some extent.*

**Question 4.** Once an emerging risk is identified, do you select leading indicators to measure changing likelihoods? (Example: In 2009, the threat of missiles fired by North Korea received much publicity. One company monitored investment flows to/from North or South Korea as an advance indication of the threat’s credibility.) Percentages back out respondents stating that the question is not applicable to them or they are not sure of the correct response.

- 11%/7%/4%            Yes for all
- 48%/57%/51%        Yes for some
- 37%/35%/43%        No
- 3%/1%/2%            We do not formally identify emerging risks.



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

For those who answered *Yes for all*:

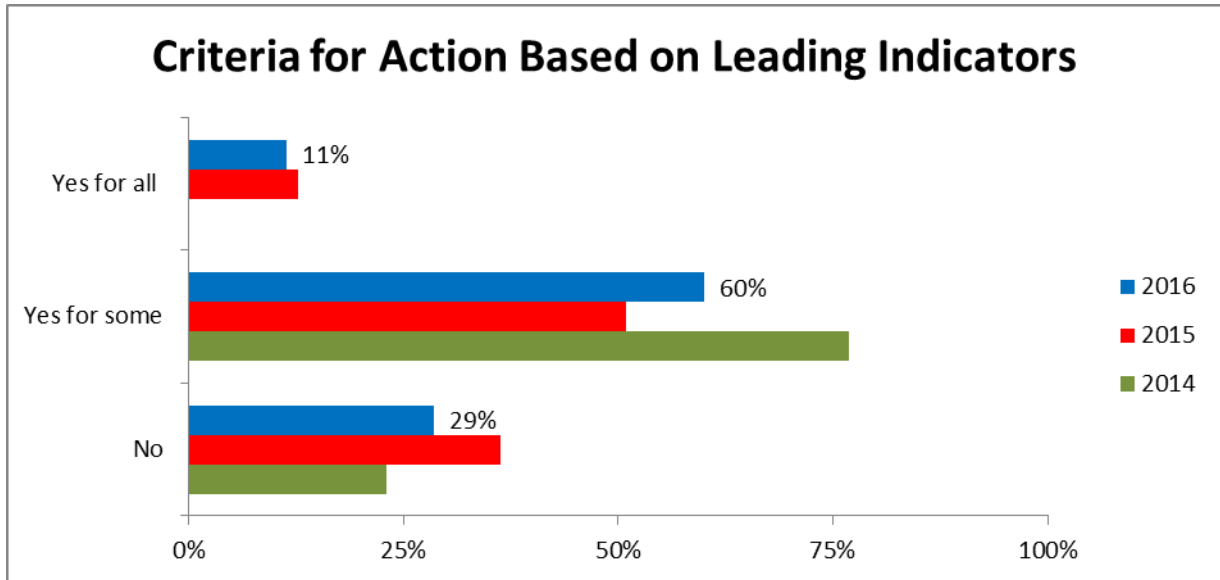
- **E.g., sales trends indicating shift to competitive platforms utilizing superior technology**
- For our industry specific risks, we monitor regulation closely by following the state regulators, meet regularly with state regulators and work with other companies facing the same risks through trade associations.
- **Yes, it is called indications and warning (I&W) within the Department of Defense. I&W flags the risk for greater collection and analysis.**

For those who answered *Yes for some*:

- Treasury and swap spread moves
- **Climate change causing methane release, which is 20 times more damaging than CO<sub>2</sub>—temperature in extreme north and south latitudes**
- Monitoring competition as product features change that we cannot develop or support
- Health and Disability Claims
- Confidential
- **Varied depending on the risk** - —the risks we review and monitor are not necessarily the traditional financial risks tied to market performance. Some of the measures and metrics are internal.
- Fluctuation in international market
- Scenario and stress testing, trigger framework,
- Risk specific—not authorized to disclose
- CERT warnings (Cybersecurity) / . . .
- For Zika, we monitored cancellations on travel insurance policies to impacted regions.
- **Maintaining watch on slight trends in reported cyber-related events, locations, who is being attacked and is this the first time, size of attack**
- VaR, CTE, Stress Testing, Scenario Analysis
- Statistical models of possible events ties to the threat
- Monitor macro and micro (industry) indicators
- **We use the NOAA global temperature index as a leading indicator of climate change; Gartner Hype Index for Technology**
- Climate change—track average temperature, sea temperatures, storm numbers/severities/tracks
- **Created an index of anomalies that are scored on a scale of 1 to 100**
- Currency levels, China GDP
- Global trends in weather, financial markets.

**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?

- 11%/13%/0%            Yes for all
- 60%/51%/77%        Yes for some
- 29%/36%/23%        No



**Question 7.** If yes, please provide examples.

For those who said *Yes for all*:

- [Ed. Note: no comments were received]

For those who said *Yes for some*:

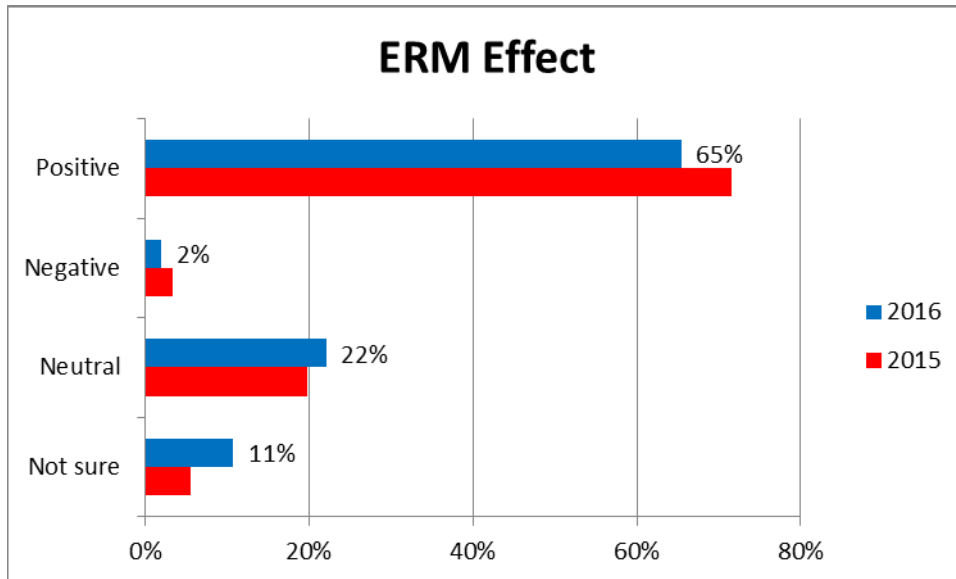
- *Committee will determine what kinds of countermeasures should be implemented.*
- *Political instability as measured by human development index*
- *I alert senior management.*
- *Actions are based on the risk plans put in place.*
- *\$ amount monitoring exposures, political activity and trigger framework for investment planning*
- *Risk specific—not authorized to disclose*
- *We are able to curtail or modify underwriting if we see our exposure increase materially.*
- *Goes beyond risk appetite and threshold*
- *Volatility and percentage change*
- ***Wearables: tracked penetration and capabilities before introducing experimental insurance products***
- ***If anomaly scores increase above a threshold, then action is taken.***
- ***Remix the investment portfolio, buy more reinsurance, take less risk.***
- ***The criteria is based upon a much larger perspective that involves diplomatic, informational, military, and economic perspectives—that combined define the criteria for mitigation or acceptance.***



### Section 3: Methodology

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

- 65%/72% Positive
- 2%/3% Negative
- 22%/20% Neutral
- 11%/5% Not sure



**Question 2.** Why?

For those who said *Positive*:

- *It has enabled us to identify where we can take additional risk prudently, and we have been rewarded for this additional risk.*
- *Foresee risks ahead*
- *Modestly positive. When ERM works well, communication and understanding within management teams improves.*
- *More proactive measuring and monitoring; increased discussion; more transparency regarding risk taking activities*
- *Formal processes to identify, monitor, manage risk*
- *Increased transparency; expectations around analysis supporting key strategic decisions*
- *Hedging risks we take*

- *You can't treat what isn't measured—awareness of embedded options in insurance products has led to more appropriate capital allocation , risk budgets, ROE measures and hedging*
- *ERM requires answers to difficult questions, even if the answers are insufficient. **ERM causes the company to think about issues that might have been avoided previously.***
- *Has raised it to the level of attention that it needs. We now need to sell the concept of value added.*
- *We have a framework to identify free capital.*
- *Requires more focus on various risks and has resulted in change in Board and management focus and organizational structure*
- *It unifies sectors of the company and analyzes global company risk*
- *Has led to an organized way to identify and assess risks and set in place plans to mitigate*
- ***Awareness and education***
- *Helps the firm plan for approaching risks in order to ameliorate these*
- ***ERM attitudes lead to consideration of risk at the enterprise-level, which aids asset allocation. Portfolio vol should be less important than surplus vol (in my opinion), and ERM is helping more people to come around to this view.***
- *Started conversations around risk and monitoring/mitigation of key risks*
- *Better understanding of risk and more intentionality about understanding and mitigating risks taken*
- ***Allows Company to evaluate strategic and business plans based on risk-adjusted decision making***
- *Enable taking pre-risk and corrective steps to minimize the risk*
- *Helped alert regulators to approve actions necessary to address serious financial concerns in the Long-Term Care Insurance industry*
- *Understanding of risk has allowed for better pricing practices*
- ***More thorough evaluations of opportunities***
- ***I think monitoring of risks, recognizing the correlation of various risks, and recognizing both risk and risk appetite has been beneficial to the property-casualty industry.***
- ***It has forced a broader perspective than many actuaries have.***
- *Risk management has been used to build a framework to identify and mitigate or benefit from risks. It is closely tied to frameworks around control, as well.*
- *I consult in the area.*
- ***Once more are aware of risks (know more about what you don't know you don't know), they can make better short- and long-term decisions. This is important for us on resource allocation, but also to remain diversified as a company and the product/advisory offerings we consider now and in the future.***
- *The firm's management is much more aware of the risks they are undertaking to generate shareholder returns.*

- *Enhances risk awareness and creates tools for managers to demonstrate that they are managing their risks*
- *It enables comparison between lines of business that have different loss/profit generating characteristics either by risk type or emergence of cash flows. / **It helps management think longer term and make comparisons to other risk frameworks.***
- *Provides additional lens for reviewing project and initiatives outside of the traditional cost-benefit analysis. Thinking through risk enables associates to more effectively plan for the future and reduce the potential for adverse events occurring.*
- *Help share a common view of the major risks for the company through top managers and board*
- ***Forces to see the interconnectedness of the entire organization***
- ***Better awareness of risk culture***
- *Greater awareness and quantification of risk*
- *Life companies are much more aware of many risks that were previously ignored.*
- *Better overall dialogue and understanding of risk issues*
- *I believe we better understand our different risks, and also have a greater appreciation for the need to diversify the risks our company takes.*
- *There is a greater focus on emerging risks across the various industries.*
- ***Forced companies to be more rational rather than following traditional wisdom. Also promotes open & honest discussions.***
- *Brought structure to activities performed throughout the company. Create more obvious lines of ownership for risks.*
- *More risk awareness*
- *Our business (insurance) is risk management.*
- *Long-term stability of players in health insurance*
- *ORSA requirements. Awareness of risks.*
- ***Just common sense***
- *Raised awareness by creating new metrics and indicators used in valuing business*
- *Make people aware of risks, educate boards of directors.*
- *Leads to mitigation by clients*
- ***Our ERM committee provides a second review of our new products and the financial and regulatory trends going on. They help to identify risks that may be missed early on in projects.***
- *Provides consistent perspective on risks (negative and opportunities) across the organization. Helps us understand risk appetite and economic capital needs.*
- *Enhanced discipline for risk management activities*
- *Greater awareness of future potentials; more information for better business decisions—**proactive instead of reactive***
- *Improved financial risk mitigation. Improved disaster mitigation.*
- *Gives a better picture of the spectrum of risks and their interconnectedness*

- *Capital Management; Own Risk and Solvency Assessment—impacts on decision-making using informed risk management; investment decisions using ALM; management actions/discussion stemming from stress testing analysis*
- *More staff consider risk mitigation and exposure analytics in business-as-usual.*
- *Discipline of identifying risks and management strategies*
- *Better equipped to understand risks and to set/communicate better limits*
- *Made return to risk tradeoffs more transparent*
- *First time different risks were aggregated into a total risk view, allowing for better capital allocation decisions.*
- *Good framework for balancing risks against returns, improves communication, cross-training, strategic planning*
- *Because it helped to reduce mistakes of the past and to control risk taking*
- *Has provided a structure to identify, measure and monitor risks*
- ***Permits the U.S. military to remain a credible force regardless of the specific global threat***

