

# THE Actuary

VOLUME 16 ISSUE 6

DEC 19  
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Financially literate?

All in a day's work

Changes in the East

## GOING FOR GOLD

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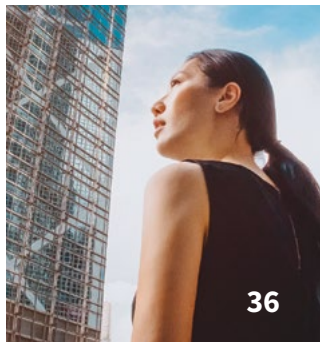
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*The Actuary* received an honorable mention in the 2019 FOLIO: Ozzie Awards for Overall Design (Single Magazine Issue, Aug/Sep 2018).



# THE Actuary

VOLUME 16 ISSUE 6

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PHOTO: STEVE UTASKI

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**POSTMASTER: Send address changes to the SOA, c/o Communications Department, 475 N. Martingale Rd., Schaumburg, IL 60173-2226.**

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# Weathering the Winds of Change

Following is an excerpt from Andrew D. Rallis' presidential luncheon speech at the 2019 SOA Annual Meeting & Exhibit. Read or view more online at [bit.ly/Rallis-SOA](http://bit.ly/Rallis-SOA).

**S**erving as Society of Actuaries (SOA) president means I can both give back and pay it forward. I believe I'm here at the right time. Throughout the year, I will continue to listen and communicate with transparency to members, while keeping pace with the challenges and opportunities fast approaching our profession.

Let me pause for a word of thanks to our immediate past president Jim Glickman. He has been a model of volunteerism, giving us year after year of his time, helping young people start their careers, working on committees, serving on our Board and as president. Jim has left the SOA as strong as

it has ever been, with a growing membership and volunteer base, and he has strengthened relationships with our sister actuarial organizations.

I have been handed the baton, and what happens next to the profession depends on us. There are strong winds of change that could threaten to blow us backward, but if properly harnessed, could propel us forward. To turn these headwinds to our advantage, I plan to focus our attention in three areas:

- » Globalization of the industry and the profession
- » New technologies such as artificial intelligence (AI)
- » Transforming our leadership abilities to help meet the needs of our constituents

Our work as actuaries is global. Many actuaries work for companies that are owned by foreign entities or for companies that themselves own foreign entities. That alone means actuaries are often called on to work across borders and to be familiar with different regulators. But more so, our actuaries today are increasingly mobile and may work for one type of company in one part of the world and move on to work in a completely different kind of company or role in another part of the world.

Consider the stories of two SOA members who I count amongst my closest friends and colleagues.

Lisa Kuklinksi, FSA, MAAA, started her career in a way very similar to me—at the student program at MetLife.



PHOTO: ADAM DONOHUE

**ANDREW D. RALLIS**, FSA, MAAA, is president of the Society of Actuaries. He can be reached at [arallis@metlife.com](mailto:arallis@metlife.com).

In fact, we both attended Stuyvesant High School. Early in her career, she jumped on the opportunity to take a rotation in Mexico, which she eventually parlayed into the chief actuary role of U.S. and Latin America for MetLife. She has served on the SOA's Latin America Subcommittee. She is newly elected to the SOA Board and will now lead our International Committee as chair.

Or, consider Siyi Sun, FSA, CERA, MAAA. I first met Siyi when MetLife acquired the ALACO division of AIG, where she worked in the valuation department. She earned her bachelor's degree from Shanghai Jiao Tong University and her master's from Arizona State. I had the honor of mentoring Siyi in MetLife's International Asset/Liability Management practice, and then in our Asia regional chief actuary role in Hong Kong. Now she is the general manager and CEO of MetLife's China joint venture.

These are only two of the remarkable actuaries who developed their careers in ways to rise up and meet the globalization of the profession. I know there are many more. We can no longer take for granted that our careers will begin and end in the same geography, or that we can safely ignore developments in other parts of the world. That's why the work of our International Committee is so important. The SOA has subcommittees focused on China, greater Asia and Latin America. I intend to make that work a priority, and I hope you'll join me in that effort. You will see us continue our International Strategy Review and stay fully committed to our work with the International Actuarial Association Renewal Task Force.

You can expect our pre-qualification syllabus to underscore the influence of international business issues, such as International Financial Reporting Standards (IFRS), so you, too, can cross those borders and bring the SOA's highest standards to new markets.

And while we continue to stretch our arms around the globe, we're going to fully embrace AI, too. In fact, actuaries have been embracing new technologies for decades. Anyone remember when it was state-of-the-art to use thick volumes of commutation tables to compute actuarial values? How much have our lives already changed with the use of distributed processing, simulation models based on first principles and, most recently, predictive analytics?

Now, AI will disrupt our work again, and, like before, if we expand our toolkit accordingly, we'll be able to incorporate AI into our work. As actuaries, we can harness our skills to transcend any given technology.

To see what I mean, consider an actuary like Carlos Brioso, FSA, CERA. Carlos is director at the Center for Data Science and Analytics at New York Life. I don't know Carlos personally, but I have been following his story due to another enviable title he earned: Kaggle Competition Master.

My aspiration for the SOA is that we be the place where young professionals get to work side-by-side with actuaries like Carlos and other AI pioneers.

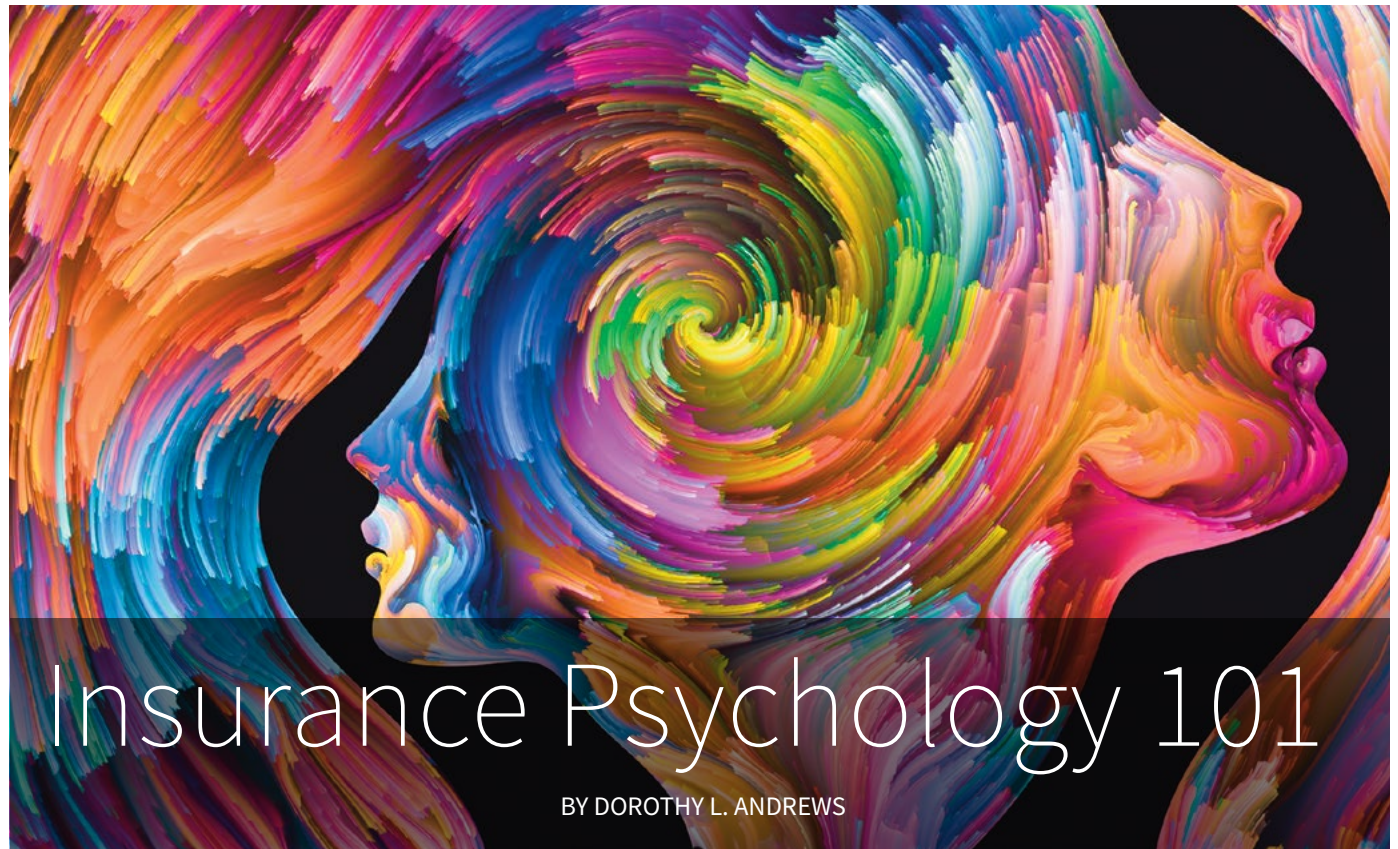
Last, I want to talk about the transformation I think we as actuaries must pursue to take our leadership to the next level. This will require us to rise to the challenge in four key areas:

- » Excellence
- » Listening
- » Integrity
- » Creativity

The first is excellence. In a way, globalization and AI are aspects of this. We must know when, where and how to bring the right technology into play to solve the problems of our stakeholders. Excellence is what they expect of us. However, before we can solve those problems, we must truly understand them—which is why “listening” is also foundational to leadership. And “integrity” is closely linked to professionalism—how we go about our work matters as much as arriving at the right answer. Finally, “creativity” is a key ingredient. No machine can take the place of human ingenuity. It means looking deeper at the problem than an algorithm can. It means looking at the big picture.

To fulfill my vision of enhancing the SOA in these areas, I'm going to need your help. My fellow board members and I will be listening for your ideas in a variety of ways throughout the year. I know this year is going to go by fast. Whether in the areas of globalization, AI and transforming, I'll need your help and guidance along the way.

Please, please volunteer your time and share your views. I'm a good listener, and I promise your ideas will help me secure the profession for future generations. ■



# Insurance Psychology 101

BY DOROTHY L. ANDREWS

SHUTTERSTOCK

*Understanding the psychological profile of consumers will be key as we become more connected through technology and more disconnected interpersonally.*

**ONE THING WE HAVE LEARNED SINCE THE ARRIVAL OF INSURTECH IS CONSUMERS ARE SHAPING THE FUTURE OF INSURANCE.** The consumers of the future are psychologically needy, and they want insurers to respond to their individual needs with products that are easy to understand and acquire, cost-efficient, well-managed and provide protection for their long-term needs through retirement.

Millennials, the first generation born digital, are the most studied generation to date. We know what they want, how they want it and at what price. We also

know this generation is burdened with more than \$1 trillion of debt.<sup>1</sup> In fact, this group is saddled with more student loan debt than any previous generation,<sup>2</sup> and this debt load is delaying their acquisition of the proverbial American dream. The 80–95ers, as they are referred to by some, currently aged between 24 and 39, have more than \$300 billion in outstanding student loan debt. Mortgage debt is their second largest debt component—but it is only a fraction of the mortgage debt load of previous generations.

The reluctance of millennials to finance the

American dream of their ancestral generations is largely credited to the fact that they lived through the financial crisis as children. Seeing their parents struggle through the financial crisis and witnessing many people lose their homes mutated a fundamental change in the psychological DNA of millennials. They are more fiscally conservative and more socially responsible, gravitating toward brands that align with their values. They have a lower average net worth than Generation X due to a lower rate of homeownership, but they have higher average retirement savings and more education.



This evidence may not suggest a need for financial literacy, were it not for their accumulating levels of credit card debt. A 2019 study conducted by Experian<sup>3</sup> revealed millennials carry less credit card debt than the national average, but it is rising. The average debt for millennials rose 7 percent over last year's levels, the second largest increase over other generations. Generation Z crossed the finish line first with a credit card debt increase of 11 percent over last year. A major factor influencing credit card use among young people is points rewards programs. The top contenders of this generation of "point chasers" are purchases of groceries, dining out, hotel stays and airline tickets, with men more likely than women to use credit cards just for the rewards.<sup>4</sup>

The need for financial literacy for millennial and younger generations could not be greater, and it presents a golden opportunity for insurers to develop financial IQs and establish long-term bonds with maturing consumers. The future of long-term care insurance, for example, is especially dependent on new premiums for its viability. Insurers can be instrumental in developing literacy programs for such long-term plans of care, improving competencies

regarding the complexities of these products in step with consumer maturation levels. The rock 'n' roll band Gooding<sup>5</sup> is using their music to help high school students become more financially literate. They were the guest entertainment at the 2019 Global Insurance Symposium sponsored by the Iowa Department of Insurance. Commissioner Doug Ommen endorses using rock bands to get kids excited about financial literacy, saying "the fit is very natural."<sup>6</sup> He points out: "A lot of times as we look at our industry, the companies are grappling with how to reach consumers. We thought it would be appropriate to bring financial literacy together with the innovation that is highlighted in the Global Insurance Symposium." Insurance companies can follow this lead with outreach to future consumers of insurance products by aiding in the development of their financial literacy, creating early bonds that will last into adulthood.

The digitization of insurance is an important mechanism to reach future consumers of insurance, satisfying one of three basic psychological needs for optimal functioning and growth: connectedness. It is unlikely the psychologists Dr. Edward Deci and Dr. Richard Ryan

were thinking of digital technologies when they introduced their Self-Determination Theory in 1985, prescribing the human need for autonomy, competence and connectedness to sustain a sense of well-being and to flourish. Younger generations are dictating how they want to be connected to their environment and others, and digital technologies are native to their ecology. We as a species are evolving, but our reptilian brain, the oldest of our three cerebral structures, remains relevant. It controls our autonomic responses, making quick decisions using immediate stimuli. The more simplistic the input, the more rapid and efficient the decision-making. This translates directly to the design of insurance products: keep it super simple (KISS).