For those who said *Negative*:

- ***Complete regulatory compliance orientation, intended to satisfy regulators, giving false sense of security but without really effectively addressing risks.***
- ***It's an expensive extra layer of middle-management who repeatedly spend time conducting deep dives into counting the number of angels that can dance on the head of a pin.***
- *Restricting investments and risk taking*

For those who said *Neutral*:

- *No effect. Our risk officer is ineffective.*
- *Still immature*
- ***ERM has offered additional perspective; however, management has not tended to implement any initiatives that appear dampening in an upward/positive environment, particularly if negatively impacting personal incentive compensation outcomes.***
- *ERM as a compliance work*
- *As a consulting firm, ERM is not high on the priority list of activities.*
- *I feel that ERM is still in the initial stages and so we can't yet quite see what impact it will have.*
- *Not much change has occurred in the day-to-day business operations. Risk Management dictates from abroad only provided hurdles to the business, and are designed to serve rating agency concerns.*
- ***Difficult to measure success, but easy to identify failure***
- *Link to being more strategic—developing*
- ***It is merely a formalization of what we have been doing for many, many years.***

- ***Company has always acted risk averse; ERM not fully integrated yet, still some way to go; Solvency II introduced more focus on risk and more discussion which is good, but also had a significant price—so all in all -> neutral.***
- *Emerging area of practice*
- ***Our company has a program but it's a bureaucratic process, not an attempt to really understand and manage our risks.***
- *Decisions are rarely based on future risks—management is more concerned with issues raised by equity analysts and peer- company comparison.*
- *We don't currently use ERM.*
- *Well diversified within the company*
- ***While we have an ERM program with quarterly updates, I don't think Senior management and the Board take it seriously enough.***
- ***Had already been doing it but not called by this name—good management***
- *Not really part of daily business processes*
- *Some positives, unclear if any positive impacts to shareholders*
- *So far, it has been an exercise in number crunching. / I have not seen it have any impact yet on the way we do business.*
- ***Comes with added bureaucracy that creates its own risks and can be manipulated for political purposes rather than for “pure” risk management and mitigation***

For those who said *Not sure*:

- ***It depends on what is meant by “enterprise risk management.” If this means a strong risk management framework and strong culture of risk identification, assessment, measurement and mitigation, then ERM has had a positive impact. If this means having a dedicated ERM department running complex economic capital models, then ERM has had no impact. Our company believes that ERM assessments should be simple and easily understood by all.***
- *We have used it in macro terms, but we have not seen its impact on the separate divisions.*
- *I'm not too close to the work our organization is doing in ERM.*
- *ERM rarely manages emerging risks successfully, which is the major causes for financial disruption of a company.*
- *Management buy-in is still required.*
- *As a consultant, we advise our client on ERM but I haven't seen it at our own company.*
- *I am not directly involved in enterprise risk management.*

**Question 3.** Under what circumstances have quantification efforts enabled better decision making?

- *They have given us a better sense of the relative sizes of the risks that we take.*
- *Comparison of different quality investments*
- *When similar events happen in the past*
- ***More rigorous analysis of liabilities has helped management to rationalize reinsurance purchasing decisions.***
- ***Quantification efforts have increased understanding of risk and how it changes in different environments allowing for more robust discussion about risk tolerances.***
- *Quantification of cyber risks (e.g., monitoring external threats and internal employee activity) has helped identify areas of focus. Measurement of the sensitivity of earnings and capital to equity movements has identify varying dynamics by line of business.*
- *NA*
- *Challenging decisions can be supported through a cost-benefit / risk-reward lens.*
- *Stress testing can quantify effects of adverse scenarios.*
- *When embedded options can be modeled*
- *NA*
- ***In understanding trends in results and taken a much more pro-active stance***
- *Acquisitions*
- *Economic Value-Based quantifications have enabled better decision making.*
- *When Management fully subscribes to an ERM culture, or (b) when it's too late—the event that could have been mitigated has occurred*
- *Different sectors behave differently and don't always communicate perfectly.*
- *Prioritization of scarce resources for mitigation*
- *Awareness and education—communication through quantifying potential outcomes*
- *Some situations*
- *Liability-driven strategic asset allocation*
- *We have not yet gotten to the point of quantifying—our ERM effort is owned by a nonactuary so it is not grounded in the traditional actuarial analysis.*
- *Part of our decision-making process*
- *Supports long-term revenue, earnings and capital growth strategies*
- *Unknown*
- *Usually when history enables trends identifications and analysis*
- *Geography based pricing for P&C. Faster Underwriting Practices in L&A business*
- *Credit risk analysis*
- *When capacity limits are defined*
- *Cyber risk*

- **Actuaries are forced to consider the tail of the distribution when pricing and reserving.**
- **Identifying opportunities. Taking earlier action.**
- **They make a problem easier to show that it exists.**
- *Knowing how big our cyber risk is (e.g., number of records we have) has allowed us to put more resources to prevention, but also caused us to finance these risks greater via insurance.*
- *Identifying large potential risks and translating them into profit impacts has led to product strategy shifts toward (away) from (un)desirable risks even when the competition has not yet moved.*
- *Maximum retention limits and exposure to cat risks and pandemics*
- *Unclear*
- *M&A activity, pricing using predictive models*
- *Risk identification and assessments help size risk exposure and enable the design of a more effective & efficient control environment*
- *Strategic planning, capital management*
- *Better communication.*
- *Stock market slides; Currency swings; demographic changes (mortality improvement, fertility changes)*
- *Product development*
- *We use a relatively sophisticated economic capital model as our primary pricing metric.*
- *N/A*
- *Where actuaries are reasonable good at quantifying risk relative to all risks undertaken by the organization, e.g., allocating capital among existing business and selecting among competing new endeavors*
- **Primarily by avoiding actions which would worsen risks to which the organization is already more exposed. On a smaller scale, we have also compared the capital held for some operational risks against the cost of trying to reduce them.**
- **Able to better frame an exposure relative to another exposure when using the same methodologies to quantify**
- *Existence of robust and meaningful historical data*
- *Seeing where we are vs. a target helps a lot.*
- *Economic Capital and ORSA reporting*
- *Benefit from seeing anticipated diversification/concentration of risk*
- *Always*
- *Normal actuarial decisions*
- *Other than health care trend monitoring, I can't think of a good example.*
- *All*
- *Integral part of our management process*
- *I'm not involved enough in the process to answer this question.*

- *Allocation of economic capital. / Exposure management based on prospective view of risk.*
- *When direct comparison can be drawn*
- *In assessing solvency of the companies*
- ***Giving a clear hierarchy of the relative importance of major risks***
- *Not aware of any*
- *Drives better awareness and focus on right items*
- *ALM*
- *ORSA, Stress Testing discussion*
- *Increased volatility in financial (especially fixed income) markets*
- *When quantification of variability can be presented in a way that helps understanding (e.g., from Boards of Directors)*
- ***Decision whether to write a large case is conditioned in part on potential impact to risk profile; costing of the case uses bespoke risk capital assumption based on complementarity to existing portfolio***
- *Made return to risk tradeoffs more transparent in the trading books*
- *Provides for a common “currency” of risk taking across various risk types and informs capitalization decisions*
- *Enormously, in terms of aggregation of risk in geographic areas, industry segments, lines of business, in terms of risk retention, quality of counterparties, etc.*
- ***In determining when new concept/capability/doctrine/organizations need to be incorporated into the U.S. military’s force structure***

**Question 4.** Under what circumstances has qualitative analysis enabled better decision-making?

- ***Identifying operational risk concerns, prioritization of dealing with such concerns***
- *Strategic asset allocation*
- *Exposure to data that was previously unavailable has led to smarter decisions.*
- *When a worldwide event without a prior history happens, for example, financial crisis in 2008–2009*
- ***Challenging managers to think about emerging risks is beneficial.***
- ***Some risks are hard to quantify—qualitative analysis focused on understanding the risk and our action under various scenarios allows for better understanding of our preparedness for the risk, any gaps in management or opportunities to exploit.***
- *Qualitative assessment of operational risks has helped management allocate resources to mitigation activities that are of most value. It has also helped identify areas requiring further assessment and understanding.*
- *We have increased our controls around Model Risk and Operational Risk.*



- **Increased transparency around the external environment that puts pressure on specific courses of action**
- **Critical assessment of risks related to novel financial instruments, coupled with skepticism about risks as represented by originators and intermediaries, has allowed companies to avoid mistakes made by other, less skeptical companies.**
- When the impacts are hard to assess such as cyber attacks and climate change
- NA
- Not Sure
- When Management adopts a culture conducive to bringing in multiple perspectives, including contrarian views
- Numeric models are never perfect. Most of the time they fail because of poor assumptions. Qualitative analysis helps in the assumption department.
- **Not everything can be reduced to numbers and there are a lot of unknowns. So qualitative assessment should always be used to adjust the quantitative.**
- Probabilities and statistics are not reality. A coin is not 50% heads, 50% tails. Qualitative thought applies common sense and thought process that “quantitative analysis” does not efficiently get at or a deeper conversation and explanation is necessary.
- NA
- **Generates awareness and conversation**
- Risk analysis is performed on all factors of product development.
- Supports long-term revenue, earnings and capital growth strategies
- Risk control frameworks have led to better documented procedures and formalized review processes.
- When risks are more qualitative or expectational in nature, and where clear identification of causes and results, and their severity and frequency, are hard to quantify
- Understanding Model Limitations with discussion to allow for full disclosure when making decisions;. Economic Capital Modeling in the Tail
- Capital management
- When quantification is difficult—strategic risk is an example
- OHS considerations
- **People are aware of cognitive biases.**
- Knowing regulations has created opportunity for our compliance consulting but also driven us to focus on competitors whose business we want by highlighting their lack of ability to stay up-to-date on regulations they help customers comply with.
- Business continuity risks, regulatory risks, reputation risks
- Unclear
- Underwriting cyber insurance; it enables decision making anyhow, it remains to be seen whether it was better decision making.
- New project review process when risks may be known but project is too immature to begin quantifying the impact

- *Strategic planning, better understanding of risks within the company*
- *Understanding impact on resources using reverse stress tests*
- ***Behavioural Economics—lapse rate considerations, etc.***
- *Capital planning*
- *Decisions about data cleanup projects versus our assessment of operational risk*
- *NA*
- ***I'm not aware of effective qualitative analysis that did not include an overabundant amount of hubris, e.g., "the qualitative analysis that we did enabled better decision making because we're smart," rather than "the qualitative analysis that we did was a horrible mistake and we learned a lot from the process, enabling us to make better decisions in the future."***
- *Qualitative analysis allows us to see patterns of behaviour or knowledge that quantitative analysis might not reveal.*
- *The qualitative analysis of risks have helped refocus strategic efforts to the biggest risks faced by the enterprise*
- *Understanding the service supply chain and whether to expand or contract in various areas*
- *Where appropriate data to support quantification is unavailable*
- *Getting a sense on how management is thinking about risk (Low, Mid, High)*
- *Lead to fewer blind spots or missing of related risks*
- *Always, to add experience and judgment to numbers*
- *Normal actuarial decisions*
- ***There has been some push back on managers in areas where qualitative ratings have dropped. The biggest push back comes when someone has a negative internal audit finding.***
- *None*
- *Major issues*
- *I'm not involved enough in the process to answer this question.*
- *We're having more multi-functional discussions, and using that multi-functional experience.*
- ***When uncertainty is high***
- *In assessing the governance and operational risks of the companies*
- *Not aware of any*
- *Risk identification and assessment exercises—discussion of risks and integrating top risk identification into business and strategic planning*
- *I haven't seen it.*
- *Ability to accurately assess risk factors and combine with existing portfolio*
- *Made return to risk tradeoffs more transparent at the board*
- ***By understanding the biases of models like stochastic interest rate generators that don't create negative rates and mean revert***
- *All—underwriting especially*

- *In determining the scale of the new concept/capability/doctrine/organization that is incorporated*

**Question 5.** Under what circumstances has a combination of qualitative and quantitative analysis enabled better decision making?