Welcome to "the future of insurance products" issue of *The Actuary*. The content is intended to help you examine how future trends in psychology-based consumer demands will influence the design, pricing, valuation and digitization of insurance. Media psychology is essential to appealing and understanding the insurance needs of future consumers whose native language is digital and a medium for human connectedness technology. Enjoy the issue. ■

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# The Future of Insurance is a Shared Responsibility

BY ANNETTE JAMES

*To move forward, companies need to see regulators as collaborators for consumer protection rather than as impediments to innovation.*

## **RECENT INNOVATIONS IN INSURANCE, FUELED BY TECHNOLOGY COMPANIES (INSURTECH),**

provide exciting new opportunities for cheaper, simpler, customer-centric insurance products. Using a variety of technologies like artificial intelligence (AI), machine learning, predictive analytics and mobile technology—as well as blockchain and distributed ledger technologies—companies are able to develop new products with new underwriting and distribution models to meet the

changing needs of today's consumers.

This environment provides a challenge to insurance regulators, as many of these innovations fall outside of the current regulatory structure. The primary role of the state regulator is to protect the consumer, which aligns well with the focus of the customer-centric InsurTech innovators. The divide is technology. Regulators need to find ways to work collaboratively with stakeholders to bridge the divide and determine the best

approaches to effectively regulate a rapidly evolving industry to protect the consumer, ensure a level playing field, and encourage healthy competition and innovation.

In a perfect world, consumer protection would be seen as a shared responsibility; the appropriate regulatory structure would be obvious to all stakeholders and would simply fall into place. But we are not there yet.

Insurers and InsurTech companies are eager to embrace the new technologies and sometimes

see the regulator as an impediment to innovation. Current regulatory restrictions related to rebating, producer licensing, distribution and marketing are among the laws that concern the companies driving technological innovation. Additionally, the length of time it takes to revise laws in every state in which a company operates is a source of frustration. Regulators' concerns include cybersecurity, data privacy, and solvency of regulated and currently unregulated entities.

So, how do we move forward?

Simply stated, you cannot regulate that which you do not understand. Regulators will need to collaborate with the technology innovators to better understand the types of innovations being developed and to identify the areas of regulation that may need to be revised, while educating the innovators on insurance law. Some states are already achieving this goal by hosting technology sandboxes, fashioned after the innovation hubs used in other countries, where technology companies meet with state regulators to have nonbinding discussions regarding insurance regulatory requirements as they relate to the proposed products, technology, models and processes.

Other states are considering using regulatory sandboxes, which allow technology firms and insurance companies to test their innovative products in a controlled environment while certain laws and regulations are waived. Earlier this year, Kentucky passed a law to create the first U.S. InsurTech regulatory sandbox. While some states have embraced the concept of regulatory sandboxes, some stakeholders are concerned that allowing some entities to operate outside of the insurance regulatory structure and avoid certain laws may be in conflict with the regulator's duty to protect the consumer and would create an unlevel playing field.

Regardless of the approach, to move forward, companies need to see regulators as collaborators for consumer protection rather than as impediments to innovation.

Regulators are also starting to use some of the same technologies used by the technology innovators. This will allow regulators to streamline current processes while developing a deep understanding of the benefits, risks and limitations of innovative technologies, which would facilitate effective communication with innovative companies.

Regulators may need to hire individuals with

technological expertise in areas such as predictive analytics and AI, and create new functional areas of oversight to effectively regulate the evolving insurance industry. However, tight budgets may restrict a state's ability to develop the required expertise.

One of the biggest risks to the actuarial profession, and by extension to the insurance industry, is reliance on other experts. The risk related to the dependency on third parties for critical information or processes will only grow as insurance companies increase their reliance on InsurTech firms to develop new and innovative products. Company actuaries and regulators alike have a responsibility to understand the information, models and products that third parties provide.

For example, some underwriting models are developed by data scientists or other professionals who are not subject to the actuarial standards of practice and may not fully understand insurance-specific limitations and requirements. It would be important for the creator of the model to provide sufficient documentation so the individual using or reviewing the model can evaluate its efficacy, appropriateness and compliance with insurance laws. Therefore, regulators

may need to reevaluate the level of transparency needed from insurers relating to the information provided by third parties and the extent to which these third parties may need to be regulated.

The National Association of Insurance Commissioners (NAIC) is currently working on several key initiatives aimed at ensuring insurance regulation keeps pace with the rapid rate of technological innovation. However, we all share responsibility for the future of insurance.

Risk and opportunity are two sides of the same coin. These new innovative approaches to insurance provide exciting opportunities for consumers. With sufficient foresight, diligence and collaboration, we can all work together to enhance these opportunities while mitigating the risk. ■



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(From left to right): Wai Ling Yung, Ed.D.; Andy Peterson, FSA, EA, FCA, MAAA; Jae Min Lee, FIAK; Greg Heidrich; Sheree Baker; Hyoyoung Kwon; and Karen Williams

PHOTO: MATT LEE

### The Institute of Actuaries of Korea Visits the SOA

The Society of Actuaries (SOA) had a special visit on Sept. 9 at its headquarters in Schaumburg, Illinois, from President Jae Min Lee, FIAK, and Senior Researcher Hyoyoung Kwon, of the Institute of Actuaries of Korea (IAK). The two IAK delegates met with SOA Executive Director Greg Heidrich; Andy Peterson, FSA, EA, FCA, MAAA, senior director, International; Sheree Baker, senior director, Governance; Karen Williams, project specialist, International; and Asia-Pacific Lead Wai Ling Yung, Ed.D.

During the meeting, there was a broad discussion on organizational best practices and opportunities for continued collaboration with a focus on professional development. The SOA looks forward to continuing its work with the IAK to service members, candidates, employers and universities in South Korea.

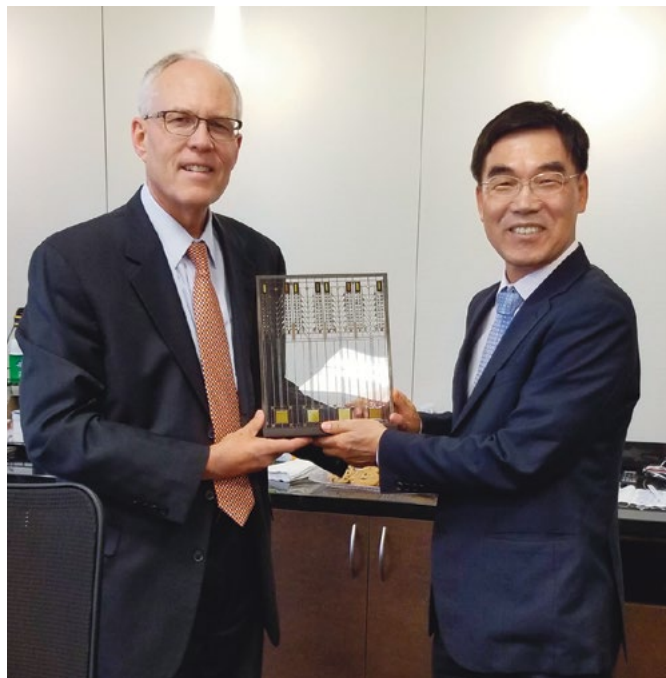


PHOTO: WAI LING YUNG

SOA Executive Director Greg Heidrich presents IAK President Jae Min Lee, FIAK, with a gift of appreciation. The stained-glass replica of one created by world-famous Chicago architect Frank Lloyd Wright is called Tree of Life and is a symbol of the continued growth of the IAK and SOA relationship.

## Product Development Section Update

It's quite fitting that the theme of this issue of *The Actuary* is "The Future of Insurance Products," as that is what we're thinking about every day in the Product Development Section. Our focus is to identify trends affecting the future of insurance. But, more important, we are concentrating on how to educate actuaries on how to envision and shape the future themselves.

What is our vision for how actuaries develop future products? Listening. Listening to customers, distribution partners, technology firms, disruptors, other industries, data sources and *all* of a company's stakeholders. And I mean *all*. Involving all stakeholders has its obvious advantages (ensuring the product works for all areas, product buy-in, etc.), but many of our best ideas can be inspired by the most unlikely departments. Call centers and operational areas are the two areas I recommend visiting first if you're personally going on this journey, as they are often the first contact with customer feedback on what works and doesn't work with existing products.

I often like to say that when developing a new product, you should spend 90 percent of your time listening. And if you do a good job of listening, the remaining 10 percent is actually quite easy.

The Product Development Section has been hard at work delivering a lot of content related to these efforts, and it would not be possible without the support of our section members. We develop numerous sessions at both the SOA Annual Meeting & Exhibit and the Life & Annuity Symposium, present at the Accelerated Underwriting Seminar, produce a spectacular newsletter (*Product Matters!*), sponsor research projects and even coordinate exciting contests. Our last two contests were about the future of wearables and dynamic pricing in insurance.

Please visit our section's webpage ([SOA.org/PD](http://SOA.org/PD)) to join the section or to check out the many resources available to you. Most important, if you'd like to get involved with the section, please look for volunteer opportunities on the SOA Volunteer Opportunities Database or send an email to [sections@soa.org](mailto:sections@soa.org). We'd love to have you!

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# Financially Literate?

BY CHRISTA CARTER

Increasing the public's understanding of the various financial products and tools used throughout life is critical to obtaining financial security



After the ages of 25 to 35, people learn very few new financial insights.



**A**



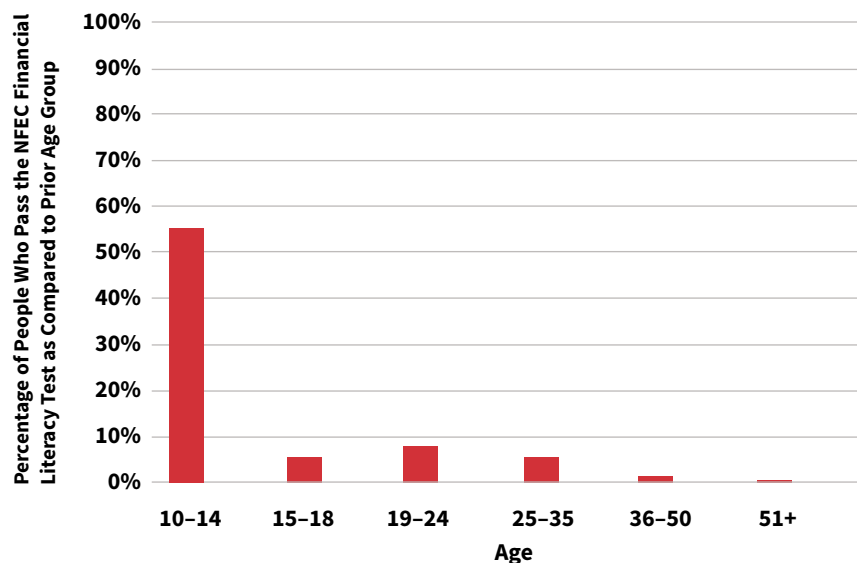
key way to maintain a healthy mind is to never stop learning. When it comes to financial education, this same mantra is also the key to financial stability.

In order to achieve financial stability, new knowledge must be acquired to make sound financial decisions. Priorities, income and expenses change throughout life, and different knowledge is required to wisely make financial decisions at various stages.

However, research shows that in reality, less financial knowledge is acquired with age (see Figure 1). After the ages of 25 to 35, people learn very few new financial insights. Yet the financial instruments used by those over age 35 dramatically differ from the financial tools commonly used up to that point in life. Additionally, the tools used by those older than 35 are significantly more complex in features and more costly in penalties. Technology also has enabled an increased array of choices in recent generations.

Financial capability defines the level of knowledge needed to make financial decisions that are best suited to one's situation and progress toward achieving financial stability. Different financial products are available and appropriate depending on the situation, as well as the past behavior and available assets of the individual. Financial capability can be considered within the context of a maturity model with stages that include basic, intermediate, capable, well-equipped and highly knowledgeable levels of understanding. Each level progresses in terms of the complexity of financial instruments understood, but additional tools also enable a higher ability to build and maintain assets that can withstand hardship events and shocks.

**Figure 1** Growth in Financial Knowledge



Source: Data from Financial Literacy Test & Survey Center. National Financial Educators Council, <https://www.financialeducatorsCouncil.org/financial-literacy-test> (accessed September 16, 2019).

### Basic Knowledge of Financial Instruments

The first stage of financial capability, basic knowledge, includes the ability to create and follow a budget, balance a checking account and understand the importance of savings. This stage of knowledge is typically sufficient to manage monetary assets up to age 18. While the tools may be basic in application, they are not always applied in practice. According to the FINRA Foundation National Financial Capability Study, 19 percent of individuals in the United States report they spent more than their income in the past year.<sup>1</sup>

Effective use of banking products is a major hurdle in achieving basic financial capability. As previously stated, almost one-fifth of people in the United States are unable to keep their spending within their income. To fund the difference, almost one-fifth of checking account holders are heavy overdrafters who pay more than three fees a year. Most of these heavy overdrafters are younger than age 35, and the fees assessed comprise almost a full week of annual income.<sup>2</sup>

Mastery of a checking account must be accompanied by discipline in maintaining a savings account. In the United States, 46 percent of individuals lack a rainy day fund.<sup>3</sup> According to a 2017 GOBankingRates survey, more than half of Americans (57 percent) have less than \$1,000 in their savings accounts.<sup>4</sup> Withstanding and recovering from economic shocks are consequently difficult, and worry about such events also increases stress levels.<sup>5</sup> The 2017 Global Benefits Attitudes Survey reported 59 percent of people worry about their financial futures, and 34 percent cite financial concerns as negatively affecting their lives—lack of a savings net can mean homelessness with one unexpected hardship.

### Intermediate Financial Capability

Quite often, a solution used to address an inability to follow a budget or to fund unexpected expenses is to access credit. The entry-level product many people select is unsecured credit—a credit card. Responsible usage of a credit card requires an intermediate level of financial knowledge—specifically, the ability to understand interest rates and credit terms.

Just over half (51.64 percent) of the respondents to a survey from the National Financial Educators Council correctly answered that loan payments are based on interest rate and term. Use of credit card, student loan and other credit products without this level of knowledge has far-reaching and long-term effects for the future financial stability of an individual. The negative impact of inconsistent payments or nonpayments on a credit bureau report and credit score can reduce credit options for seven or more years, and can be a very costly lesson in terms of future interest rates for credit extensions. Not understanding payment options can have ramifications for 20+ years for student loan holders.

Individuals with low credit scores, indicative of late payments or defaults, are considered higher credit risks and receive higher interest rates for credit solutions. Those with credit scores above 760 are considered prime borrowers with low credit risk, and therefore they receive the best interest rates. A careless or inconsistent approach to managing credit commitments will result in decreases in credit scores and can be very costly. For example, the difference in interest between a deep subprime rate and prime rate on a car loan can be five times more over a 60-month term for an average priced car (see Figure 2).

**Figure 2** Interest Paid Over the Full Term of Car Loan by Credit Rating

Credit Risk	Interest Rate	Credit Score Range	Total Interest Paid	Interest as a Percentage of Original Car Value
Prime	3.60%	720+	\$2,730.54	8.03%
Near prime	7.02%	660-689	\$5,457.57	16.05%
Subprime	9.72%	620-659	\$7,700.06	22.65%
Deep subprime	15.24%	500-589	\$12,522.45	36.83%

Source of interest rate: Wamala, Yowana. Average Auto Loan Interest Rates: 2019 Facts & Figures. *Value Penguin*, September 3, 2019, <https://www.valuepenguin.com/auto-loans/average-auto-loan-interest-rates> (accessed September 16, 2019).



According to a health insurance literacy study, **ONLY 4 PERCENT** of Americans could correctly define co-pay, deductible, coinsurance and out-of-pocket maximum.



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### Capable Knowledge of Financial Instruments

A capable level of knowledge in consumer finance translates into an ability to amortize interest and understand compounding interest. These concepts are critical to understanding mortgages, CDs and bonds, and are important in life stages when building assets is the focus—usually during the prime earning years of ages 25 to 50. A common product used to build assets in this life stage is a mortgage—the credit product used to finance the largest purchase typically made throughout life. Small differences in rates for such a large purchase with an extended life of repayment can be significant. The difference in credit score between a prime and deep subprime mortgage can yield a 2.5 percent differential in interest rate, which can double the interest expense over the life of the mortgage.

While 63.8 percent of properties in the United States are owner-occupied housing, according to the U.S. Census Bureau,<sup>6</sup> a survey by TheKnowledgeAcademy with YouGov cites that only 36 percent of people were confident they understood

amortization.<sup>7</sup> This again highlights how people use financial products without a true understanding of their complexity and how exactly they work. Furthermore, these financial tools are used during the life stages at which new financial knowledge ceases to be acquired (after ages 25 to 35).

Very different and more complex products are appropriate and beneficial past age 35—specifically, different types and uses of life insurance, health insurance vehicles and retirement accounts. According to a health insurance literacy study, only 4 percent of Americans could correctly define co-pay, deductible, coinsurance and out-of-pocket maximum.<sup>8</sup> About one-third of Americans do not understand life insurance products,<sup>9,10</sup> and only 4 percent of respondents answered seven or more questions out of 10 correctly regarding disability insurance.<sup>11</sup> Long-term care and disability insurance can be a supplement to Social Security disability benefits, and it is often necessary to sustain costs of living due to a health crisis—a common hardship faced by many.



**There is a clear lack of understanding of financial products that simultaneously exists with a high level of usage.**

A report by the Stanford Center on Longevity found that nearly one-third of baby boomers had no money saved in retirement plans in 2014.

### Well-equipped in Financial Knowledge

“Saving for retirement” is a common phrase. In reality, savings vehicles are not adequate to grow the capital necessary to achieve sufficient funds to enable retirement. The terminology itself is deceiving, because investing and the accompanying risks associated with a higher return are necessary to accumulate the larger sums needed to support retirement. The terminology is a reflection of the need for consumers to connect with a simpler idea than risk-based returns. Timing of the acquisition of this knowledge greatly affects financial stability and the building of generational wealth. Assuming an 8 percent annual return, an investment with a constant contribution of \$400 starting at age 25 until age 60 would return \$923,000, vs. \$382,000 if the individual started contributing at age 35 instead of 25.

A report by the Stanford Center on Longevity<sup>12</sup> found that nearly one-third of baby boomers had no money saved in retirement plans in 2014. Nonetheless, the possession of a retirement account does not translate into financial capability, as demonstrated with other financial instruments. Common investments for retirement accounts include stocks, mutual funds and index funds. Yet, according to one survey, only 39 percent were confident they understood mutual funds,<sup>13</sup> and 17 percent do not understand the difference between a mutual fund and an exchange-traded fund (ETF).<sup>14</sup> While there is usage of these financial tools, there is not a clear understanding of what the tools are.

An additional consideration for long-term financial stability is tax consequences for different investment tools, which can vary greatly and have a large impact on overall wealth due to compounding and time. An understanding of tax consequences, contribution limits and limitations on access to funds is critical to making wise investment decisions, particularly for instruments intended to enable retirement.

Other factors requiring the continued acquisition of financial knowledge are:

- » The increased complexity of products used during ages 36 to 50
- » Technology
- » The changing tax code



The last significant tax reform in the United States was more than three decades ago, and views on investing must adjust with changes in tax laws. The tax code had been relatively slow changing, and consumers adjusted their knowledge and strategy to what they perceived to be a stable factor. But we are currently in a period of substantial change in tax laws.

Additionally, technological changes are enabling previously sophisticated and esoteric financial products to be widely available and sold as mass market retail products. Over a span of 26 years, the development of equities derivatives—combined with electronic trading—brought a once esoteric product to small investors. The daily volume of derivatives contracts overseen by the Options Clearing Corporation, the clearinghouse for all exchange-related options, went from 500,000 on average in the entire year of 1982 to 30,006,663 in a single day in 2008. This was a result of changes in regulations and the rise of online



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brokers. More recently, the VIX index was created to reflect market volatility. Now, anyone can “invest” funds in volatility. How do you explain buying volatility through futures contracts?

### Highly Knowledgeable

Lastly, the focus in later stages of life is on the protection of assets, income in retirement and financial stability of future generations. An understanding of the business cycle and its effects on investments is instrumental in the timing of withdrawals of funds for liquidity needs without greatly reducing total assets. Furthermore, a well-grounded understanding of futures, geographic and sector risk, and yield curves can help in optimizing asset allocations to maximize return in all phases of the business cycle. It is at this stage in life when new options for financial instruments such as reverse mortgages, annuities and trusts become relevant. Custodial accounts and other tools enabling the transfer of

## A GEN Z APPROACH TO FINANCIAL LITERACY

We started our company, Zogo, when we were only 18 years old in an attempt to solve our own personal finance problems. Growing up, no one taught me or my peers anything about financial literacy. At home, our parents didn’t really talk to us about 401(k) accounts or credit scores. Sure, our team members all took some form of financial literacy classes in high school, but the classes felt like lectures and were too boring to be effective.

When we learned that a lot of big corporations, especially banks and credit unions, spent millions of marketing dollars sponsoring financial literacy classes, we were shocked. These corporations were trying to put their brands in front of Gen Z, but in reality, these classes weren’t teaching financial literacy or spreading their brand.

So, we got to work trying to teach our generation financial literacy. We developed Zogo to make financial literacy learning fun, and also to help our corporate partners better reach Gen Z.

After a lot of testing, we built a financial literacy app that pays kids to learn. We break down complicated financial concepts into more than 300 bite-sized modules that meet young people where they are—on their phones. These modules start with easy concepts like budgeting, but they grow more complex as teenagers advance and make their way through the app.

Users start each module by learning five concepts before taking a five-question quiz. Kids earn points in the form of pineapples as they complete modules. They can redeem these points for rewards such as gift cards.

Our mission is to improve youth financial literacy nationwide, and we’re doing it together with financial institutions.

### ABOUT THE WRITER

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wealth to coming generations are also helpful in achieving goals of sustainable wealth at this stage.

There is a clear lack of understanding of financial products that simultaneously exists with a high level of usage. Only 40 percent of respondents to the Advanced Financial Education Test answered questions correctly to achieve a passing score of 70 percent on basic financial knowledge, but more than 93 percent of Americans have a bank account. Financial capability is important at a personal level, as lack of financial knowledge can cause monetary hardships, be the reason for rejection for a job or promotion due to a background check, cause a deterioration in health as a result of stress, and determine whether the concrete ceiling of poverty can be broken.

Collectively as a society, lack of financial knowledge increases the extremity of credit crises, disenfranchises populations of citizens, increases health care costs, contributes to volatility and instability in markets, and raises amounts of government support.

Financial capability is not only important on the individual level, but also as a societal asset. The answer to whether an individual is financially capable should not be a “yes” or “no,” but rather a range relevant to their economic situation and stage in life. Continuing to learn in later life stages is critical to financial stability and building wealth.

The ideal situation would be for all consumers to understand the products available for their purchase and how best to leverage them for their financial goals. However, this is an immense body of knowledge to acquire.

One solution to a lack of financial knowledge would be to simplify products to enable consumers to more easily grasp product features and purpose. However, financial products have evolved and will continue to evolve to serve a number of purposes from financing large-scale public works to protecting nest eggs from taxes. With a large market of small investors available to provide funding and active litigation when every contingency is not addressed in contracts, complexity with widespread availability is the result. Furthermore, the needs of both counterparties in a financial transaction must be satisfied. While it is simpler to pay the same amount each pay period, the cost of funds and missed opportunity costs change each pay period. This mismatch in needs between borrower and lender alone will spur innovation and complexity. Simplified products are not sufficient to serve all financial needs or legally protect all parties. We need something more.

Increasing complexity can also be attributed to complex tax laws, periods of high volatility in markets and an effort

to differentiate products amidst increasing levels of competition. Having a financial mentor; a knowledgeable and trusted adviser; or engaging a financial services professional to transfer knowledge, guide decisions and assist in increasing financial knowledge is necessary for financial security. ■

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BY MARSHEL LI

# Digitize or Die!



**Technology has changed the insurance landscape for good**

The development of technology is usually beyond human expectations. Years ago, people never imagined that a simple device (cell phone) plus a single software (application) with one sign-in could be the gateway to so many different products or services. For example, super apps in China (WeChat and Alipay) have bundled versatile functions, including instant messaging, social media, electronic payments and taxi reservations.

The advancement is so subversive that people may see this as the fourth industrial revolution in human history. Just like the steam engine is the symbol of the first industrial revolution, electricity symbolizes the second and the computer marks the third, digitalization (fusion of the internet, data and automation) is leading the charge of the fourth industrial revolution. Digitalization is ingrained in our daily lives, and the financial services industry is on the brink of a major revolution when digitalization enters a new phase.

### Emerging InsurTech Trends

The implementation of new and innovative technology transforms the way in which insurers do business. KPMG's Global FinTech 100 features the companies that are truly digitizing and creating new products and services in the financial field. In the 2018 Global FinTech 100, there are a total of 12 insurance innovators from North America, Asia and Europe. The sectoral breakdown shows that insurance lags behind payment (34 companies), lending (21 companies) and wealth (14 companies). But, surprisingly, insurance is ahead of neo-banks (10 companies). It is pleasing to see that the insurance industry is knocking hard on the door of the new digitized world.

In 2019, another in-depth research study KPMG conducted on the insurance industry revealed 10 key trends of InsurTech based on experiences across multiple regions. The current and emerging trends are expected to reshape insurance companies globally over the next couple of years. These trends include the notions that:

- ① | Customer satisfaction will be a more important key performance indicator (KPI) than operational efficiency.
- ② | The incumbent insurers will likely learn from the new highly automated insurance platforms and adopt their technology in underwriting, pricing, claims and so on.
- ③ | Claim settlement is expected to become one of the most important elements of customer engagement. It is now more about the user experience and the speed of the settlement.

- 4 | Health ecosystems are essential for the future success of those operating in the life insurance sector. Without access to the relevant data sets, insurers could not manage risks and engage with customers effectively.
- 5 | It is necessary to apply digitalization to the business model, which requires a culture change and compatibility with the market segment.
- 6 | Data is the lifeblood of the new order, and the price of data is going up.
- 7 | Artificial intelligence (AI) and machine learning likely will be the biggest drivers of efficiency. To this point, AI and machine learning have been massively applied in the automation of processes.
- 8 | The changes in automobile insurance coverage, from insuring individuals to insuring vehicles, will continue. It is possible that auto insurance could be split, with individuals holding a general third-party liability coverage and vehicles “holding” their own damage coverage.
- 9 | Big data and new technology may force the oldest professionals, like actuaries and underwriters, to take new roles where their specific skill sets could be redeployed to meet emerging needs.
- 10 | Organization transformation is crucial to the success of the insurers that are willing to digitize their business. It includes the recruitment of digital talents, the dynamic structure of a digital model, redefinition of processes and systems, vibrant ways to interact with clients and so on.

**Disruptive Insurance is Driven by Digital Technologies**

Using big data and intelligent models to improve productivity has taken root in people’s minds. More insurance players are actively engaged in the development, application and improvement of intelligent technology.

In 2018, AIG launched a cross-border insurance policy using blockchain’s digital ledger. Blockchain enables data sharing across a network of individual computers, and it helps solve the biggest challenge insurers face by eliminating silos of information. The technology improves the transparency and efficiency of the transaction.

AI is commonly used in robotic process automation (RPA). RPA has been shown to perfectly match the needs of a chat box platform (CBP). Using the technology of natural language processing/understanding (NLP), RPA can handle very complicated queries from clients. It is estimated that around 90 percent of repeatable, standardized work with clear rules could be processed by RPA.