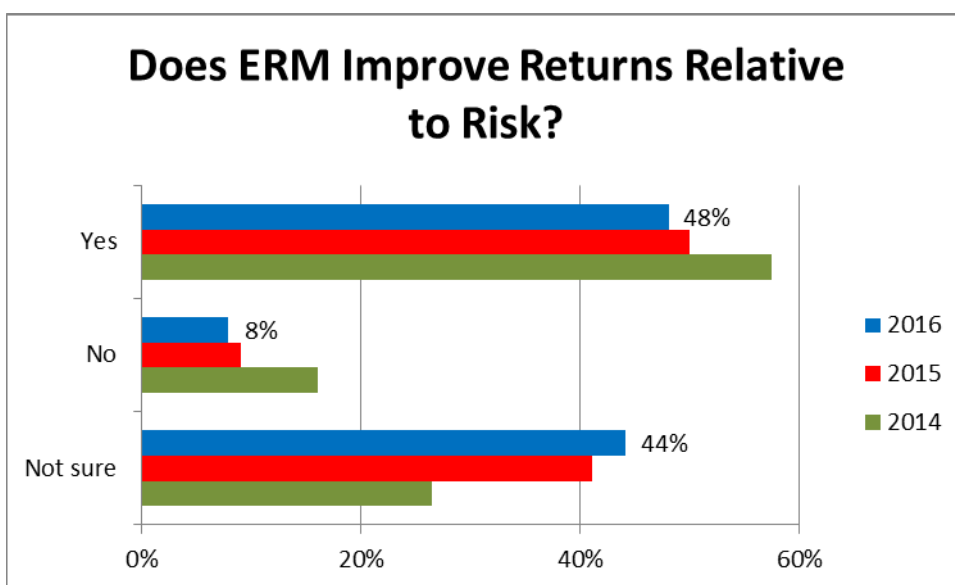
- *When management is engaged in enterprise risk management and not just a small area*
- *Strategic asset allocation*
- *When a combination of the repeat of historical events and a new event without a prior history happens*
- *Stop it.*
- *Identifying the profile of a given risk (e.g. low likelihood/high impact vs. high likelihood/low impact). Assessing the impact of a new initiative on the company's risk profile.*
- *NA*
- ***Modeling done in connections with pricing and ARM, with accountability by management to the Board, not compliance oriented, has benefited companies.***
- *For scenario-based events that measure the effectiveness and speed of response and identify correlated variables*
- *NA*
- ***Both are always necessary for optimal decision making.***
- ***Ying and Yang. Quantitative analysis is a great form of communication and often provides useful graphical analysis or ranges of potential outcomes or outlier outcomes. Quantitative analysis communicates uncertainty and attaches meaning to numbers (something tangible) vs. call it fluff. / / The flip side is that quantitative analysis is often viewed as a religion and absolute and is mistreated. Also numbers can be made to lie to not explain the entire picture, process or understanding very well. Strong qualitative analysis should be able to reinforce what a model or quantitative analysis is attempting to do and capture. Also if things are too complex to quantitatively capture or too much noise "qualitative analysis" may explain and provide better analysis for a decision maker. / Buying our Odyssey, consumer report provided good quantitative metrics but we qualitatively discussed multiple cars and pro(s) and con(s) to make the best decision.***
- *NA*
- ***Generates awareness and conversation***
- *Both are used in all risk analysis.*
- *Supports long-term revenue, earnings and capital growth strategies*
- *Unknown*
- *Generally always*
- *Model Risk Management practices. Economic Capital.*
- ***Many actually—that's how company decisions are made.***

- *Operational risks*
- *Areas where impact to underwriting and/or new product developments*
- ***Overcoming cognitive biases about quantitative data.***
- *Cyber, regulations, giving clarity around the fines and penalties (financial impact) but also tracking litigation and associated total costs (defense, etc.)*
- *Strategic risks associated with new markets*
- *Unclear*
- *At an enterprise level, both have benefits. A qualitative review enables a high-level view of risk that can drive appropriate action (easy to react to a high vs. low rating). A quantitative analysis enables a comparison of two risks for prioritizing (high vs. VERY high). Quantification also helps in the evaluation of risk mitigation costs (i.e., are we comfortable paying \$x to mitigate a \$y risk)?*
- *Strategic planning*
- *N/A*
- *Strategy development*
- *N/A*
- ***Qualitative analysis by nature is driven and accepted or rejected by an organization's politics rather than enabling better decision making. The folks who decide that the qualitative analysis that they want to believe decide whether the decisions were good or bad—and the deciders never make bad decisions—until they do, and then they no longer respond to risk surveys because they've driven their company into bankruptcy and are out of a job.***
- *We have analyzed loss events both quantitatively and qualitatively, looking for issues which require a broader solution.*
- ***For risks with little to no data, qualitative methods offer a baseline from which to begin to frame out how to approach a quantitative view. One can apply a Bayesian approach.***
- *Decision whether or not to play in the Obamacare Health exchange business*
- *Combining the two is powerful to align gut feel thinking and risk measuring with numbers.*
- *Review of existing strategies*
- *Always*
- *Normal actuarial decisions*
- *None*
- *Depends on issue*
- *I'm not involved enough in the process to answer this question.*
- ***E.g., use of predictive modeling combined with underwriting expertise. Focus efforts on exception underwriting.***
- *Almost all the cases*
- *In assessing the overall risk of the company both prudential and conduct risks.*
- *Not aware of any*
- *ORSA discussion; capital management*
- *Increased volatility is quantitative after the fact and qualitative before.*

- *When it improves understanding of possibilities (variability)*
- *Assessment must also pull in qualitative factors such as consideration of reputational and operational risks.*
- *Made return to risk tradeoffs more transparent in the banking book*
- *Comparison of MBS market in 2006 allowed us to exit deferred annuity market and lower exposure to MBS*
- *All*
- *In determining how to modernize the U.S. military against future global threats that are undefined yet, but hinted at on the research and development side*

**Question 6.** Does implementing ERM improve company returns relative to the amount of risk? (Please select one.)

- 48%/50%/57%                      Yes
- 8%/9%/16%                        No
- 44%/41%/26%                    Not sure



**Question 7.** Why or why not?

For those who answered *Yes*:

- *If it is not done in a stove pipe, it can be used to better allocate resources.*
- ***You can implement a countermeasure in advance***
- *Yes on larger items like reinsurance purchasing, but **the idea that a company can build an optimal portfolio of risks is fiction.** Marketplace realities will dominate the process.*

- *More focus on risk/reward trade off - so don't waste time on risks that don't offer appropriate reward*
- *A strong risk culture, with risk assessment as a key part of business decision making leads to better decisions, less rework, and better alignment of tactical initiatives to strategy.*
- *Many decisions are made with a view of what is given up and what is gained by taking that course of action.*
- ***Results from poor ERM has been disastrous, as seen in 2008. Short term returns are reduced by effective ERM but so-called tail scenarios, which occur every 10-15 years, are avoided. There is a net benefit to solvency and viability, but discipline is needed to stay the course during "normal" years.***
- *It allows Risk avoidance through product design and budgets.*
- *It permits additional methods of assessing risk for product design and product management.*
- *In the long term . . . demonstrating successful risk management during a crisis, in particular, demonstrates the value add. However, this value or perception of value may be fleeting.*
- *Applying thought and thinking about is usually a good thing. Trying to think and prospectively prevent bad things and trying to be proactive vs. reactive is ideal. **Not everything can be prevented and mistakes are made, but ERM provides a framework and structured thought process to make and change a risk/decision-making model.***
- ***A company can be proactive rather than reactive, which generally results in less expenditure in time, talent and resources to confront.***
- *Reasons described above: appropriately defining risk as total balance sheet risk rather than simply asset vol.*
- *More awareness and focus on pricing appropriately for risks*
- *The property-casualty industry is in the business of risk. Recognizing in a more explicit way the tradeoff between taking risk and making profit has been helpful.*
- *Risk goes down.*
- ***Because if you understand more about risks, you can better see if the amount of return matches something that is high risk versus low risk. Sometimes people in our business do not see the huge amount of risk (likelihood of error) and only see the revenues.***
- *Even if every corporate-level decision is not run through the model, the management sees the model results often enough that decisions leading to lower returns/risk are avoided.*
- *ERM require a conscious decision on risk taking that weighs the cost (i.e., are we comfortable paying \$x to mitigate a \$y risk?).*
- *ERM helps to better understand where to allocate capital.*
- *Why not?*
- *More transparency and improved oversight of risk taking activities*

- ***Appreciation of diversification—opportunities to take on more risk in areas where we are underweighted while trying to limit the amount of additional risk we take in areas that are over weighted***
- *Better understanding of risk-adjusted economic return, but what really matters to management is IFRS return on equity.*
- ***Quantifying the risk the organization is undertaking is essential to understanding whether one use of capital is better than another. Using the ERM department’s definition of “amount of risk,” it’s a tautology to say “ERM improves company returns relative to the amount of risk.”***
- *It’s a more scientific approach than reliance on traditional methods or regulatory requirements.*
- *It can help reduce volatility but also point to areas that are not taking on enough risk—redeployment of risk capital.*
- *ERM is not about limiting or eliminating risk. It’s understanding risk to allow the company to optimize risk/return.*
- *You can quantify your risks against a target and not guess all the time.*
- ***KPIs can help identify common risks and exposure so fewer surprises. Moved from intuitive to factual.***
- ***It should if done correctly. But unexpected changes in health costs or regulation can affect earnings greatly even if a perfect risk analysis was done when pricing and benefits were determined.***
- *Developing risk appetite and tolerances forces more informed, and strategic planning*
- *It help them better identify, assess, manage and report their risks periodically*
- *Maintains focus on appropriate businesses*
- ***You can only improve what you measure. Measuring risk might mean getting out of lines of business which are too risky for the return.***
- *There is a better risk perception, even if not exactly quantifiable.*
- *Better information leads to better decisions.*
- *Enables superior risk adjusted return decisions*
- *N/K*

For those who answered No:

- ***Absolute dollar, likely not. As a percentage of the risk exposure, yes. When involved in writing new business, ERM favors great business and stands in the way of writing good business. So margins go up, but absolute dollars go down. / / Additionally, hedging is an incremental cost (unless it is mispriced). Nonstatic hedges usually fail in the events in which they are designed for.***
- *Although it is possible that some form of implementation would provide value beyond normal business control and underwriting processes, I haven’t seen that in practice.*

- **ERM is often implemented as “red-tape.” The theory of ERM is excellent (i.e. take the risks you want and diversify away the rest). However, the application becomes cumbersome.**
- *ERM is one of many tools used by management, but it only affects, or determines, what shouldn't be done. Just as a negative can't be proven, nor can its effect be measured.*
- *ERM as a compliance work*
- *Whenever you limit risk, you limit returns.*
- *See #2.*
- **The cost is too high.**
- *Didn't change things, already doing a version of it*
- *We are a public sector corporation.*

For those who answered *Not sure*:

- *Improved returns are only part of the risk/return story.*
- *We are currently within an extreme low interest rate environment and we implemented ERM within that same time frame. Our controls have not seen much improvement yet.*
- **ERM can go crazy in its specificity. If policies are reasonable and reasonably implemented, ERM should improve returns. With too much specificity, the costs can well exceed the risk.**
- *We have not been able to quantify.*
- *It's hard for a % return to be high when you hold a lot of risk capital.*
- **ERM is usually required due to regulatory reasons, so is this question even relevant? In any case, it really depends, since ERM implementations are largely variable. For example, it depends on company efficiency and employee expertise if ERM can be done efficiently and effectively. If not, it likely won't improve overall returns.**
- **We have not formally quantified the impact—right now it is more about making sure the risks are top-of-mind and less about quantifiable analysis.**
- **Hard to prove a negative. ERM is focused on the tail.**
- **Ill-defined question—depends on decision and measurement horizon (many short-term impacts are not well correlated with long-term impacts). Further, implementing ERM has generally immediate need for investments (in money, people, procedures, etc.) and is short-term disruptive, so that the actual benefits will only emerge in the long term.**
- *The question asked if they improve returns. In the long run in theory I think that it would. But due to not taking some risks the expected return is arguably lower and incurring much more expense.*
- *In some cases yes, in other cases potential to have strengthen this as can make recommendations but not authority to implement. Finding ways to highlight risk.*
- *Difficult to measure the change in impact created by ERM*



- *This is unquantifiable.*
- *Positive effect of ERM versus higher costs*
- *I think there is too much emphasis on return when trying to do something that is right.*
- ***Depends on whether company will follow through on all findings, or just go through the motions***
- *NA*
- *Insurance companies had always managed risks.*
- *Not sure whether we can quantify the amount of risks taken including emerging risks*
- ***In theory there is no difference between theory and practice.***
- *Measurement is difficult.*
- *Not quantified*
- *Implies a measurement based on comparing at least two sequences of events while only one actually occurs*
- ***No evidence that it is any better than historical methods of managing risk and return***

**Question 8.** Are there lessons learned that you would like to share with risk managers developing an ERM framework (e.g., what worked, what did not)?

- *No point in spending any effort on a project which is a “show trial,” meaning management isn’t interested in investing or supporting changes*
- *It’s a long road to travel!*
- ***Keep it simple. Deliver consistent, timely and actionable MI to decision makers using a push based technology OTHER THAN EMAIL (i.e., on demand real time dashboards).***
- ***Getting insights from individuals with key knowledge of the industry and business is valuable.***
- ***ERM cannot be standalone. The framework needs to be fully integrated within business processes. A key element is business area ownership of risk management, so an ERM framework and tools cannot feel like a “compliance” exercise. The role of risk oversight is to help the business make their own decisions, not impose limits that are not understood.***
- *Persistence pays in the end.*
- *NA*
- *Staged implementation to achieve buy-in and shift culture in the right direction*
- ***Do not fall in love with your models. Look around you and understand what is going on. The bubble in real estate in 2007 was pretty obvious at the time if you were paying attention, but was not addressed adequately by models. Real-life economic scenarios are not adequately modeled by probability distributions. There is caprice in the economy, and this should be factored into risk management. Models that generate asset prices and interest rates only are not***

- adequate. Risk management should incorporate other variables, such as unemployment, that can affect cash flows.*
- *See 7 just above.*
  - *Try to step back from the weeds and keep the process as simple and understandable as possible. It can become too overwhelming and daunting if you don't.*
  - *Leverage existing models and frameworks and look to integrate them and reconcile them. Do not assume that you can build a better model from scratch (sometimes you can, but oftentimes you can't).*
  - *Don't overbuild the process. Don't get caught up in the technical beauty of risk assessment and become meaningless to the decision makers.*
  - *Involving a lot of the operation helps with Culture and input for defining a Framework. This process though does break down in a run state as "everyone" still believes that they can have an impact on the final say of what Risks to take/not to take. Having more independence from the actual operations will enable more effectiveness when big change "needs" to occur.*
  - *Collaboration internally leads to better buy-in over time. Sometimes, you need to pursue 2–3 failed attempts until you have enterprise buy-in on the final approach.*
  - *Bring lots of people to the table in developing. Focus on communication and change management.*
  - *Finding an objective metric/similar to add value and have a deeper conversation.*
  - *Develop and report regularly without expecting instant buy-in. Promote the ERM view, teach about ERM, and listen to questions and concerns. Be persistent. Don't let quantification eliminate judgment.*
  - *Sell it to everyone.*
  - *It is imperfect and requires a diversity of folks to do it properly. Second, you just aren't going to convince or force some people to adopt. They have to learn the hard way.*
  - *It must evolve over time to become part of the culture and it must be supported/promoted/required by top management.*
  - *Each organization has to find what works for them. Risk managers are advised to know their audience/constituents.*
  - *Establish routine reports you know are meaningful to management—avoid including many reports that aren't meaningful. / Be sure to include current events type material that changes at regularly. Sometimes you will need to do research that wasn't asked for, and present it efficiently and understandably, in order to demonstrate areas of management that ERM can assist in.*
  - *(1) Risk education and culture should be at the foundation; don't discount this effort. / (2) Senior management involvement is very important from the beginning / (3) Start small and solicit business unit buy-in as program expand to derive the most value from their insight.*
  - *Not by me*
  - *Engage key stakeholders (particularly board) early and often.*

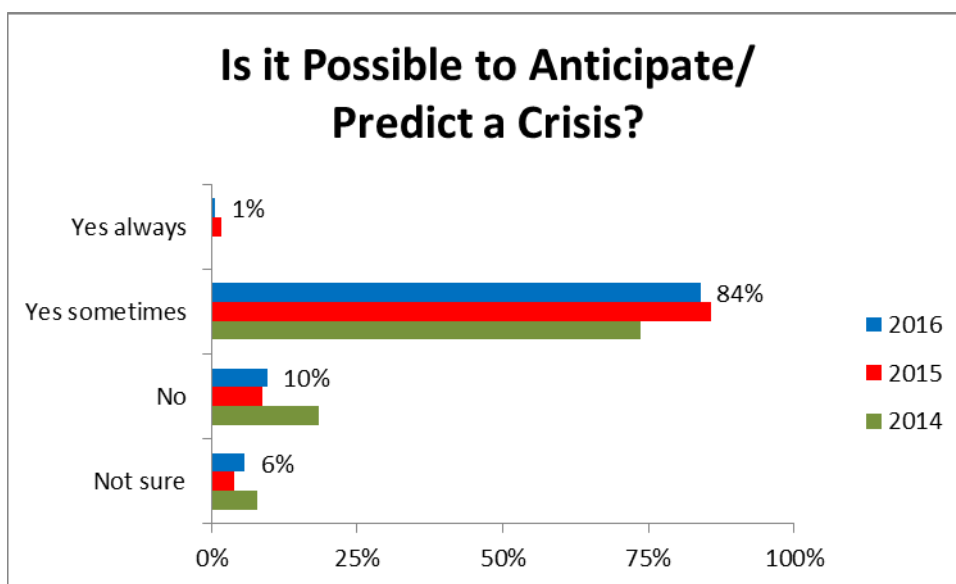
- *I think sometimes we fall into the trap of thinking that all of our stresses in our EC model are equally well conceived. However, some are backed by more rigor and justification than others, and I worry that we occasionally head towards the wrong answer as a result.*
- ***Brainstorm possibilities frequently.***
- ***Examples of what didn't work: (1) AIG's measurement of risk in its CDS portfolio circa 2008, (2) selling a bunch of GMxB benefits based on historical data, (3) selling a bunch of business with "vanishing premium," "shadow accounts," "noncancellable" and similar benefits. / / An example of what works: keeping portfolios of business at manageable sizes and making significant efforts to identify, mitigate and manage the inherent risks.***
- *Measured changes are needed. There is an adoption process and people need to see how this extra work isn't just extra work, that it provides a tangible benefit.*
- *Just having a risk list is worthless. You need to do something with that risk list and tie it into strategy and financial planning.*
- *How do you get over the barrier of sharing your risk appetite/risk tolerance with your front line employees? Is there trust there?*
- *Overcommunicate*
- *An effective ERM program must be driven from the Board and CEO if it is to have traction.*
- *Culture change is critical and difficult.*
- *Not really*
- *Stick to talking about things where risk management information might change actions.*
- *Make it part of the business.*
- *Build ERM framework around organization's current DNA.*
- ***Tone at the top is essential. Board and CEO must buy in and (depending on the size of the firm) appoint a CRO. From there, partnering with the business, building on the momentum of the tone at the top, communicating the value of risk-based decision-making promoted by the framework and gaining buy-in from the business through risk champions (appointed by the business) helps to build a strong ERM culture. When ERM is perceived as a "compliance exercise" only, the business will see ERM as a necessary cost—the work will get done, but much of the value-add will be eroded.***
- *Always remember that nature reserves the right to surprise us.*
- *Yes*
- *Short-term risks are easier than long-term risks.*
- ***Create a hit parade of risks and reduce the blind spots (i.e., uncover the unknown unknowns).***
- ***Make sure the role of contrarian is spread around—if only one person has it then they are viewed as not being a team player.***

- *Make sure risk owners are clearly designated and they are responsible to submit their own updates which have their name attached when the Board sees any of their risk reports.*

## Section 4: Predictions

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

- 1%/2%/0%                      Yes always
- 84%/86%/74%                Yes sometimes
- 10%/9%/18%                 No
- 6%/4%/8%                    Not sure



**Question 2.** Comments

For those who answered *Yes always*:

- ***This is a silly question. Anything can be predicted. The real question is whether any one person/org can consistently predict crises.***

For those who answered *Yes sometimes*:

- *The problem isn't that you can't identify, it's that you have trouble acting on it. Declining credit quality in CMOs, for example, was identified as a time bomb at our company as far back as 2005. But short-term incentives deterred us from taking as dramatic of action as we should have.*
- *Investment bubbles are visible to at least some folks in advance.*
- ***But getting the timing right can be tricky. Being too early could be the same as being wrong.***

- *History has shown that in some cases, signs do exist*
- ***A crisis can be anticipated, but not predicted. If a crisis is being predicted, it has probably already started.***
- *Political crises, no. Economic crises, yes. They come as a result of humans behaving badly, which can be observed and results anticipated. The real question is not if, but when and how bad will it be?*
- *Extreme valuations or volatility typically precede crises*
- *We should always look for ways to hedge risks but realize that prediction is never perfect.*
- *If you predict it continuously—you'll probably be right someday—but how often are you wrong?*
- ***You could have predicted the 2008 housing collapse if the government had told us the truth.***
- *Sometimes we are blind and I for sure do not have a crystal ball, but often one, if thought and scrutiny is applied, can see issues and problems developing especially if political will does not exist to address. **The Twain quote . . . history rhymes (maybe not every pattern is identical, differences emerge)** but certain events can be, others cannot in my opinion.*
- ***Need to have forward-looking vision to try and anticipate what is coming up or at you***
- *Depends on definition of crisis*
- *At a macro level, you can see how shifts in demographics pressure various social and financial systems. The unwillingness (politically) to address those stressors early enough lead to system failures.*
- ***Many crises have pre-crises “signs” that can provide hints to the coming crisis occurrence, its expected strength, etc. This is true, for example, for volcanos, earthquakes, water shortage, political unrest, financial instability, etc. But others, like pandemics, are almost completely unpredictable.***
- ***For example, a climate crisis is significantly more likely now, given U.S. presidential election result and political—wait for it—climate.***
- *E.g., Monitoring of some other financial industries that are more active in the space or similar and learning lessons learnt*
- *Anticipate is the right word. Timing is difficult.*
- ***I think you can have a sense that a crisis is coming, and even what the buildup of it is, but predicting the timing of the straw that breaks the camel's back I would say is not possible. Perhaps though you could time it well if you knew the camel was fully loaded and see that someone just threw a brick.***
- *If the crisis is structural there will be indications, but the exact timing will be uncertain.*
- *“Yes, rarely,” should have been an option. Or the question should have been, “Is it possible to accurately anticipate/predict a crisis and appropriately plan for its impacts?” in which case the answer would definitely be “No.” On the other-other hand, the question could have been, “Is it possible to anticipate/predict a crisis*

*and adequately plan for its impacts?” in which case I keep my “Yes, rarely,” answer.*

- ***Sometimes it’s possible to identify drivers which will eventually trigger a crisis, but not its timing. The Arab Spring would be such an example.***
- *The “hiding in plain sight” concept*
- *Some crisis can be noted; if lemmings are all going one way, look into why instead of following.*
- *If analysis shows that there is or would be an unwanted mismatch in assets and liabilities or unwanted negative cash flow due to asset allocation either currently or in a projected environment*
- ***The dilemma is how a person knows what he/she doesn’t know.***
- *The effect of low oil prices lead to reduction in subsidies, more tariffs and increase in unemployment as staff is made redundant due to austerity measures adopted.*
- *Usually*
- *Not with 100% certainty*
- *We often choose to ignore what is in front of our faces for political expediency.*
- *Possible but not very highly probable*
- ***Anticipate, yes. Predict, no. Crises are inevitable; the risk is mitigated/eliminated by being prepared (e.g., cyber attacks are inevitable, the crisis of a data breach is avoided by having strong security measures in place).***
- *Usually “predictions” of crisis are made after the crisis has begun.*
- *Planning is prudent, but there are still black swan events.*
- *While a crisis may be predicted, the level of conviction to take necessary action is extraordinary and the penalty relative to competitors if you are wrong is quite large.*
- *There are many **gray rhinos** that are inevitable, just the time and place are unknown.*
- *Need to be able to extrapolate from egregious events*

For those who answered No:

- *Some leading indicators will point to an increased likelihood of a crisis, but the complex nature of crises prohibits anything close to an actual prediction until it’s practically upon us.*
- *Crises tend to appear when you do not anticipate them; once you’ve anticipated a crisis, it’s less of a crisis and more of a scenario to address. (Yes, it’s just terminology, but there’s some truth in there.)*
- ***But it’s possible to be prepared for one.***