Additionally, the internet of things (IoT) has been vastly applied in the auto insurance sector. European insurance giant Generali is also investing in data-driven fraud detection to fight against claim fraud.

With the application of AI and cloud computing, Ping An Life launched a “Smart Customer Service” to process more than 96 percent of new applications without any manual interference. On the other hand, Ping An P&C applied big data and machine learning in the process of handling the vehicle claims. With high accuracy output from object recognition, Ping An now closes more than 98 percent of claims within one day.

Insurance is deemed a traditional financial service. Value is the key measure to evaluate how well an organization is doing. Disruptive technology forces insurers to rethink:

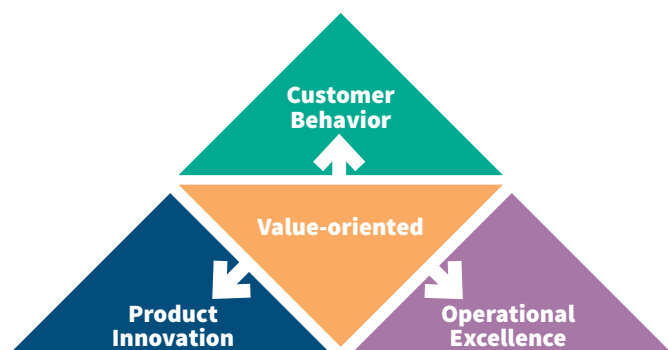
- » What additional value is provided to the client.
- » How data and technology can garner more client insights.
- » How we can build better connections with clients.
- » What the differentiator of products will be.
- » How any ecosystem would make work more efficient and effective.
- » How to transform the practice of insurance ultimately.

**Changing Customers and Changing Needs**

The world is changing fast, and so is the customer (see Figure 1). When you realize from the population pyramid that millennials are set to become the largest living generation, you must admit they will overtake older consumers as the biggest spenders. They are the revolutionary force affecting the market today. That being said, insurers need to figure out who they are:

- » There are 2.5 billion millennials globally.
- » They comprise one-third of the world’s total population.
- » Their generation’s size is 1.5 times larger than Generation X.

**Figure 1** Opportunities From Disruptive Technology





» More than 90 million millennials reside in North America, and 400 million reside in China.

Besides those demographic characteristics, what kind of behaviors do millennials demonstrate?

**Millennials Are Digitally Savvy and Socially Active**

- » More than 50 percent check their phones at least once every 10 minutes.
- » They shop online more frequently than previous generations.
- » They actively comment via social media.
- » They are easily influenced by online celebrities.

**Millennials Advocate Sustainability and Equality**

- » They prefer to work for brands that share their personal values.
- » They purchase sustainable goods and services.
- » They support fairness and diversity.

**Millennials Have a Distinctive Lifestyle**

- » They prefer to spend on experiences over assets.
- » They adore a sharing concept like Airbnb and Uber.
- » They love mobility and working in pioneering jobs (like startups).

Indeed, insurers could leverage these facts to secure growth by meeting millennials’ expectations and needs. There are three key areas for insurance players to invest in (see Figure 2).

**1 | Customer and Experience**

- » Launch an omnichannel content strategy to offer a seamless experience both online and offline.
- » Partner with other service providers, like WhatsApp and Facebook, to interact with customers.
- » Connect customers with various devices like wearables, sensors and voice robots.
- » Simplify communication by providing precise and timely updates.

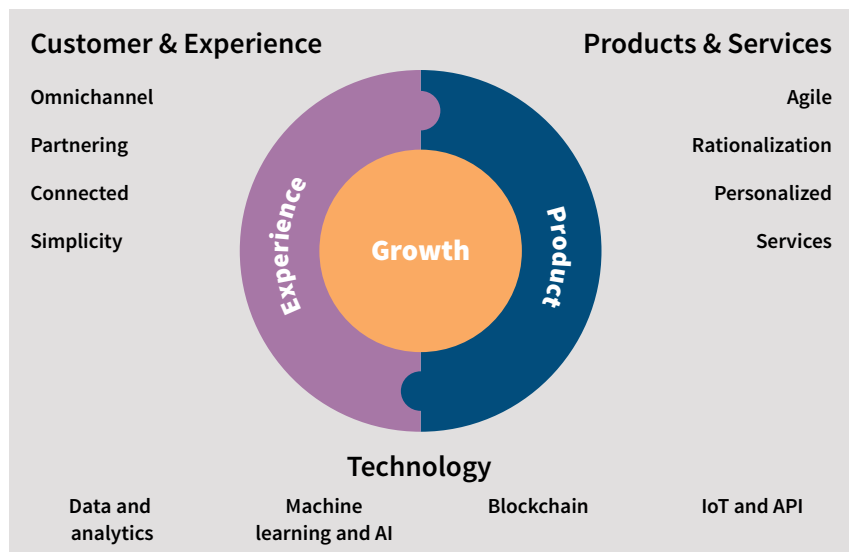
**2 | Products and Services**

- » Provide agile products that recognize and react to life events and changes of circumstance.
- » Rationalize the basis for underwriting and pricing, using both external and internal data sets.
- » Personalize products and services for the right customer at the right time.
- » Embed value-added services to transform products into solutions.

**3 | Technology**

- » Sharpen data analytics skills to process both structured and nonstructured data.
- » Leverage machine learning and AI to streamline the operational process.
- » Explore blockchain to track medical history and authorize claims instantly.
- » Boost the growth of usage-based insurance thanks to IoT; provide precise pricing basis and strengthen risk mitigation measures.

**Figure 2** Key Areas for Insurers to Invest In





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**Most successful digital insurers adopt a different organizational structure to speed up the claims process, shorten the turnaround time and maximize efficiency.**

### Real Business Examples

#### Oscar Health

Oscar Health is a U.S. company that provides health insurance for both individuals and employers. The company is applying big data and machine learning to reinvent preventive health care management and claims processing in an effort to reduce the cost of health care.

In the transition of health insurance, the charge basis has shifted from being results-oriented to focusing on the prevention of diseases. Health insurers should consider encouraging customers to demonstrate healthy behavior and charge fees accordingly.

As an InsurTech company, Oscar innovatively has introduced intelligent devices to provide health management programs for customers. Oscar also offers wearable devices to monitor supplementary exercise and overall health. Customers are

rewarded with an Amazon voucher if they meet healthy standards.

#### Lemonade

Lemonade is a U.S. company that offers renters and home insurance policies for homes, apartments and condos. Lemonade created a new business model based on behavioral economics and technology.

The company uses behavioral economics research to displace fraud and conflict while removing motivation for minor claims and keeping in check the inclination to defraud an insurer. It uses AI in the form of chatbots and machine learning to provide insurance policies and handle claims, replacing brokers and eliminating paperwork. When a customer applies for insurance, the company's software pulls data and information about a particular home or neighborhood from a variety of sources. Policyholders file claims through

the company’s chatbot, A.I. Jim, who reviews the claim, cross-checks it with the policy, runs 18 different fraud algorithms and determines whether to approve the claim.

Besides technology applications, Lemonade differentiates its business model from traditional companies with its focus on doing good. It keeps a flat 20 percent of a customer’s premium to cover expenses and uses the remaining 80 percent to pay claims and purchase reinsurance. Unclaimed premiums, called “giveback,” are donated to designated charities.

**ZhongAn**

ZhongAn is the first online P&C company in China. It applies technologies such as big data, cloud computing, blockchain, AI and IoT to achieve product customization, dynamic pricing, scenario-based sales and automated claims settlement. ZhongAn is also the first listed InsurTech company in China and has attracted billions of dollars from investors.

ZhongAn’s strategy is “Insurance + Technology.” Besides incorporating technology development into the insurance value chain, it also is commercializing technology’s strengths in insurance markets.

In November 2016, ZhongAn announced it founded a subsidiary, ZhongAn Technology, which would focus on technology solutions and boost the informatization of the insurance industry. Last September, ZhongAn Technology reached a deal to establish a cloud-based end-to-end operating system for Japanese P&C company Sompo.

**Digital vs. Traditional Insurance**

Digital insurance differs from traditional insurance in many aspects (see Figure 3). Besides the application of new technologies, digital insurance also adopts a totally different manner in which to run the business.

Traditional insurance provides comprehensive coverage, aiming to provide benefits as fully as possible in a bundled policy. Typically, it is a combination of a

basic plan and various riders like accident, critical illness and so on. Traditional insurance typically is high-sum assured and low frequency, and has a long coverage period. In contrast, digital insurance is always designed in the form of low-sum assured, high frequency and over a short period of time. Besides comprehensive coverage, digital insurance also can provide fragmented coverage.

Insurance is a financial service to meet clients’ needs. However, digital insurance is embedded into various scenarios to serve the specific needs of these scenarios—it does not independently exist. For example, travel insurance is bundled with a tour package in a travel app, or accident insurance is offered on the website when you book a tennis court.

Most successful digital insurers adopt a different organizational structure to speed up the claims process, shorten the turnaround time and maximize efficiency. Compared to the traditional pyramid structure based on function, digital operators make the business line independent. Each business line is focused on products that make other supporting functions into even more products, making sure the product could be launched or upgraded responsively according to market circumstances.

It is worth noting that digital insurance products need to be revisited more frequently, for the terms and conditions (T&C) and price. The cycle could be as short as a couple of months. A few players admit much of the fragmented coverage, especially for new risk exposures, is actually priced based on trial and error, different from the traditional “rule of large numbers” pricing strategy. Digital insurance relies much more on the relationships of many nonstructured data sets. One realistic way to price this type of insurance is to have a hypothesis (T&C and prices) and then test it with the real experience, refine, retest and so on.

**A Case Study of a Digital Insurance Product**

One privately owned Chinese insurance company called Funde Sino Life launched a product three years ago that has received a lot of digital awards. The product, “Baby’s Piggy Bank,” is a common education savings plan for

**Figure 3** Key Insurance Features Comparison

Comparison	Traditional	Digital
Philosophy	Comprehensive	Fragmented
Position	Financial service	Scenario element
Organization	Pyramid based on functions	Honeycomb based on products
Design and price	Based on experience	Based on data correlation
Review frequency	1–2 years	2–3 months
Life cycle	3–5 years	6–12 months



university expenses. In the eyes of actuaries, the benefit is simple: It is a single premium policy that will refund four times cash when the individual turns ages 18, 19, 20 and 21. But why was it so popular and welcomed by clients?

The product has a very clear target client segment: young parents with small children. The key pain points of these young parents include:

- » They are not disciplined with their spending in daily life.
- » They don't like a long and regular savings plan (they spend money on experiences).
- » They have a low sense of financial responsibility.

To address those concerns, the Baby's Piggy Bank product was designed as a single premium, but it allowed for additional funds (of any amount) to be contributed at any time. The company created different scenarios for parents to "top up." The key is to link the top up with memorable moments of growth and maturity, such as:

- » During Chinese New Year, children say good wishes to seniors. In return, seniors will give "red pocket" to kids. This pocket money could be used to top up.

- » Say a child gets a high score on a final exam. Instead of giving the child money as a reward, parents can top up instead.

Those scenarios make the top-up similar to daily spending—just like buying a coffee or a magazine, it is not a big deal. And every time they top up, clients are invited to mark down the feeling, reason or any wishes in the form of text, voice recording or video blog (vlog).

On top of that, Funde Sino Life developed fancy tools and a modern interface. Young parents love to use the "storyline" to recall the important moments by reloading the text, voice memo or vlog from the cloud.

Last but not least, the company takes advantage of social media to share the storyline with grandparents, other relatives and friends. By sharing this information, others feel like they are accompanying the kids growing up, even though they may not live nearby or be a part of their daily lives.

Like the financial industry, insurance is transforming with the emergence of disruptive technology, evolving customer expectations and stringent regulatory requirements. Without digitalization, insurance players would not be able to compete with other service providers. Although the traditional insurance model still contributes the majority of industry business, digital insurance has grown significantly in the past few years due to the widespread use of cell phones, e-payments, facial recognition technology and so on.

There is no doubt digital insurance will overhaul traditional insurance and dominate the industry in the near future, providing a better customer experience, more precise pricing, tailored services and 24/7 accessibility. Digitize or die! This is not even a question for the future. It is happening now. ■

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Like the financial industry, insurance is transforming with the emergence of disruptive technology, evolving customer expectations and stringent regulatory requirements.

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BY ARNAB SARKAR

# All in a Day's Work

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## Risk mitigation from a trader's perspective

# A

actuaries and insurance risk managers are aware of the many risks embedded in insurance products. In addition to exogenous shocks and contractual risks tied to policyholder behavior, some products are more exposed to financial market risks. This article focuses primarily on the financial market risks and the multifaceted role a financial trader plays in risk mitigation. A trader is responsible for the life-cycle management of traded securities; serves as a bridge between insurance portfolio risk managers and the broker-dealers; aggregates and communicates relevant market, policy and regulatory information; and helps design better operational and technology-enabled interfaces for executing trades.

The financial risks in insurance contracts arise primarily from exposure to the payoffs tied to the product's underlying assets—namely equities, sovereign bonds, corporate bonds, foreign exchange and commodities. The liability payoff structure is primarily sensitive to the historical and implied forecasts of the performance and volatility of the asset over the life of the product, and the relevant discount rate used to calculate the net present value of the product.

Financial risk management in the insurance industry begins with the mapping of underwriting cash flows of the insurance product into tradable financial indices or benchmarks. The trader then transfers the underwriting risks to the capital

markets through the trading of securities tied to those indices.

### A Framework for Risk Trading

A trader follows a framework of managing the tradable assets in relation to the value of liabilities originated due to the sale of an insurance product. A foundation based on asset-liability management (ALM) is fundamental to understanding the portfolio risk and decision-making process of the trader. A trader attempts to understand the assumptions used to value the products and deduce the sensitivity of the product's value to key financial variables such as interest rates and volatility. The sensitivities of the product value to the change in the underlying asset are the first order of risks the trader strives to mitigate. This approach compels the trader to think in terms of the assets they need to buy or sell to match the needs of the liabilities. For example, a liability portfolio deficient in treasury securities should accumulate treasuries. Similarly, liabilities that have an embedded insurance against falling equity indices should sell short equity indices.

The securities held in the asset portfolio can be levered or bought using cash. From the point of view of capital efficiency, is

Feedback from traders is important when structuring products that can be readily hedged and features that can be easily priced.

borrowing a security intrinsically less punitive than buying it? Leverage is also used to position for a short on an index in an asset portfolio that needs to match a liability portfolio that has guaranteed a payoff tied to the falling index value. Traders can create leverage using contracts that derive value from the performance of an underlying entity: derivatives. There are two common forms of derivatives: futures and options. Futures follow major equity indices and sovereign bonds, and options give the buyer the right to buy or sell the underlying asset at a fixed price at a future date. Traders also use over-the-counter instruments, which can be customized according to maturity, strikes and underlying assets.

In addition, the stock of hedge assets considered as part of assets may constitute either a static or dynamic hedging strategy. A static hedge is one that does not need to be rebalanced as the price or value of characteristics of the hedged item changes. This contrasts with a dynamic hedge, which requires constant rebalancing. Most hedged portfolios contain securities that will expire or mature. A static hedge used as a supplement to dynamic hedges will need to be periodically adjusted or reconstructed, usually at comparatively longer intervals than its dynamic counterpart.

### A Day in the Life of a Trader

Let's examine the operational flow underpinning the framework described. It starts with generating asset and liability risk sensitivities, and it ends with the execution of trades to close the mismatch between the two. Risk sensitivities for assets and liabilities are generated using a valuation framework based on the closing prices of a previous day, and forecasts of performance and implied

volatilities of various equity, interest rate, foreign exchange and other asset classes. The valuation framework may incorporate a simulation of both financial and behavioral assumptions tied to liabilities. The risk sensitivities are made available to the risk managers and traders early in the day. The trader reconciles the available sensitivities to expected sensitivities based on market moves on financial variables the day before. This requires some understanding of higher-order sensitivities and familiarity with the liability profile. In case of inconsistencies, the trader can report them to the risk managers and the pricing and valuation actuaries. Such inconsistencies can be caught and corrected using an attribution of assets and liabilities, if required. An attribution report explains the changes in the value of assets and liabilities to the changes in the underlying benchmarks over a period of time.

Based on the mismatch between assets and liabilities, a trader will need to rebalance the portfolio by trading futures or options to close any gap within a predetermined tolerance measure. The risk tolerance metrics themselves may be based on economic value, solvency surplus, accounting surplus and liquidity buffers, and they are guided by regulatory, accounting and internal performance measures.<sup>1</sup> Trading during widely watched economic data release dates (like change in nonfarm payrolls and retail sales) are typically volatile. The trader should focus not only on liquidity and heightened volatility, but also on the change in correlations between the different assets they need to execute. Spreads between certain assets may diverge by large measures temporarily, and the trader may need additional time and access to execution tactics, participation, spreading and liquidity-driven strategies. The trader should be cognizant that the marketable instruments used to mitigate the risks may not correspond exactly to the underlying asset risks, leaving some basis risk in the process.

Figure 1 illustrates how the exposure to equity indices and maturities across key Treasury rates has breached the tolerances due to market moves in the underlying benchmarks. A trader will execute trades to bring the tolerance



**Figure 1** Hypothetical Hedging Dashboard

EQUITY INDICES					
Underlying Mapped Exposure	% Change	Liability Sensitivity	Asset Sensitivity	Mismatch Over Tolerances	# of Contracts of Equity Futures to be Traded
Equity Index 1	1.45%	(64,700)	(74,500)	9,800	1,225
Equity Index 2	-0.80%	(89,000)	(92,500)	(3,500)	(583)
Equity Index 3	0.45%	(17,500)	(16,600)	900	
Equity Index 4	2.50%	(32,000)	(25,500)	6,500	2,167
Equity Index 5	0.65%	(6,500)	(7,200)	(700)	
KEY INTEREST RATES					
Underlying Mapped Exposure	Change in Basis Points	Liability Sensitivity	Asset Sensitivity	Mismatch Over Tolerances	# of Contracts of Treasury Futures to be Traded
Key Rate Maturity 1	4	475,000	474,820	180	
Key Rate Maturity 2	6	194,000	186,750	7,250	(2,417)
Key Rate Maturity 3	8	895,000	894,770	230	
Key Rate Maturity 4	10	1,250,000	1,241,300	8,700	(1,450)
Key Rate Maturity 5	12	1,565,000	1,555,250	9,750	(813)

within an acceptable level. Occasionally, the trader may find that the liabilities to which asset indices are mapped exhibit an imperfect correlation due to the nature of liabilities, which subjects the portfolio to basis risk. The trader may subjectively decide to over-weight one index vs. another in anticipation of reducing the basis risk. Historical correlations between indices and asset classes also may break down, and the trader may need to use experience to de-risk the portfolio.

While rebalancing a liability portfolio with embedded optionality with only linear instruments like futures, the asset-liability mismatch suffers from the lack of convexity. Such short convex portfolios need to buy the underlying assets when such assets appreciate, and vice versa. One way to compensate for a lack of optionality in an asset portfolio is to own convexity by buying options. By

buying options, static hedges are sometimes added on top of a dynamic rebalancing strategy to add convexity to the asset portfolio.

Throughout the day, the trader focuses on the performance of the different financial asset markets. Following the global markets is vital and includes paying close attention to economic numbers, central bank rate decisions and member speeches, policymakers' talks, earnings releases, bond auctions and the issue of new securities. The trader summarizes any relevant details to portfolio and risk managers, which can be escalated further to actuaries and financial officers at the firm.

Similar to rebalancing trades at the beginning of the day, the trader closes any mismatches by the end of the day by executing trades. Over a period of time, daily rebalancing trades that are needed to close the

asset-liability mismatch can be cumulatively analyzed to calculate the hedge effectiveness of the program.

Simplistically, the hedge effectiveness is the extent to which changes in fair value or cash flows of the hedging instrument offset the changes in the fair value or cash flows of the hedged item. One can also calculate a quantitative measure of hedge effectiveness based on regression analysis to figure out the correlation between the hedged item and the hedging instrument. It is one of the key measures that indicates the success of a hedging program.

Finally, premiums raised from underwriting contingent claims are invested in stocks; developed and emerging market sovereign and corporate bonds; and other interest-bearing instruments, namely mortgages, securities lending, real estate and preferred stock. A trader helps portfolio managers with asset allocation, investing the premiums after reserving for potential claims. The investment income helps pay claims, commissions and administrative costs while financing operations for the insurance firm. The trader monitors new issues coming to the market, dealer inventory and available information on holdings across existing buyers to source securities. Traders help with security sourcing where portfolios may be restricted in terms of concentrations on maturities, ratings, sectors and other characteristics.

### **Optimizing the Trade Execution Life Cycle**

A trader spends a significant amount of time studying market microstructure to understand liquidity and market participant behavior. They also study research on pre- and post-trade analysis to improve execution strategies.

Pre-trade analysis separates trade orders based on the time of day or month, order size, underlying assets, sectors and portfolios. Pre-trade transaction costs analysis (TCA) provides portfolio managers with estimates of trade costs and market impact based on extensive study of historical trade execution. It evaluates all pertinent trade execution methods and highlights the strategy that is most consistent with a manager's risk preferences. The trader considers different algorithms based on tactics, participation, schedule, spreading, liquidity, execution rate and crossing networks to reduce execution cost and slippage.

Post-trade TCA helps firms analyze trader performance across numerous metrics. Trade execution quality can be assessed by comparing actual executed prices to selected benchmark prices. A range of benchmarks can be considered, including volume-weighted average price, opportunity cost, performance and open/close/previous close prices.

Such feedback can help align a trader's execution strategies to the objectives of the fundamental and quantitative

portfolios and managers. Traders continually seek to improve execution strategies, align behavioral profiles with implementation strategies, and optimize trading strategies driven by portfolio and client constraints.

The trader is also accountable for support with supplementary functions related to post-trade settlement issues, choosing execution and clearing venues, and maintaining regulatory upkeep such as LIBOR to SOFR transition. A trader provides valuable input during negotiations and signing of credit support annexes, and choosing the types of collateral that can be posted to preserve capital and minimize counterparty risk. A trader helps choose an optimal instrument to gain exposure to an underlying asset based on initial and variation margin, eligible collateral, easy-to-access venues, clearinghouse requirements, liquidity, funding costs and dealer balance sheet constraints. For example, to gain exposure to a given underlying asset, a trader can use futures, exchange-traded funds (ETFs), cleared and bilateral swaps, or even options based on some of the criteria cited. The choice of the trading instrument is crucial to optimize the risk capital used for the hedging program.

### **Integrating Risk, Actuarial and Finance to Develop ALM for Future Products**

In the future, there is an expectation that the regulatory framework governing insurance companies converges to the broader financial sector. This should call for consistency between statutory and economic risks. Broader financial market integration also necessitates that diverse regulations be harmonized across jurisdictions.

In the same vein, ALM based on the different metrics discussed should converge toward a more market-consistent measure based on economic risks. Robust modeling of liability profile and policyholder behavior, lapses, surrenders, and income utilization using big data and predictive analytics can help with market-consistent pricing, reserving and risk management of product blocks. Business groups like finance, risk and actuarial that traditionally have worked in silos will need to share a common set of core data, underlying infrastructure and assumptions.

Insurance product managers and actuaries developing new products will seek input from ALM groups and traders to create products that can be hedged readily using liquid instruments. Traders will play a significant role in providing market-consistent input data that can facilitate the valuation and pricing of new product launches. Feedback from traders is important when structuring products

that can be readily hedged and features that can be easily priced. Another vital consideration is the amount of effort required to unwind a contract with a counterparty in case they are surrendered—there should be minimal effort involved. Aligning the objectives of product managers and risk managers will be key in designing a new generation of products. ■

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<sup>1</sup> Schneider, Richard. 2018. The Great Juggling Act. *The Actuary*, May.

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## A VALUATION PERSPECTIVE

Valuation has always lagged behind product innovation. As insurers come up with new and innovative product designs, features and underwriting methods, the regulations and accounting methodologies are always trying to catch up—it is only natural that the regulatory bodies are not able to predict every new idea. But valuation has been evolving. It's a slow evolution, but the future seems clear. Increasingly, valuing insurance liabilities is becoming a process for developing a current market risk-adjusted view of the business. The recent changes for Generally Accepted Accounting Principles (GAAP) Long-Duration Targeted Improvements, International Financial Reporting Standards (IFRS) 17 and principles-based approaches to U.S. statutory valuation are examples of this.

More recent regulatory changes have focused on the stochastic analysis of market risks, using various methods to assess capital markets and interest rate risks. It is likely that a stochastic view of risk will continue to be the future direction of this evolution. As tools and technology advance, stochastic analysis of other risks will also become more commonplace and routine. For example, risks around mortality, lapses, partial withdrawals and other policyholder behavior will be more easily calculated using similar tools and methods. This will go beyond the simple sensitivity testing often performed today to full nested stochastic models that test each of the key risks, both independently and interdependently.

Additionally, companies are starting to use predictive analytics, machine learning and artificial intelligence (AI) to come up with better models for setting assumptions, underwriting business and analyzing risk. The next evolution of this process will be to create machine learning or AI processes that replicate or mimic these types of analytics on-the-fly to model the dynamic and reactive nature of the changing course of business within stochastic projections.

The use of machine learning and AI will need to be well understood, including the risks that:

- » These new methods may not perform as expected.
- » Users of these methods may not understand the results and inner workings as thoroughly as they do with more traditional methods.

This will be especially challenging for regulators that will need to develop a framework for understanding the myriad new methodologies being developed across the multiple companies they oversee.

These technological advances will only accelerate in the future, and it will be all but impossible for highly specific regulations to keep up with the ever-changing ways in which insurance is being written and distributed. To cope with this, a principles-based approach will almost certainly be necessary to adapt quickly enough to the changing landscape. This means that actuarial judgment and expertise will become even more important.

The job of the actuary will evolve from explaining the appropriateness of current processes, procedures and methods to also educating regulators and users of valuation results on the new methods and technologies. It will be necessary to help them understand how these technologies are utilized, managed and validated.

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BY ZHAO YULONG AND ZHANG YUEYI



GETTY IMAGES

# Changes in the East

A response to new challenges in China's insurance market



In March 2012, the former China Insurance Regulatory Commission (CIRC)<sup>1</sup> kicked off the project to establish “China’s second generation solvency regulation system.” Not only does the new regime follow the Insurance Core Principles, but more important, it takes into account local market characteristics.

In early 2015, CIRC completed the new solvency standards, known as China Risk-Oriented Solvency System (C-ROSS). With a one-year parallel running period in 2015, C-ROSS officially went into effect in January 2016. This new solvency regime was designed to strengthen capital requirements, promote risk management and corporate governance, and to ensure the healthy and sustainable development of the Chinese insurance industry.<sup>2</sup>

**Achievements in C-ROSS Phase I**

In the three years since the implementation of C-ROSS in 2016, we have noticed significant improvements in China’s insurance regulation and insurance market (see Figure 1).