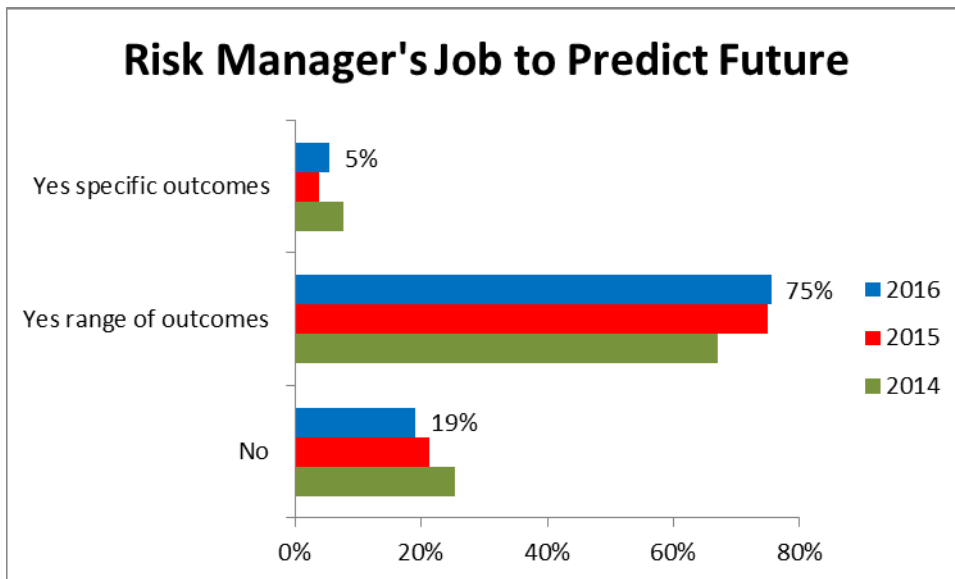
For those who answered *Not sure*:

- *Anticipate yes, predict not so much*

- *If the crisis is a true Black Swan event, then no, but depending on the data being analyzed, there are certain events that can be avoided if you are analyzing the data correctly.*
- *Crisis is ill-defined. Depends on the severity of it. Usually, no.*
- *I am a retired actuary, and very interested in the development of ERM, but I have no practical experience.*
- ***You can do “what if” scenarios and stress testing to develop general responses to events of varying impacts both financially and operationally.***

**Question 3.** If you consider yourself a risk manager, is predicting the future part of your job?

- 5%/4%/8%                      Yes—specific outcomes
- 75%/75%/67%                Yes—range of outcomes
- 19%/21%/25%                No



**Question 4.** Comments

For those who answered *Yes—specific outcomes*:

- [Ed. Note: No comments were received]

For those who answered *Yes—range of outcomes*:

- *Thinking about potential outcomes and what can happen and implications—identifying risk tolerance*
- *Goal is not to predict but to prepare.*

- *“Those who do not learn from history, are prone to repeat past errors and mistakes.”*
- *Escalate aspects of items that are foreseeable but not being addressed*
- *Possibilities are anticipated.*
- ***While one side of risk management is about accurate predictions, the other piece is monitoring and mitigation. By actively monitoring risks and having mitigation strategies prepared should a risk move in one direction or another.***
- *Understanding risk requires an understanding of outcomes and the many and varied paths that lead to those outcomes.*
- ***Range of POSSIBLE outcomes***
- *Predicting the future isn't a fruitful exercise; positioning yourself for possible future events is a better approach.*
- *Financial projections under various assumptions and scenarios*
- *The future that can be predicted is when the history is repeated.*
- ***Making guesses about things that may happen is equivalent to being lost in a garden of forking paths.***
- ***Actually both specific outcomes and range of outcomes***
- *Our job is to make sure what the outcomes might be if the base case prediction or expectation is wrong.*
- ***My job is to make my clients think about scenarios they have not previously considered—mostly plausible ones, but also extreme ones.***

For those who answered No:

- ***All you can do in my opinion is identify the relative sizes of risks and discuss what you can live with and what you can live without.***
- ***My role is to understand the sensitivity of company results to potential events, but not to predict when they might occur. The goal is to put tools in place to allow for good decision making if an event occurs and to reduce the likelihood/impact of a potential event within a reasonable cost.***
- *Preparing for the future, not predicting it*
- *No one can truly predict the future.*
- ***It is the communication of the possibilities, not the predicting of the future that is critical.***
- ***I don't predict the future; I help the company fathom a future that is different from their “expectation.”***
- *Our job is to accurately identify uncertainty (risk) and help company to appropriately balance risk/reward. Predicting the future, even a range of outcomes, is generally not possible (although likelihood of outcomes is)*



**Question 5.** A bubble occurs when price significantly exceeds the valuation justified by fundamentals. This can occur to assets, liabilities, the economy, etc. Are there bubbles that you have identified in today's environment?

- Yes
- *Real estate is nearing bubble status.*
- *Stock prices*
- ***Currencies themselves are in a bubble. There will be a coming reset which will go back to a pseudo-gold standard.***
- ***I'm concerned that loose monetary policy will eventually lead to inflation. I expect that when the tide turns, it will do so more quickly than most expect.***
- Yes
- No
- *Identified is a strong word, everything is relative.*
- *ETFs*
- *Low interest rate environment has put pressure on nontraditional asset classes and decreased yields there, not commensurate with the underlying risk.*
- ***Technology stocks and high-end real estate***
- *Yes, regional housing prices (e.g., Toronto Condos)*
- *Money supply*
- No
- *Certain asset sectors*
- No
- Yes
- *Currency; demand for assets vs. available investable assets*
- No
- ***Student loans and health care. Too much government money is being pumped into the system.***
- *Not certain—interesting question. Bubbles probably always exist. If interest rates are artificially low, maybe a bubble exists. If stakeholders are taking too much risk (driving up equities), maybe a bubble exists. Are houses overpriced connected with interest rates?*
- Yes
- *No. Skeptical of the whole concept of bubbles . . .*
- *Not in the context of this question*
- *We are trying to identify bubbles, but haven't succeeded yet.*
- ***Pockets of the Canadian housing market***
- ***The price of prescription drugs because of copyrights/intellectual property rights, have made access and affordability of drugs a problem for North America healthcare systems.***
- *Housing, startups, impact of media*
- Yes

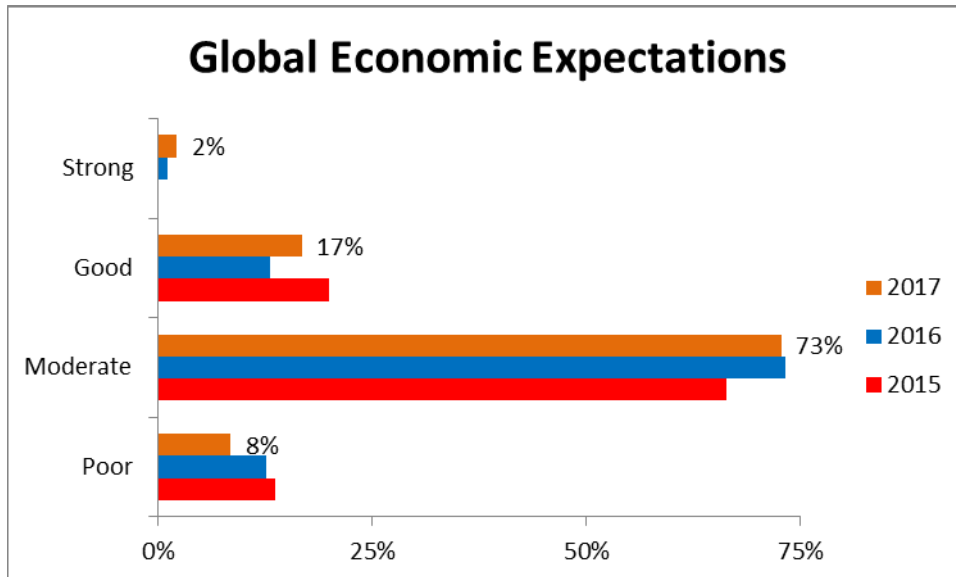
- *Yes*
- *No*
- *No*
- *No*
- *Not currently, but have in the past for my industry (departure of competitors/insurance carriers)*
- *Assets appear to be overvalued*
- *Sorry, that is not publically disclosed information.*
- *Yes, but not authorized to disclose*
- *Housing*
- *I suspect there is a bubble in equity prices and bond prices due to excess capital held by companies and very low Treasury yields. Though there are plenty of articles in the news stating the rationality of equity prices.*
- ***In short, everything bought up by the European Central Bank is too expensive.***
- *Persistent low interest rates leading to bubbles in equity & lower grade bond markets, U.S. dollar*
- *No*
- *Real estate*
- *Yes—the housing bubble*
- *No*
- *Canadian real estate, bond price*
- *This is a black swan. I'll go out on a limb and say, "the S&P 500's market value highly exceeds the value justified by fundamentals," so 18 months from now (enough time for Trump to have an impact), I can say, "I told you so!"*
- *Real estate in selected markets*
- ***Import/Export gap with China***
- *Concerns over certain asset classes, but not "bubble" yet*
- *Stock market*
- *Yes*
- *Stock market*
- *Assets, housing; liabilities government*
- *Fx based products (Ed. Note: fx is a common abbreviation for currency)*
- *Residential prices in Canada*
- *Common stocks could be approaching a bubble in the United States given the run-up with a new, untested presidential administration with many rigid, nonthinkers being considered for key positions.*
- *Stock market*
- *Medical costs, Education costs, CEO compensation*
- *No. Not specifically focused on this issue.*
- *No*
- *There are significant asset bubbles that you can see in the real estate market from time to time.*

- *Student loans*
- *No*
- *U.S. large cap equities in selected industries*
- *NA*
- *U.S. equities appear to be in a bubble.*
- *Canadian real estate*
- *Yes—almost always are bubbles*
- *Debt bubble, in that the consequences of current public (and to a lesser extent private) debt is not well understood*
- *Housing prices*
- *Yes, certain classes of assets*
- *Not specifically but concerned that certain market prices are too high*
- *No*
- *Bonds, index life/annuity products*
- *Financial institutions share prices.*

## Section 5: Current Topics

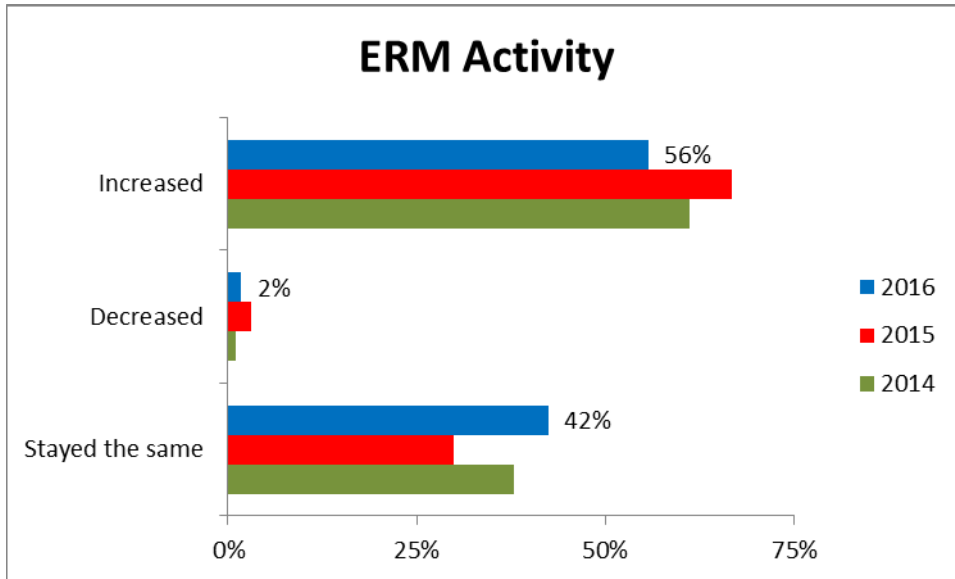
**Question 1.** Your expectations for the 2017 global economy are:

- 8%/13%/14%      Poor
- 73%/73%/66%    Moderate
- 17%/13%/20%    Good
- 2%/1%/0%        Strong



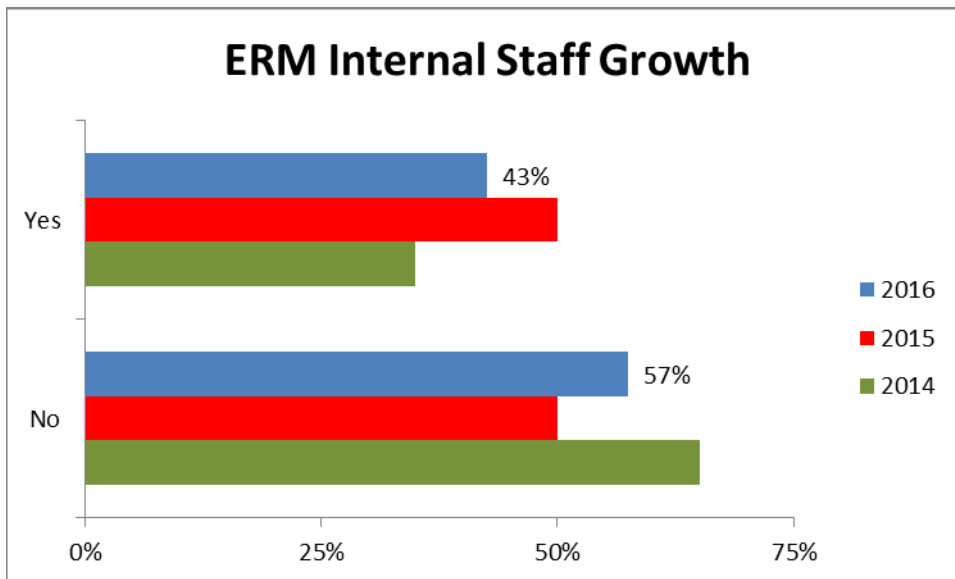
**Question 2.** Did you experience a change in the level of ERM-focused activities for your organization or clients in 2016?