**Transforming the Solvency Regime From Volume-based to Risk-based**

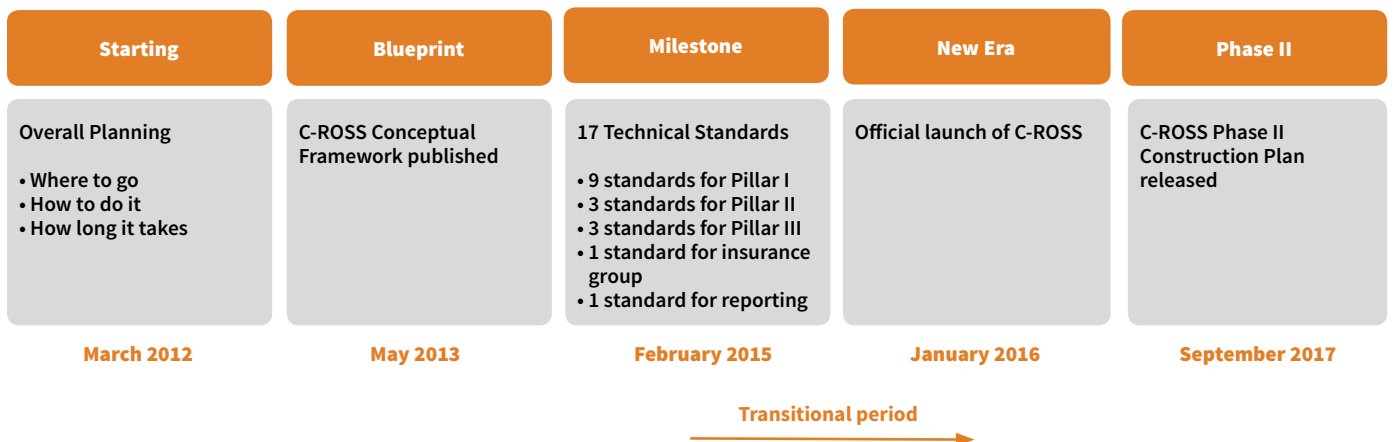
In the old solvency regime, minimum capital requirements were quantified as a percentage of the past year’s premiums or reserves, which did not properly reflect

the underlying risks the insurers had undertaken. However, with the implementation of C-ROSS, moving from a volume-based to a risk-oriented construct, we noticed an apparent uptick in risk sensitivity and a broad expansion in risk coverage of regulatory approaches. Under C-ROSS, the measurement of the capital requirements more accurately and comprehensively reflects the various underlying risks, including insurance risk, market risk, credit risk and control risk. The assessment of the uncaptured risks, which are difficult to cover by holding capital (e.g., operational risk, strategy risk, reputational risk and liquidity risk), are now evaluated under a new supervisory tool under the C-ROSS framework.

**Establishing the Risk Management Capability of Insurers**

As a risk managing system, C-ROSS is not merely a risk detecting or risk measuring system. C-ROSS emphasizes the risk management awareness and capabilities of insurance companies. More fundamental, C-ROSS facilitates the abilities of self-diagnosis within industry participants through a reward-penalty mechanism. To raise risk management awareness and abilities, C-ROSS introduced two regulatory tools: Integrated Risk Rating (IRR) and Solvency Aligned Risk Management

**Figure 1** Roadmap and Current Development of C-ROSS



Requirements and Assessment (SARMRA). The regulator assesses each insurer's overall risks on a quarterly basis utilizing IRR, and evaluates the insurer's risk management abilities on a yearly basis through SARMRA.

Also, through C-ROSS, China's regulator has established a detailed list of minimum risk management standards for insurers, which are periodically evaluated against their implementation process. These standards, which assess the comprehensiveness and effectiveness of an insurer's risk management system, also cover governance structure, internal controls, management processes and so on. These standards also provide a best practice model for the industry, especially for small and medium sized insurance companies. Since most insurers in China are small and medium sized, their risk management capabilities have been improved significantly by following these best-practice risk management standards.

### Pragmatic and Valuable Experience for Emerging Markets

C-ROSS essentially has the same underlying philosophy as other international practices. Although many features are tailored specifically for China, they also are applicable for other emerging markets. From an international perspective, C-ROSS contributes a positive experience in formulating regulatory rules and promoting fair and reasonable guidance for international insurance regulation.

In recent years, the China Banking and Insurance Regulatory Commission (CBIRC) has been proactive in fostering dialogue and maintaining regular communication with the supervisory bodies of other jurisdictions and international organizations. As an example, in 2017, the former CIRC and the former Office of the Commissioner of Insurance of Hong Kong reached a framework agreement on mutual recognition solvency regulation. This kind of mutual recognition on an equivalent assessment authorized Hong Kong reinsurers to use a more appropriate and subsequently lower credit risk factor when accepting the reinsurance business from domestic China direct insurers.

In addition, to strengthen the exchange and cooperation of international insurance solvency regulators, CBIRC has initiated an annual Workshop on Asian Solvency Regulation & Cooperation (WASRC). Since 2016, the CBIRC has hosted four workshops, which, in aggregate, 78 officials and representatives of regulatory bodies from 18 jurisdictions have attended.

### C-ROSS Phase II Kicks Off

In response to the new challenges faced by China's insurance sector, the former CIRC announced a C-ROSS

Phase II project roadmap in September 2017, which includes four aspects:

- 1 | **Update current rules and recalibrate risk factors to cope with the changing market environment.** With the fast growth and the rapid changes in China's insurance market, some risk factors and correlation coefficients among various risks need to be reviewed and calibrated to better reflect the current industry environment.
- 2 | **Resolve new issues that emerged in Phase I.** First, despite the sufficiency of available capital across the industry, certain insurers' available capital is not good quality. Some entities even made fake capital injections using multilayer investment products or by other complex transactions. C-ROSS Phase II will establish a new requirement of "exogenousness of capital" to ensure the capital injected comes from external sources. Second, IRR and SARMRA assessments will become more standardized by establishing Standards of Practices. Third, the solvency filings will be housed and cross-checked in response to data quality issues.
- 3 | **Address new assets with businesses that cover new types of entities.** CBIRC aims to further refine regulations with intensified supervision over complex and multilayer investment products. The intention behind this is to enforce a look-through approach to identify underlying risks.  
Solvency regulation will cover emerging entities such as insurance groups, mutual, captives and pension insurers, and asset management companies affiliated with insurers. Current risk identification and classification for these new entities have not yet been developed.  
In addition, the capital requirements of new businesses in the industry—such as credit guarantee, critical illness, catastrophe products and so on—should be studied and examined.
- 4 | **Further strengthen regulatory cooperation among jurisdictions.** To further promote and actively participate in prudential regulation and build mutual trust with other jurisdictions, a more comprehensive and sophisticated C-ROSS equivalent assessment system will be established.

### Key Elements of C-ROSS Phase II

Three tasks are articulated in C-ROSS Phase II, including rule revision, implementation reinforcement and strengthening regulatory cooperation.

Rule revision (task one) includes review and modification of relevant standards and risk factor calibration for insurance risk, credit risk, market risk and control risk.

In response to capital quality issues, the so-called exogenousness of capital requirement will be established to further regulate available capital. Meanwhile, C-ROSS Phase II will reform the IRR and SARMRA tools to ensure C-ROSS exists as a risk managing solvency system. In addition, specific rules of the market discipline mechanism will be improved.

Implementation reinforcement (task two) includes enhancement of the C-ROSS Data Bank by utilizing its automatic data verification and technology driven analysis function. In addition, C-ROSS Phase II will improve the working mechanism of the Solvency Regulatory Committee under the new unified regulatory body, the CBIRC. Actions in strengthening supervision of auditors, actuaries, rating agencies and other intermediaries will be considered to ensure the quality of implementation of C-ROSS.

Strengthening regulatory cooperation (task three) implies closer collaboration with the Central Bank, China Securities Regulatory Commission and the Ministry of Finance. Other tasks falling in this category include the establishment of a C-ROSS equivalent assessment system, the assessment of the impacts of the changes of both international and domestic accounting standards on solvency regulation, and the engagement on global regulatory policymaking.

### Implications of C-ROSS Phase II

C-ROSS Phase II, serving as a timely update and a meaningful supplement to the existing system, is of great importance to China's insurance industry. The rollout of the Phase II project would:

- » Lead to more stringent capital requirements that could indicate an increase in required capital and a decline in available capital. A decrease in leverage would further enhance the financial stability and financial resilience of the insurance industry.
- » Build a monitoring system with different types of risk, time frames and micro to macro analysis, as well as different monitoring objects. Establish a mechanism with the CBIRC head office and branch offices, research institutions, intermediaries and industry associations. Strengthen the risk early-warning and decision-making supportive ability of solvency information. Eventually, the authority aims to construct a multidimensional, stereoscopic and open risk analysis and monitoring system.
- » Be closely tied to China's further opening up of policies in the financial sector and proactively participate in the international insurance communities by building a



A detailed list of minimum risk management standards for insurers has been established through C-ROSS.

regulatory mutual trust mechanism through an equivalence assessment. In the task of the Phase II project, standards that are not conducive to market opening would be revised. Under the equivalence assessment, lower counterparty risk factors for offshore reinsurers and many other rule revisions are expected to create a more friendly environment for international carriers.

» Strengthen the industry's role in the protection of long-term assets management to enhance the core competitiveness of industry practitioners, which in turn would lead to a more prudent culture and strategies among insurers.

In summary, the Phase II project would lead to a higher regulation standard, a more stringent risk monitoring system and a more open market. What's more, it will also promote prudence within the industry. ■

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- <sup>1</sup> CIRC and CBIRC merged to become the China Banking and Insurance Regulatory Commission (CBIRC) in 2018.
- <sup>2</sup> For more background on C-ROSS construction work in Phase I, please refer to Yulong, Zhao. 2014. China's C-ROSS: A New Solvency System Down the Road. *The Actuary*, February/March.

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**FEATURE**



BY DAVID BOETTCHER

# Nest Egg Challenges

New solutions for gaining access  
to high investment returns in a  
low interest rate environment







or those looking forward to retirement, we live in interesting times. Few have the privilege of a generous defined benefit plan to fund their retirement. Whereas in 1975, 33.1 percent of U.S. private pension plans were defined benefit plans, in 2015, only 6.6 percent of U.S. private pension plans provided defined benefits. This trend is a global phenomenon with similar experiences in developed countries around the world.

Increasingly, the burden is on individuals to plan for and fund their retirement themselves. Not only must they accumulate sufficient funds at retirement, they must also achieve an adequate investment return after retirement on their accumulated assets to ensure they do not outlive the drawdown of these assets to provide their retirement income.

**Investment Returns Pre-Retirement**

Let’s consider investment returns first. With interest rates at historic lows, securing sufficient funds to sustain a fulfilling lifestyle post-retirement looks challenging. Low interest rates may have acted to inflate the value of accumulated assets, but the ability to rely on future fixed income cash flows as a source of retirement income looks grim. More and more, retirees are faced with a reliance on more volatile investment income such as dividends and equity appreciation to provide for their retirement needs.

The shift to defined contribution plans requires individuals to take much more of

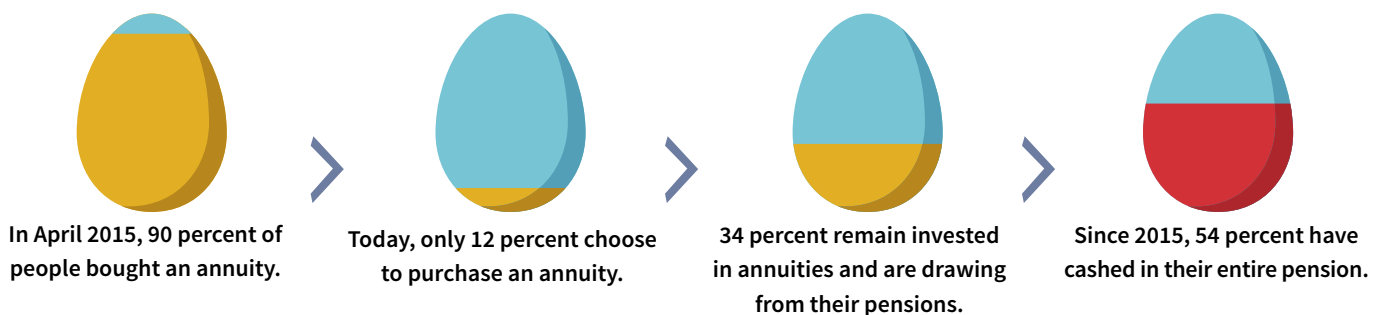
the investment management burden upon themselves. In a low interest rate environment, professional management fees can absorb a large proportion of the available investment returns. Furthermore, whereas defined benefit plan sponsors are able to take advantage of the illiquid and long-term nature of their pension obligations to pursue less liquid investments with their potentially higher long-term needs, individuals often have difficulty accessing the same resources. What’s more, individuals should not pursue an illiquid investment strategy without the benefit of the pooling of risk provided through defined benefit plan sponsorship or an insured product.

The time is right for insurers to step up to the challenge. Variable annuities with lifetime guarantees have provided the opportunity for individuals to share the risk of volatile investment returns with an insurer. Equity release or lifetime mortgages, most notably in the U.K. market, have allowed individuals to access the value of an illiquid asset (their home) as a way of financing their retirement. Perhaps it is time to consider new insurance products that allow individuals to participate in the private equity and illiquid asset investment strategies of insurers and private equity firms active in the pension de-risking market so they can gain access to higher investment returns in a low interest rate environment.

**Investment Returns Post-Retirement**

Turning to the challenge of outliving one’s funds, individuals often underestimate

**Figure 1** The U.K. Annuity Market After Abolition of Compulsory Annuitization



*The time is ripe for creative solutions that address the shift in the burden of responsibilities from pension plan sponsors to participants.*

their future expected lifetime. To illustrate just how little value at-retirement consumers place on a lifetime annuity today, let's look at the abolition of compulsory annuitization in the United Kingdom in 2015. While about 90 percent of people bought an annuity in April 2015, now a mere 12 percent are choosing an annuity, 34 percent are remaining invested and drawing from their pension, and 54 percent (!) are cashing in their entire pension.<sup>1</sup> So some portion of one's retirement funds should go toward the provision of lifetime income depending on survivorship (see Figure 1 on page 41).