- 56%/67%/61%      Increased
- 2%/3%/1%        Decreased
- 42%/30%/38%    Stayed the same



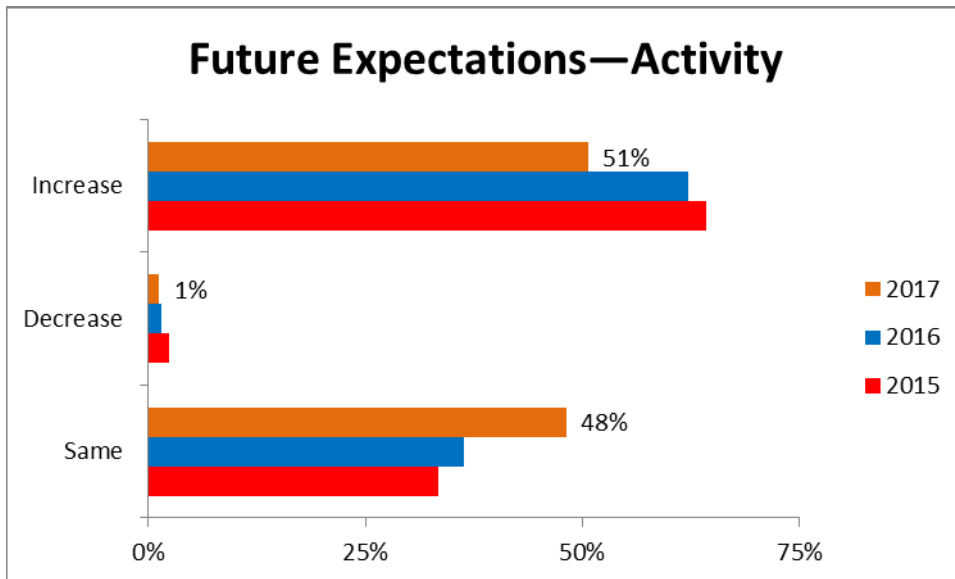
**Question 3.** Did your internal ERM staff increase in 2016?

- 43%/50%/35%      Yes
- 57%/50%/65%      No



**Question 4.** Do you anticipate a change in the level of ERM-focused activities for your organization or clients in 2017 relative to 2016?

- 51%/62%/64%            Increase
- 1%/2%/2%             Decrease
- 48%/36%/33%        Stay the same



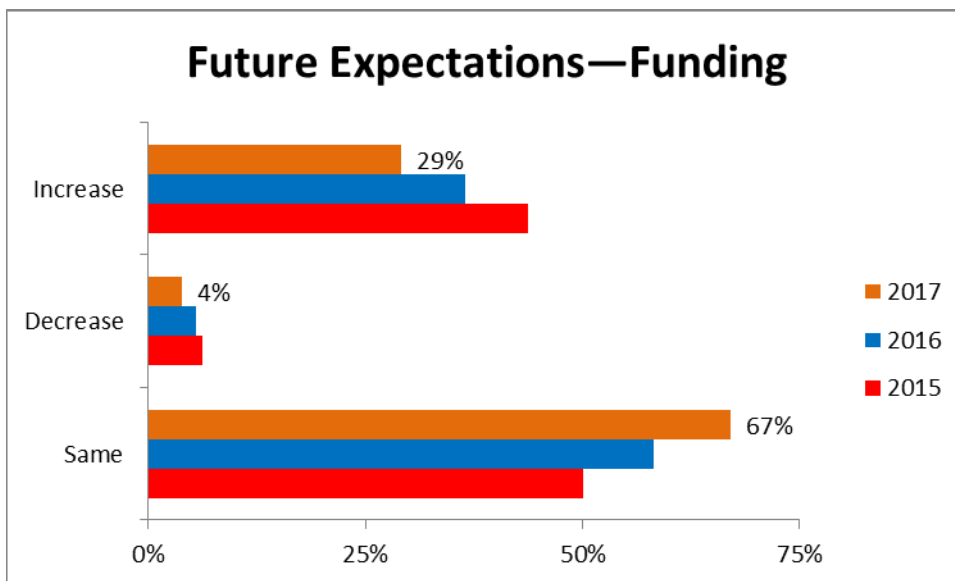
**Question 5.** What activities are being added?

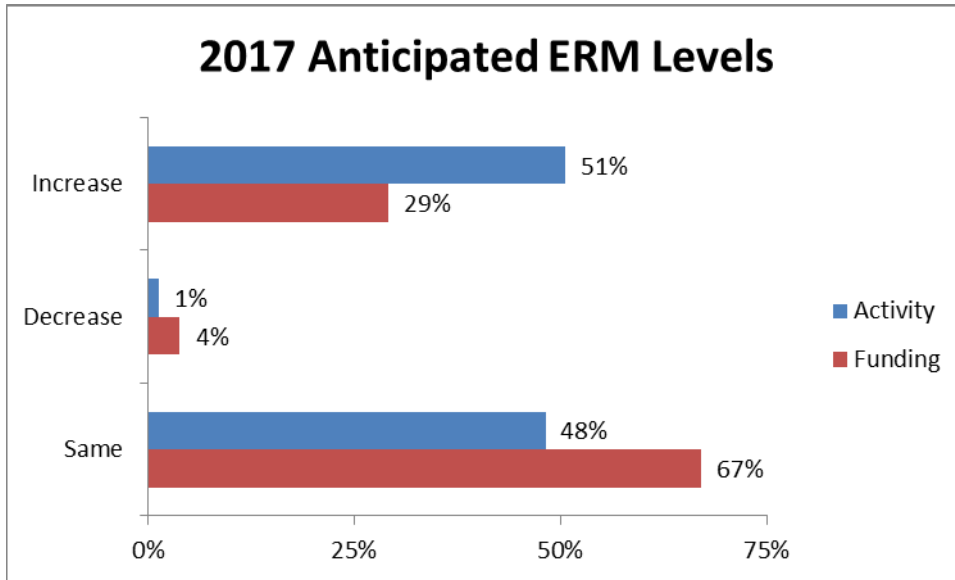
- *No explicit focus on new activities*
- *More intense reporting*
- ***Loss Data Collection, Fraud Consolidation, Process Mapping***
- *Not added but rather continued expansion of activities*
- *Assessment of risk at lower levels (within business units, by specific risk categories)*
- *Policies procedures and documentation for assumptions and models in light of **principle based valuation***
- *None*
- *Quantitative risk assessments*
- *Economic capital*
- *None—we will continue the same process.*
- *Larger Model Risk Management Efforts*
- *International operation oversight*
- *Control Assurance, Projects and Shared Services, Strengthen Insurance Risk*
- *Final stages of broad implementation*
- *None that I can disclose*

- **Greater collaboration across group companies**
- *Expansion of existing activities; Model Risk Management, Strategy, Vendor Risk*
- *Better view on operational risk*
- *Additional personnel*
- *Implementing ERM*
- *Risk reporting and expanding model governance*
- *Deeper analysis and modeling*
- *More scenarios*
- *Relate capital to risk*
- *Modeling and simulations*
- **Risk dashboard, register, tolerances and action plans. Scenario and stress testing.**
- *Own Risk and Solvency Assessment, Solvency Control Levels*
- **ORSA**
- *More reporting, more operational risk, more governance*
- *More focus on higher risk products and regions*
- *Data science approaches*
- *Economic reactions to political fallout, climate change scenarios*

**Question 6.** Do you anticipate a change in the level of funding dedicated to ERM-focused activities for your organization or clients in 2017 relative to 2016?

- 29%/36%/44%      Increase
- 4%/5%/6%        Decrease
- 67%/58%/50%    Stay the same

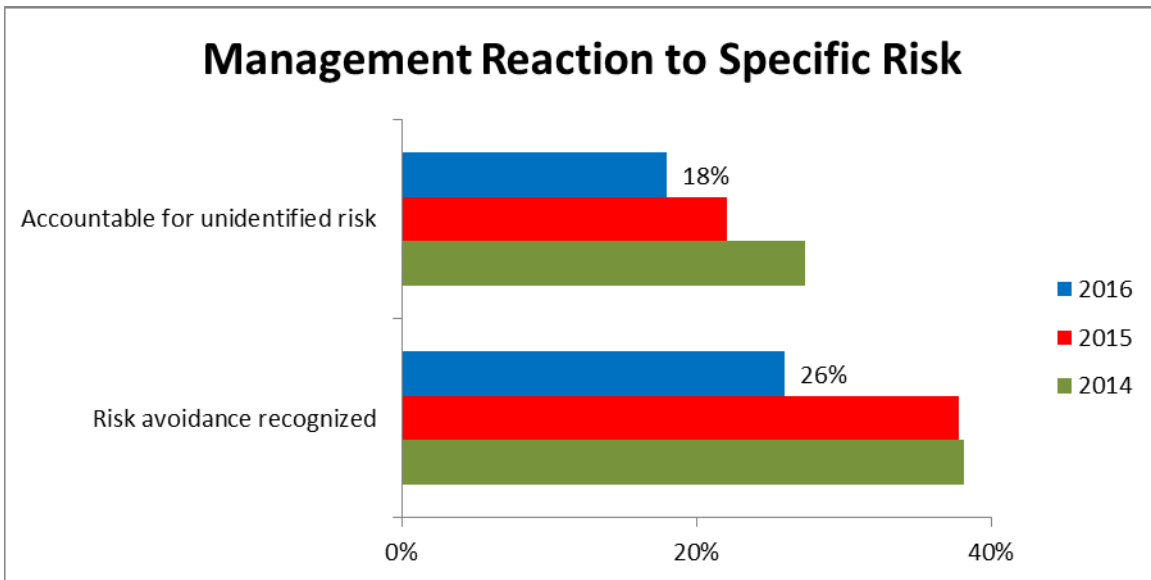




**Question 7.** The true measure of an ERM program is how it is received by the board and senior management. Which of these is true in your situation? (Please select all that apply.)

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

- 16%/25%/24%      Our ERM function can say no to a strategic opportunity.
- 42%/53%/63%      Our ERM function has input but not a vote when a strategic opportunity is being considered.
- 46%      Our ERM function has input and a vote when a strategic opportunity is being considered (new response in 2016).
- 94% report that at least one of the preceding is true.
  
- 6%/9%/13%      Our ERM function has no input when a strategic opportunity is being considered.
- 26%/38%/38%      If the firm avoided a risk identified by the ERM department, the value of the department is recognized.
- 18%/22%/27%      If the firm was subjected to a risk not identified, the ERM department would be held accountable.