Two developments in Canada's 2019 federal budget are worth noting. To improve the flexibility offered to those with registered pensions savings, individuals can now elect to have a portion of their accumulated pension savings used to purchase an Advanced Life Deferred Annuity, which is essentially a life annuity where life annuity payments can be deferred until the end of the year in which an individual reaches age 85. The idea is to provide a backstop on longevity risk, thereby allowing the retiree to manage their investment strategy to a defined time horizon rather than an uncertain one (which is an easier problem to solve).

In addition, the budget introduced the concept of a Variable Payment Life Annuity (VPLA). A VPLA allows an individual to continue to retain their funds in

a defined contribution plan while sharing both investment risk and survivorship with other plan members, thereby allowing the pooling of risk without the burden of capital required by a fully insured plan. For example, a plan may offer a choice of interest rates (say, 3 percent and 6 percent) with payments defined using this assumption. If investment income is in excess of the selected interest rate, then future payments are increased. If investment income is less than the selected interest rate, then future payments are decreased.

The benefits of survivorship are similarly shared through a survivorship adjustment that adjusts benefit payments based on the comparison of actual mortality experience to an underlying assumed mortality that was used at the time the VPLA was purchased. The adjustments depend on the ages and annuity amounts of the surviving retirees. This design is similar to variations of tontine and participating product designs that have emerged in other markets to achieve some element of risk sharing without requiring the use of a fully insured product with the resultant cost of capital.

The time is ripe for creative solutions that address the shift in the burden of responsibilities from pension plan sponsors to participants as plans have moved from defined benefit to defined contribution. More effective use of alternative investment strategies and the sharing of longevity risk will allow individuals to enhance their retirement income in a measured and cost-effective manner. ■

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<sup>1</sup> Reichman, Carmen. State of the Annuity Market 3 Years After Armageddon. *FT Adviser*, April 12, 2018, <https://www.ftadviser.com/pension-freedom/2018/04/12/state-of-the-annuity-market-3-years-after-armageddon> (accessed September 15, 2019).

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# reinvent in the Age of AI

BY DAVE SNELL



As an avid futurist, I enjoy the opportunity to share my thoughts about the potential impact of technology. But as an actuary, I must first qualify my predictions: Much of what I will describe in this article is going to happen, but some of my predictions will be wrong. Unfortunately, I have no confidence limits or meaningful probabilities that I (or anyone else) can apply to them. As many have said, “Predictions are difficult—especially about the future.”<sup>1</sup>

I will offer some historical perspectives on the advances made in artificial intelligence (AI) generally, and machine learning (ML) more specifically, and then offer some predictive modeling perspectives to extrapolate these advances for health care and longevity.

## Humans vs. AI

AI has been around for several decades, but the hype of the early 1980s was followed by a period of disappointment. Manually coded rule trees looked promising for small, simple applications, but they did not scale well as complexity increased.

I was the original architect and co-inventor of an underwriting expert system that has evaluated more than \$100,000,000,000 of life insurance applications in several countries and languages, but now it has a staff of more than 100 to maintain and enhance it. Back then, the idea of dynamic self-modifications to meet changing needs seemed beyond the capabilities of AI. Then, in 1997, something dramatic happened that rocked our belief in the overarching superiority of humans over machines for strategic logic. Deep Blue, a program from IBM, beat Gary Kasparov in chess. He was the world’s champion—and he was soundly defeated by a program.

The excitement in the AI community was palpable, but the skeptics pointed out that it was just a game, and one with very logical rules. They asserted that true intelligence would require an ability to interpret human languages, such as English, with its vast ambiguities and puns. In 2007, another IBM program, Watson, beat the world’s best *Jeopardy!* players. The language barrier had been breached. However, Watson was not programmed even to know that it had won.

## New technologies point to the fact that actuaries must evolve in a changing world of artificial intelligence and machine learning



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Fast-forward to 2017, and an AI program defeated the world's 18-time champion in Go, a strategy game far more complex than chess. As a comparison, a chess player has about 20 moves available at any point during the game, while in Go there are about 200 possible moves at any given time. As the turns cascade, the different game possibilities become enormous. Yet, once again, the doubters could point out that Alpha Go (the AI program) was trained by inputting thousands of games played by human masters. A year later, that all changed! Alpha Go Zero emerged and soundly beat Alpha Go to become the undisputed Go champion. The training of Alpha Go Zero involved no human game histories. The program was fed only the rules of the game, and it learned by playing against itself (for 42 hours).

Unencumbered by the baggage of human knowledge, the AI ML was able to learn faster and better.

### Limitations of AI

A year later, Alpha Zero, the generalized strategy game player AI, became the world's best chess player (with only four hours of self-training). Still, naysayers and even AI experts point out that these are all applications of what they call weak AI, or narrow intelligence. It is very specific. Some of these experts say general intelligence is many decades away. For example, Alpha Zero can play chess, but it can't teach you how to play chess. Watson had to rely on Wikipedia and other stored databases—it did not have the inferential, pattern matching and creative capabilities of even a human toddler. Mastery of numbers and words

was still deemed to be a very small subset of human capabilities. And, surely, the recognition of faces and creation of abstract artwork were unattainable by AI—but not anymore.

Now, AI convolutional neural networks (CNNs) are routinely used to detect potential terrorists at airports and cancer nodules on X-rays. AI generative adversarial networks (GANs) have created paintings that have fetched hundreds of thousands of dollars at art auctions. Your smartphone, which possesses millions of times more storage and processing power than the onboard computer for our first moon landing, has progressed from a brick that only could make phone calls to a hand-held digital personal assistant that guides you through complex streets in a foreign city, keeps your appointments for you, chronicles your life via geo-tracking, shares photos and videos across continents, and remembers the phone numbers you have long forgotten.

In August 2019, yet another AI advance was announced when a program beat noted human experts in six-player Texas Hold 'em poker, a game involving multiplayer strategy and bluffing.<sup>2</sup>

I agree we have not reached the point of more general AI; however, I disagree that this milestone will be far in the future. In my opinion, we are entering an interim era of what I call Laminar AI. Thin layers of carbon fiber laminated together are far stronger than a comparable width of steel. The six layers, or laminations, of our human neocortex enable amazing pattern recognition very quickly despite the slow (about 5 millisecond) firing time between neurons. Likewise, I predict that the lamination, or binding together of many narrow AI systems, will accelerate progress toward wider and wider AI.

### **Impact of AI on Health Care and Longevity**

As precision medicine advances at near exponential rates, we will be able to diagnose diseases earlier and actually prevent most. Actuaries, medical professionals and data scientists (some human, some AI-based) will tap into the microbiome's interaction with our brains (primarily via the vagus nerve) and customize dietary treatments that will prevent future diseases for which we (as very specific individuals, since everyone has a unique combination of DNA and microbiome) have a genetic or environmental predisposition. They will mitigate or eliminate diseases already in place. They will be guided via both wearable and embeddable monitors and dosage devices. This will, in most cases, obviate the need for surgeons; the era of slash and burn to cure people will be viewed, in retrospect, as ignorant barbarism. Invasive biopsies will be replaced

by the tricorder—a Star Trek product that has already been developed as a part of an Xprize contest<sup>3</sup>—and will be enhanced significantly in the next few years. Clinical studies have shown dogs are able to smell some cancers in humans. Imagine a bot with extrasensory capabilities for smell, sight (beyond the human visible spectrum), hearing and so on, coupled with AI, to assimilate all of this data and make inferences beyond human capabilities.

The smartphone, which has become ubiquitous today, will become a relic of the past as it is replaced by ear implants that replicate its features (perhaps communicating with our optic nerve for the camera input). It will check our vital signs many times per minute, communicate wirelessly via bandwidth far beyond current imagination, and serve as a universal translator (some hearing aids available today claim the ability to translate 27 languages in real time). The internet of things (IoT), specifically of health things (IoHT), will connect us to AI ML in ways barely imaginable now.

Sickness will become a distant memory of the pre-laminar AI times of the past. Longevity will extend accordingly—but it won't just be a matter of living longer. We will also enjoy quality of life longer. Some longevity experts, such as biomedical gerontologist Aubrey de Grey,<sup>4</sup> predict that during the next five years we will see medical breakthroughs that could extend life another five years. And during those next five years, we will have breakthroughs for another 10 years of quality life, and so on ...

The possibility exists that some people alive today could become a-mortals.<sup>5</sup> They would not be immortal, since having a building collapse on them will still create a puddle of a former person, but they need not fear dying from disease. Actuaries in the annuity business will need to be especially vigilant about selling to them.

But what other concerns should actuaries have about this new world? I predict health insurance actuaries will see an initial bubble of increased marketability as the explosion of new procedures, techniques and devices affect health insurance premiums in new ways. They will need to learn how to drink from the fire hose of increased data and apply predictive modeling techniques beyond current capabilities. This will spur the development of more and more AI-based automation, as models are developed and then refined by other models and ML becomes pervasive throughout our profession. Ultimately, ML will replace some actuaries and relegate others to niche roles, such as the few blacksmiths today who attend to show horses. Life actuaries will see dwindling opportunities as people live far longer and some don't die (the a-mortals) from disease or system deterioration. Death by violence will be rare, as

privacy will cease to exist, and crime will be immediately exposed and dealt with by monitoring far beyond the capabilities of Big Brother in Orwell's novel, *1984*.

### The Pace of Change is Unimaginable

Some readers will assume I am going wildly blue-sky here with all of these predictions. But as futurist Peter Diamandis says, "The day before something is truly a breakthrough, it's a crazy idea."

Take, for example, the pace of improvement in data storage capability. In 1979, I bought my Apple II computer with the maximum 16K random access memory (RAM) available, but I needed a bit more RAM to program in Pascal, so I had to purchase an additional 16K add-in circuit board for \$300. At that rate, a gigabyte (GB) of such storage (a hard drive was not yet an option) would cost more than \$18,000,000. In today's world, a GB of storage costs less than \$0.02, or roughly a billionth of the former cost.

The rate of improvement is daunting. Who would have imagined in 2007, when the iPhone was introduced, that more than 2.2 billion of them would be sold by November 2018 (when Apple decided to stop reporting sales numbers)?

The city in which I live, Chesterfield, Missouri, hosts the world's first virtual care center. The Mercy system opened it in October 2015.

Its website, *mercyvirtual.net*, shows virtual tours of the building, which houses very specialized medical professionals who remotely monitor patients, guide complex surgeries long distances from the operating theaters, and bring the collective expertise of its 43 hospitals to patients who are sometimes hundreds of miles away.

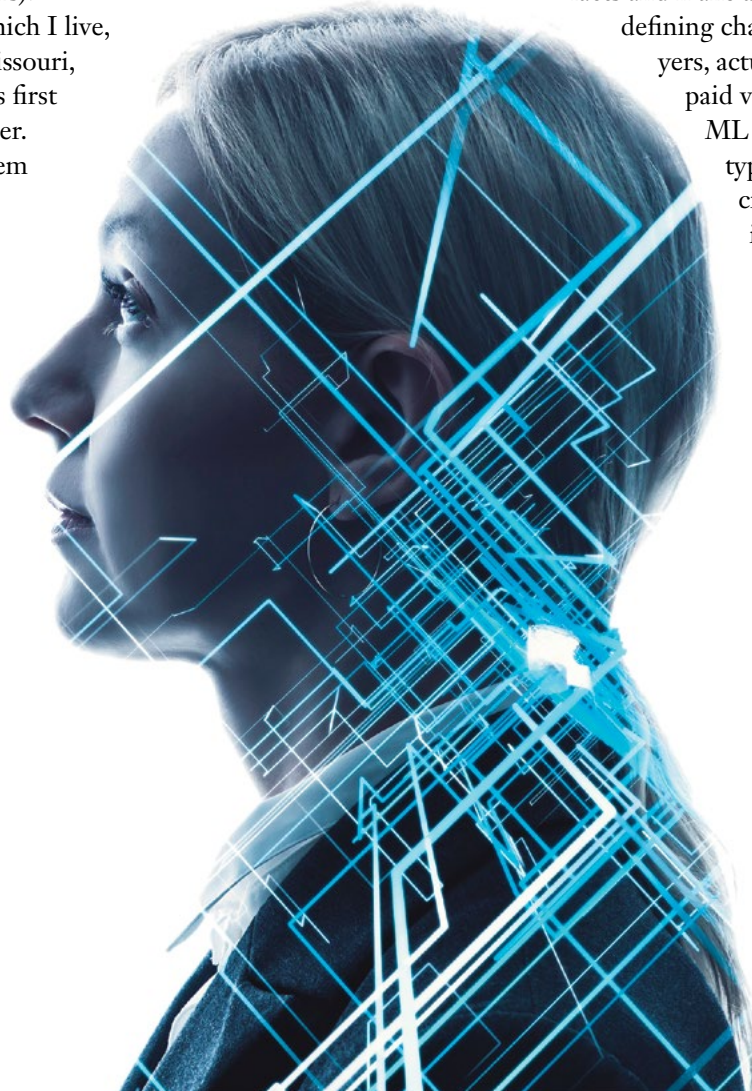
Looking forward from the amazing progress just in the last couple of years, I think of Donald Rumsfeld's famous quote: "There are also unknown unknowns—the ones we don't know we don't know." In 1884, Edwin Abbott published his revolutionary book, *Flatland*, where the inhabitants lived in a 2D world. When visited by a sphere from our 3D world, they could not comprehend or visualize its existence, just as we have great difficulty comprehending or visualizing string theory's 11 or more dimensions.

### Skills Needed to Survive

It is clear the skills that actuaries learned yesterday must be augmented with many new ones if we are to survive better than the blacksmiths, the slide rule manufacturers, the petroleum engineers and, frankly, most other specialty professions. The ability to look at a bunch of disparate

facts and make an intelligent decision used to be the defining characteristic of an expert (doctors, lawyers, actuaries, etc.), and these individuals were paid very well accordingly. Now, we see AI ML challenging and often surpassing that type of expertise. The future will require cross-functional skills. Nurses will be in demand long after the work of most

*It is clear the skills that actuaries learned yesterday must be augmented with many new ones.*



doctors has been automated. The skilled and creative home handywoman will earn far more than her white-collar counterparts. It will not be sufficient to look at a lot of disparate facts (body metrics, health histories, investment returns, tax regulations, etc.) and make premium or reserve projections—AI ML will do that better and faster and less expensively (good-fast-cheap is a powerful combination). We might need to ramp up our interpersonal skills to compete.