#### Comments/Examples

- *In practice, saying no to a strategic opportunity is achieved through discussions leading up to the decision being finalized to ensure that all issues are flushed out.*
- *Chief Risk Officer is a voting member of the top level management team.*
- *Increased effort to reduce unknown unknowns*

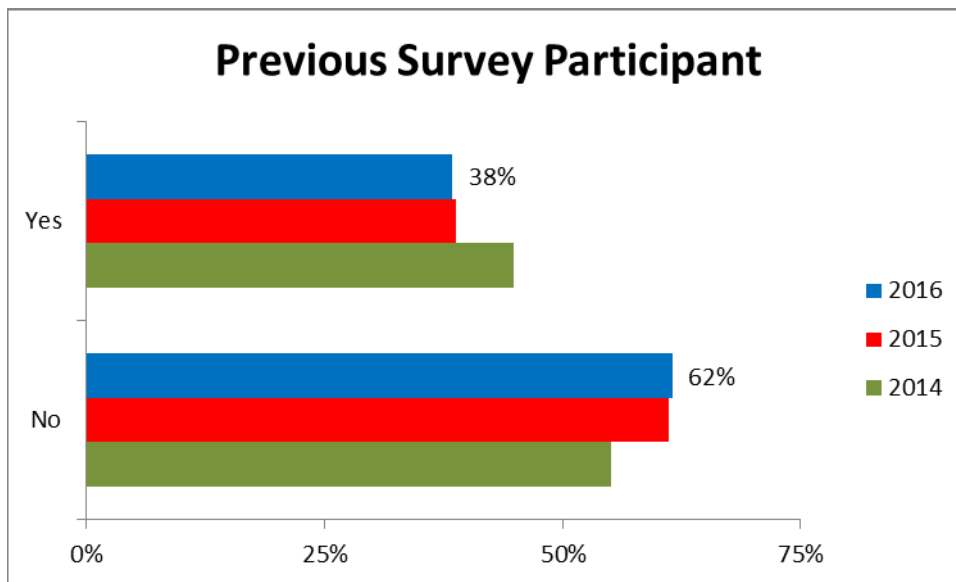


## Section 6: Demographics

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

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

- 38%/39%/45%      Yes
- 62%/61%/55%      No



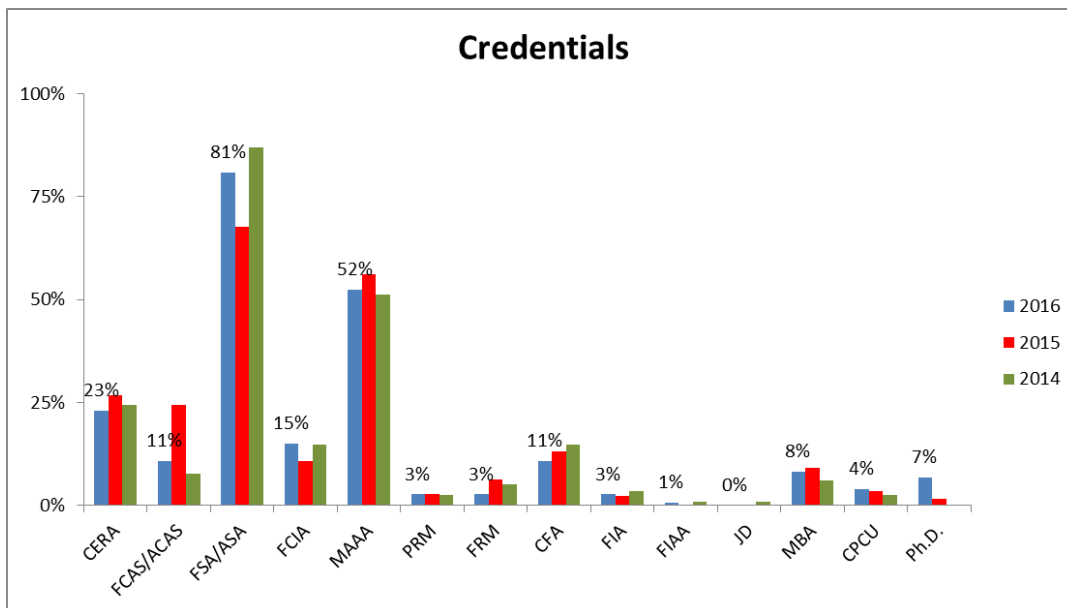
**Question 2.** What credentials do you currently hold? (Please select all that apply.)

**349 responses from 147 surveys (2.4 average)**

Percentages are based on 176 surveys

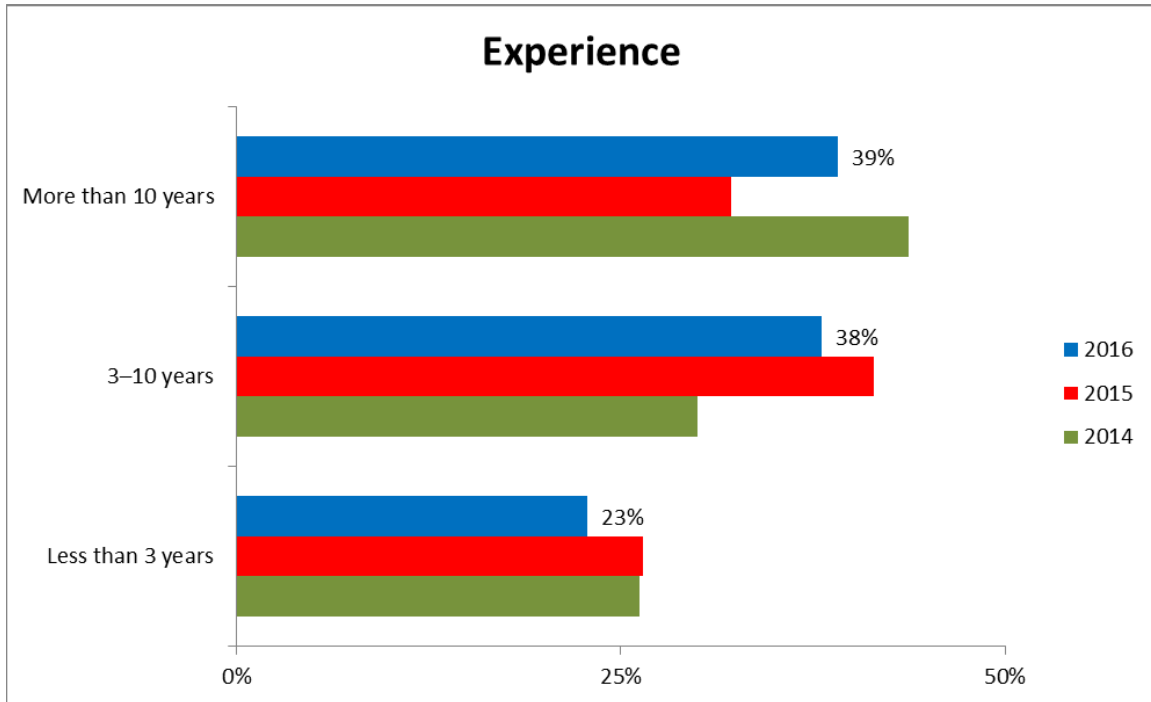
- 23%/27%/24%      CERA
- 11%/24%/8%      FCAS/ACAS (Fellow/Associate, Casualty Actuarial Society)
- 81%/68%/87%      FSA/ASA (Fellow/Associate, Society of Actuaries)
- 15%/11%/15%/10%      FCIA/ACIA (Fellow/Associate, Canadian Institute of Actuaries)
- 52%/56%/51%      MAAA (Member, American Academy of Actuaries)
- 3%/3%/3%      PRM (Professional Risk Manager, PRMIA)
- 3%/6%/5%      FRM (Financial Risk Manager, GARP)
- 11%/13%/15%      CFA (Chartered Financial Analyst, CFA Institute)

- 3%/2%/3%
  - 1%/0%/1%
  - 8%/9%/6%
  - 4%/3%/3%
  
  - 7%/2%/0%
  - 3%/5%/3%/9%
  
  - 14%/19%/19%
- FIA (Fellow, Institute of Actuaries)
  - FIAA (Fellow, Institute of Actuaries of Australia)
  - MBA (Master of Business Administration)
  - CPCU (Chartered Property Casualty Underwriter, The Institutes)
  
  - Ph.D. (Doctor of Philosophy)
  - Other actuarial credential (please specify)
    - German actuary DAV
    - Israeli FIAA
  - Other non-actuarial credential (please specify)
    - ACCA
    - FLMI (7)
    - CLU (3)
    - ChFC (1)
    - CPA (3)
    - EA
    - FCA
    - ERMCP
    - CRM
    - ERP
    - FALU
    - FFSI
    - RHU
    - Series 7,24
    - Masters (2)



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

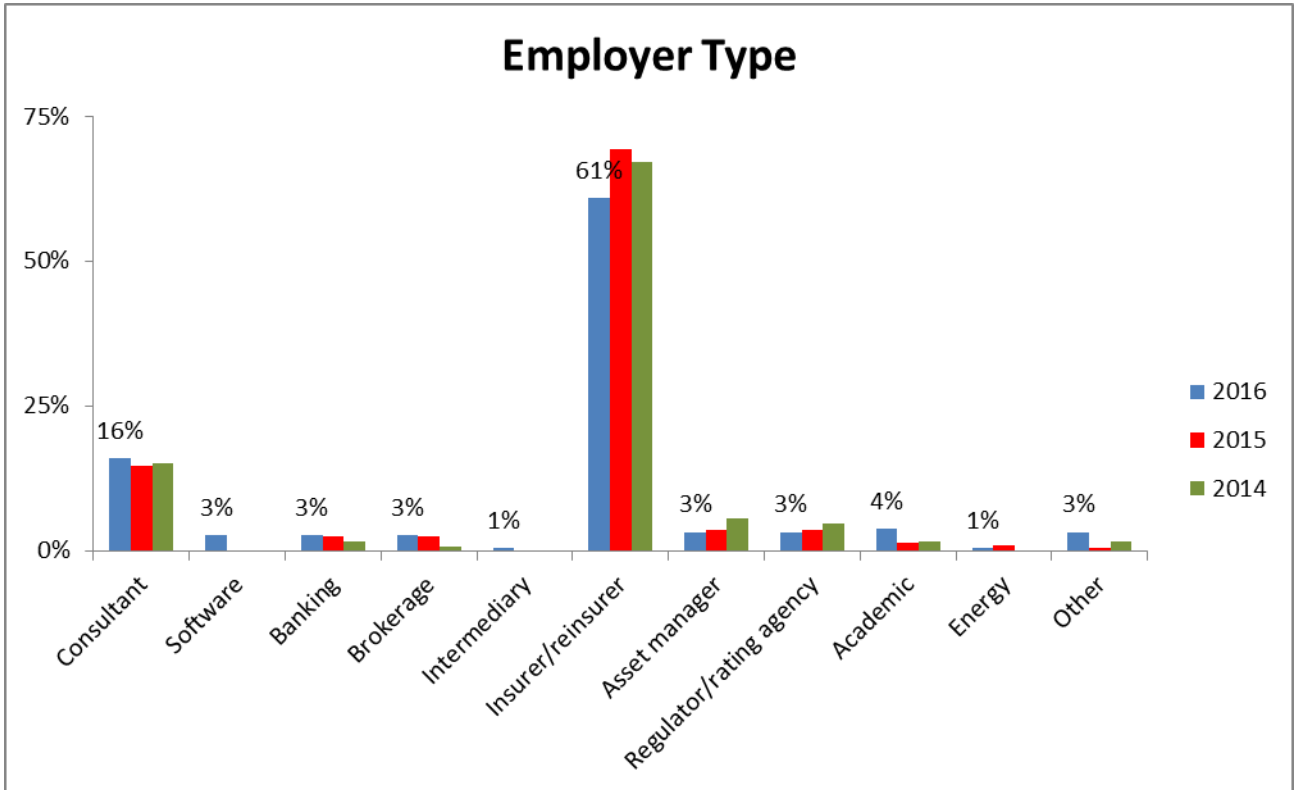
- 23%/26%/26%      Less than 3 years
- 38%/41%/30%      3–10 years
- 39%/32%/44%      More than 10 years



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

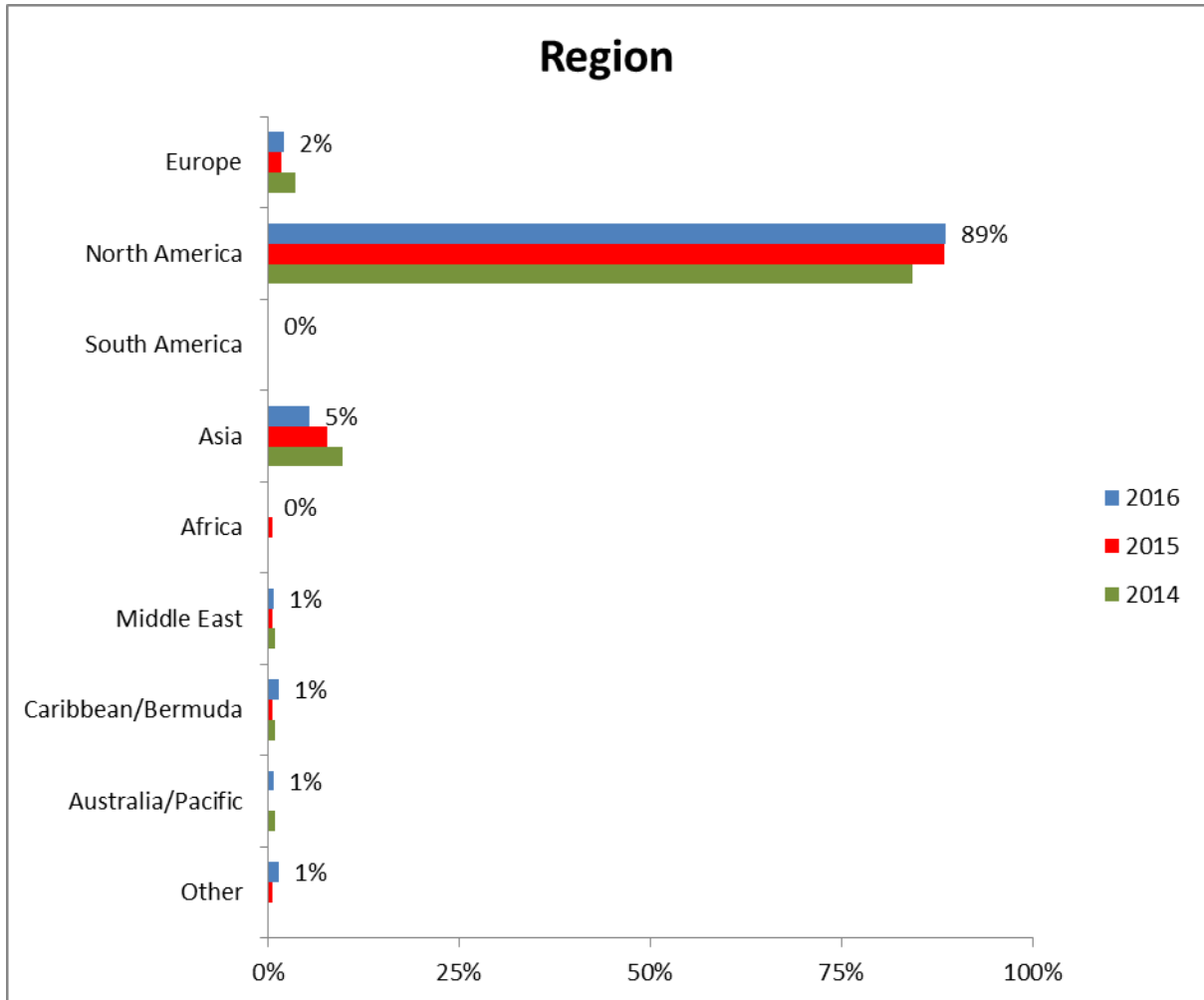
- 16%/15%/15%      Consultant
- 3%/0%/0%          Software
- 3%/3%/2%          Banking
- 3%/3%/1%          Brokerage
- 1%/0%/0%          Intermediary
- 61%/69%/67%      Insurance/reinsurance company
- 3%/4%/6%          Asset management
- 3%/4%/5%          Regulator/rating agency
- 4%/2%/2%          Academic
- 0%/0%/0%          Manufacturing/services
- 1%/1%/0%          Energy
- 0%/1%/2%          CRO at CRO Council firm
- 0%/0%/0%          CRO at CRO Forum firm
- 3%/1%/2%          Other
  - Sole trader

- Fraternal Benefit Society
- Scientist
- Public sector
- Telecommunications company
- CRO at tier banks



**Question 5.** Primary region (Please select one.)

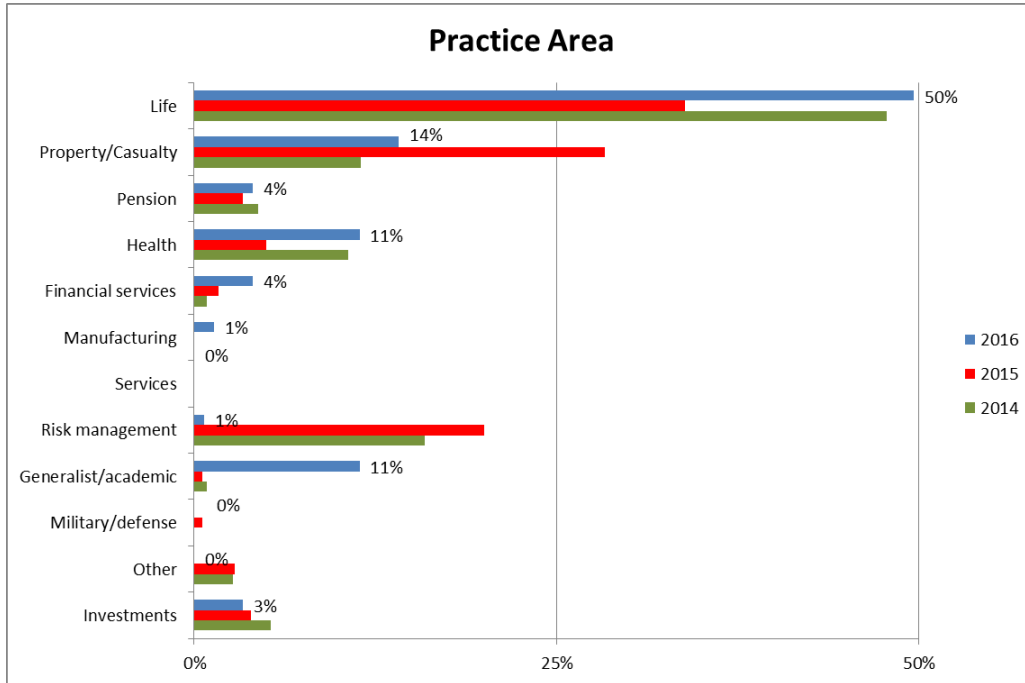
- 2%/2%/4%      Europe
- 89%/88%/84%      North America
- 0%/0%/0%      South America
- 5%/8%/10%      Asia
- 0%/1%/0%/0%      Africa
- 1%/1%/1%      Middle East
- 1%/1%/1%      Caribbean/Bermuda
- 1%/0%/1%      Australia/Pacific
- 1%/1%/0%      Other
  - Both Israel and North America
  - Combination of AU, USA, EU



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

- 50%/34%/48%      Life
- 14%/28%/12%    Property/casualty (general insurance, nonlife)
- 4%/3%/4%        Pension
- 11%/5%/11%     Health
- 4%/2%/1%        Financial services (noninsurance)
- 1%/20%/16%     Risk management
- 11%/1%/1%/1%   Generalist/academic
- 0%/1%/0%        Military/defense
- 3%/4%/5%        Investments
- 0%/3%/3%        Other
  - IT and Risk Management Academics, Pension and Health Actuary

- Regulatory Advocacy
- Research
- ERM for group of companies (P&C, Life, Investment)
- Corporate responsibility & Environment



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

- *General reading from a broad base of sources / Knowledge about current asset prices and acquisition levels*
- *Newspapers, Bloomberg*
- *Stock market indices, Treasury and swap spreads*
- *Large reinsurers and brokers*
- *World Economic Forum, CIA, SOA, Swiss Re SONAR report, CEB Inc.*
- *KPMG emerging risk survey / General searches across various risk management websites—e.g., CRO forum, GARP, MetricStream*
- *Earthquake notification APP. Harvard Business Review. London Financial Times. News Clipping apps.*
- *WEF; Banana Skins report*
- *Financial Times, Bloomberg*
- *Colleagues / Risk articles from many sources*
- *SOA website*
- *Periodicals—particularly business/investment-focused*

- *Would be helpful to publish results and publication on emerging risks (website)*
- *Internal administrative data, WSJ, news*
- *regulatory updates*
- *World Economic Forum*
- *New articles (technology, health, business, politics related)—CBC, Wall Street Journal, National Post*
- *Legitimate media (NY Times, etc.) / Industry activities (NAIC, BCBSA, SOA) / **Real science (MIT, other universities)***
- *Annual reinsurer surveys / WSJ*
- *I read the Wall Street Journal every day. I read the **Economist magazine** every week. I read the **Atlantic magazine** every month.*
- *Lawyer publications, CRO forum, Reinsurance websites*
- *The Economist, **Scientific American**, Government sources*
- *The Economist / Science fiction*
- *Lists provided by friends, industry publications and just gathering from client discussion*
- *Newspapers, actuarial publications*
- *Random conversations*
- *Joint Risk Management Section Publications*
- *The Economist is the best publication out there for this type of thing.*
- *Actuarial Magazines and Newspapers*
- *Wall Street Journal, Financial Times, **www.insuranceerm.com***
- *World Economic Forum, colleagues*
- *Other industry emerging risk surveys*
- *Twitter, SOA research*
- *internet-SOA website, flipboard, Google*
- ***Multiple daily briefings from The Hill; Daily e-mails from BenefitsLink Health and Welfare newsletter; Health Care Weekly (although it is overpriced); NY Times, Charles Schwab investment reports***
- *Newspapers, magazines, Internet articles*
- *SOA Joint Risk Management Forum resources; Risk Management newsletter; **SOA ERM syllabus***
- *News*
- *Corporate Executive Board / Daily news reports*
- *Newspapers, media news, travel*
- *WSJ, NACD, JRMS*
- *Exchange of opinions with colleagues, Selected Publications and Books*
- *Economist, **National Geographic, Smithsonian (history repeats)***
- *WEF, **Marsh Survey, Allianz Survey, NC State Survey (ERM Initiative)***

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

- *Ask Thomas Piketty to complete it.*
- *None*
- ***Seems to require more than 15 minutes, so upfront disclosure on that would be appreciated. /—Shrink the boxes in size so you can see the big lists of risks on one page. On my screen, I had to scroll and couldn't see all 15 (or so) risks at the same time.***
- *This was nicely constructed. I'll be interested in seeing results.*
- *Interesting survey—thank you*
- *NA*
- *I'd be interested in some kind of survey around how insurers implement and manage "emerging risk" programs within ERM.*
- *Could one be done by COO and adapted accordingly?*
- *This is a pretty good survey.*
- *Drop the focus on "canned" lists from global organizations.*
- *Keep working at it.*
- *None*
- *Differentiate between short- and medium-term risks*
- ***I like the idea of sharing examples where "the second line of defense" actually identified a risk that the first line missed, with a demonstrable better decision being made. Unfortunately nothing of intrinsic or entertainment value will ever be shared publicly because all the good "here's where we screwed up and here's how we tried to fix it," stories can't be shared publicly! But it's still fun to talk to the senior pricing actuaries who say entertaining things like, "I'll be retired for years before anyone knows if this makes money or not."***
- *Pretty long . . .*
- *None presently. Interesting.*
- ***It may be worth having two defined sections, professional or industry-related risk and secondly outside of industry risk concerns.***
- *The survey was well designed and easy to complete. Thank you for your efforts.*
- *No*
- *Not at present.*
- *Uncover views on the unknown unknowns*

Thanks for your participation!



[Researcher's notes for future questions]

- Add questions probing.
  - Ask open-ended question about unknown knowns.
  - Move bubble question to follow “Where do you find opportunities?” question (consider rewording S1 Q8).
  - Split S5 Q7 into 2 questions.
  - S6 Q2 check how other actuarial credentials are entered.
  - Low probability crisis you worry about
  - What actions do you take between crises to remain influential?
  - How prepared is your firm for a major risk event that has never happened before? (resilience)
  - Consider expanding *Natural catastrophe: tropical storms* to include inland convective storms or make clear it is with “other.”
  
- Make clear in survey intro that long time horizon should be used for Section 1 but that other questions will have varying time horizons.
- Create a question that talks about avoiding a bad outcome rather than “timing the market”—seems like this is where winners reside.
- Risk combination 1—what metrics are used?
- Technology—definition should include drones, self-driving cars, 3-D printing.
- Consider moving interconnectedness of infrastructure.

## **Appendix III—Survey Results 2015 and Earlier**

Detailed results for prior surveys can be found at <http://www.soa.org/Research/Research-Projects/Risk-Management/research-emerging-risks-survey-reports.aspx>.