Insurance products will have to change as well. There will be a new or increased need to cover accidents; depression; avatars; virtual reality; liability insurance for your autonomous car; replacement insurance for your android companion or your robodog; nanobot sensors; the ravages of inflation as people outlive their savings; interruption of service insurance for your solar panel grid, wind turbines or geothermal heat pump; and anxiety insurance.

Accidental death insurance will move to the forefront as the a-mortals no longer die from cardiovascular diseases or cancers. Some a-mortals may think of themselves as immortal and take unnecessary risks (as some teenage drivers do today). The colonization of other planets will pose new types of accidental death risks and pricing methods.

Sadly, suicide will become an insurance product rather than an exclusion to life insurance policies. Deaths by suicide already exceed those of wars plus homicides combined. As the frenetic pace of change overwhelms some individuals, lyrics from a 1961 stage musical come to mind: “Stop the world, I want to get off.” Pricing suicide insurance will involve actuaries changing traditional thinking on moral hazard, and partnering with bioengineers and psychologists to embed nanobot sensors that detect dangerous mental anxiety and alert intervention agencies accordingly.

On the health side, malaise or disengagement with reality might be a major risk to be insured. Some individuals may find the virtual reality experience far more appealing than the banal reality of their corporeal

lives. And, of course, they will wish to insure the avatars they have come to invest so much time with that life without them would be impaired.

Actuaries have had a good run in one of the best jobs for several decades. Are the good times about to end? Does AI ML represent the barbarians at the gate? Not necessarily!

We can survive by reinventing ourselves to avoid commoditization. Predictive analytics should be an important set of skills for us in the future, but it must be accompanied by other skills as well. We can leverage our reputation for ethical behavior and improve our communication skills. We can combine our business knowledge, analytics and compassion for families to embrace a more holistic approach to risk management.

Early humans discovered the horse was a faster runner, and we learned to ride it. We observed fire as a powerful source of heat, and we learned to control it. AI and ML can be powerful tools for good or for evil. Let’s master them, enhance the profession, and continue to serve humanity and make the world a better place. Let’s reinvent ourselves. ■



AI and ML can be powerful tools for good or for evil. Let’s master them, enhance the profession, and continue to serve humanity and make the world a better place.

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- <sup>1</sup> Variants of this quote have been attributed to Nostradamus, Yogi Berra, Mark Twain, Niels Bohr, Samuel Goldwyn and many others.
- <sup>2</sup> Brown, Noam, and Tuomas Sandholm. 2019. Superhuman AI for Multiplayer Poker. *Science Magazine*, August 30: 885–890.
- <sup>3</sup> Visit [xprize.org](http://xprize.org) for a detailed discussion of the tricorder contest.
- <sup>4</sup> Aubrey de Grey is a well-known speaker on longevity at actuarial conferences. Here is a link to a video where he describes the likelihood of living to 1,000 years old: <https://www.youtube.com/watch?v=ZkMPZ8obByw>.
- <sup>5</sup> Yuval Harari discusses a-mortals in his excellent book, *Sapiens—A Brief History of Humankind* (Harper Collins Publishers, 2015). But don’t stop reading there! His sequel, *Homo Deus—A Brief History of Tomorrow* (2017), carries the idea even further.

#### ABOUT THE WRITER

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## Going for Gold

**Q&A with Travis Gaertner, FSA, EA, senior director of Retirement Risk Management at Willis Towers Watson**

### **What do you like most about the work you do?**

There are so many things I love about my job. First, my employer is fantastic. They challenge me to be my best, and I've learned so much that not only applies to the job but also to everyday life. Work/life balance is very important to me, and I'm amazed at how much support I've received to pursue my goals outside of work. We've developed a very trusting relationship where my employer knows I will come through on the job.

Second, I enjoy working with a variety of clients. I'm a subject-matter expert in pension risk, so I get the privilege of talking to many different clients. This gives me the chance to help clients work through their very specific issues and find ways to either make their pension plans more sustainable by reducing their risk exposure or to help them offload their plan in a cost-effective way when they are no longer benefiting from it.

Third, working with a team really engages me. I enjoy coming together, being accountable to one another, and helping everyone contribute to a better work product. I'm a very social person, and I enjoy both the internal and external aspects of being a pension consultant.

### **What skills should actuaries strive to learn?**

For those of us who enjoy direct contact with our clients: Learn to listen and read the room. Because we all have so much knowledge in such a complex subject matter, our natural inclination is to talk. But we should learn to let the client express their views first. Then,

be concise in your response, guiding them to a place that will produce better outcomes in line with their objectives.

I have always loved to talk, so this doesn't come easy for me—I still have to tell myself to be quiet sometimes. But taking the opportunity to listen and read the room gives us a chance to notice the body language of others and be more engaged. Show some emotion as well!

### **How do you define success?**

I do not define it based on the outcome; rather, I define success as when you have done everything you can to execute well. At work, it's serving our clients by learning their needs, giving them your best and being there for them when they need you. Outside of work, when I'm racing as a hand cyclist, it's executing my race plan. Hitting the power numbers I want in the right places, hitting the right lines, and being very aware of my competition during a road race to be sure I'm well-positioned at the right times. If that means we sell some work, great! If that means I make the podium, fantastic! But those parts aren't up to us.

### **Tell us about your Paralympic adventures. What leadership qualities does competition cultivate?**

I am a two-time Paralympic gold medalist in wheelchair basketball, having competed in the Sydney 2000 and Athens 2004 games. I retired in 2004 to focus on my career as an actuary, but the competitive bug came back to me in 2016. I'm now on a four-year journey to attempt to go back to the Paralympics for the Tokyo 2020 games in handcycling. It's been a hard road training at such a high level when my body isn't as young as it once was, but my pathway to Tokyo appears to be pretty decent.

*I find it really does bring people together when you are engaged in their story and genuinely care for them.*

Working within a team structure in sports has taught me just about all of the most important skills I need as a consultant—meeting people where they are, communicating with people who have very different characteristics, finding common ground, being efficient with my time, and often needing to put others first.

**How do you achieve a work/family/competition balance?**

This is a difficult one, and probably my biggest challenge. I train about 15 hours a week during the year on my handcycle and in the gym lifting weights. Two to three times per week those sessions are very high-intensity interval training, which is quite painful. I'm not sure why I picked a sport that is all about how much you can suffer, so that the next day you can suffer even more!

My employer has really supported me in these pursuits, which is huge. I'm up every day between 4 a.m. and 5 a.m. to get my first workout in, so that I can be at my desk by 9 a.m. A few days a week, I need to work efficiently to be able to



Working within a team structure in sports has taught me just about all of the most important skills I need as a consultant—meeting people where they are, communicating with people who have very different characteristics, finding common ground, being efficient with my time, and often needing to put others first.



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PHOTOS: STEVE UTASKI

get a second short workout in by a decent hour so that I can be at the dinner table with my amazing wife and three children to really focus on being present while I'm with them.

**How do you foster team spirit, inclusiveness and good communication?**

I try to respect different personality types. I reach out and hear the stories of those around me. Again, I don't do this well naturally, but I find it really does bring people together when you are engaged in their story and genuinely care for them. Specifically relating to good communication, I acknowledge people and am accountable. If a client reaches out for something and I'm on the road traveling, I try to at least respond and acknowledge receipt of their email even if I can't answer their question yet. This shows them I respect their time and their needs.

**Who do you admire and why?**

I respect people who work hard, put others first and generally try to do the best they can with what they've been given. As a disabled athlete, I get a lot of people who say they are sorry I was born with one leg. Don't be, because I'm not. Do the best you can with what you have and in whatever situation life deals you. ■

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# Equity: The Next Step in Our D&I Journey

BY MALLIKA BENDER AND SARA TEPPEMA

**A**s co-chairs of the new Joint Committee for Inclusion, Equity & Diversity (JCIED), we are excited for the Society of Actuaries (SOA) and Casualty Actuarial Society (CAS) to continue to work together on our common goals for the actuarial profession. The committee has begun work on several initiatives, including:

- » Career encouragement for diverse students.
- » Professional development programs to educate our members on DE&I topics.
- » Leadership development to increase diversity in leadership in the profession and at our employers.

As we continue the hard work toward a diverse and inclusive actuarial profession, the JCIED has embraced the concept of “equity” as a core value. The practice of adding equity to “diversity and inclusion” is becoming increasingly common in nonprofit and social justice settings, but it is not often mentioned with corporate D&I efforts—possibly because the concept is not widely understood.

One helpful analogy comes from executive coach and DE&I expert Kevin Anthony Johnson:

*“Equity is a new addition because the old D&I lacked the intention of leveling not only the access but the opportunities. Equity represents the pay and career path inequities experienced by marginalized folks. We might be invited to the dance [diversity], and even asked to get on the dance floor [inclusion], but we get charged a two-drink minimum (less pay, higher standards, lower recognition, has nothing to do with dancing) while others aren’t. Equity says everyone pays the same cost of entry to the dance.”*

Equity takes D&I one step further. It promotes fair treatment and access to opportunities, while working to eliminate the institutional and unconscious barriers that limit the potential of diverse participants.

Equity is often confused with equality; however, equality doesn’t necessarily achieve the same outcomes as equity. Let’s say Jack and Jill walk up the hill and each is handed a glass of water—they’ve been treated equally, and both get to rehydrate before climbing the next hill. What if I told you, however, that Jill was forced to carry a 10-pound load up the hill, and Jack was not? Perhaps she needs two glasses of water to be able to take the next step. Recognizing that these two people did not start from the same place, and providing the appropriate resources with that in mind, is equity.

Figure 1 shows a visual representation of the difference between equity and equality with a healthy “spin.” Here you can see how equality leads to a suboptimal outcome, as compared to equity.

Let’s now look at a very current and relevant example: the gender wage gap. Many actuaries believe we are a step ahead of other professions in addressing wage inequality. Because we have a credentialing system that often ties pay to the number of exams passed, there may be less evidence



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of a gender wage gap when comparing men and women at similar points early on in their careers. However, from our vantage point, a gender disparity still exists at the highest levels of management in the profession.

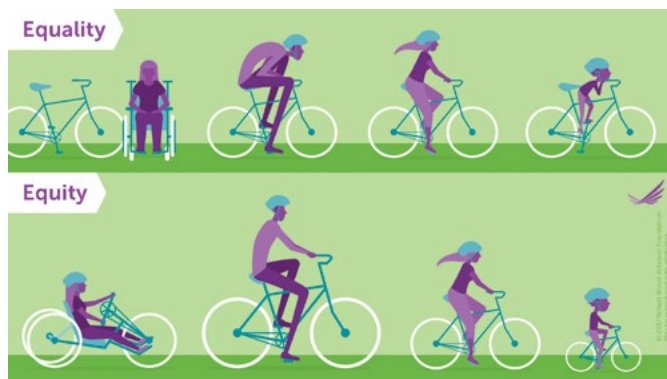
A large body of research shows there are still barriers preventing many women from reaching higher-paid leadership levels. Women across industries are systemically given fewer opportunities for stretch assignments and promotions and are less likely to have strong sponsorship or mentoring relationships within their organization. Our focus on equity will allow us to raise awareness about such barriers and take an aggressive approach toward dismantling them.

Debates around equity in insurance offerings have surfaced in recent years. One example is the recent report from the California Department of Insurance that found auto insurance discounts for affinity groups in the state “disproportionately and adversely affected drivers residing in ZIP codes with lower per capita incomes, lower levels of educational attainment and larger communities of color.” For now, assume that affinity discounts are justified by a concentration of highly educated, highly skilled members of these organizations presenting a lower risk to the insurer. The lack of equity here stems not from insurers discriminating against low-income communities, but rather from generations of systemic discrimination and bias that have blocked these people from attaining the wealth needed to acquire higher education and skills and move into lower risk conditions.

Discounts put money back in the pockets of people with wealth, rather than in the pockets of those who could benefit the most. Applying equity in this context, we could



**Figure 1** Equality vs. Equity



Source: Robert Wood Johnson Foundation. Visualizing Health Equity: One Size Does Not Fit All Infographic. Robert Wood Johnson Foundation, June 30, 2017, <https://www.rwjf.org/en/library/infographics/visualizing-health-equity.html> (accessed October 10, 2019).

suggest that eliminating affinity discounts and building that savings to the insurer into base rates would more equally spread the value across high- and low-income communities. Others might take it one step further and say that giving discounts to those in low-income communities, thus increasing their wealth and access to opportunities that lower their risk, would be the most equitable approach.

Time will tell where this debate ends up, but we can be sure we’ll see the push toward more equitable conditions in the workplace, as well as in the products we provide, becoming stronger and stronger over time. The JCIED is excited to be doing this hard work in our corner of the insurance industry to create a more diverse, inclusive and equitable actuarial community. ■

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<sup>1</sup> Meyerowitz, Steven A. “Disturbing” Disparities Found in Auto Insurance Discounts for Millions. *NU Property Casualty 360*, October 10, 2019, <https://www.propertycasualty360.com/2019/10/10/california-insurance-commissioner-sees-disturbing-disparities-in-auto-insurance-discounts-for-millions-of-drivers-414-164772/?sreturn=20190923204528> (accessed October 11, 2019).

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BY NANCY DAVIS

Since 2007, the Society of Actuaries (SOA) has offered a pathway to becoming a Chartered Enterprise Risk Analyst (CERA). But did you know that the CERA is a global risk management credential that is recognized worldwide and transferable internationally?

**10 YEARS OF CERAs**  
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reviewing the education and training pathways of the member associations and of actuarial organizations seeking to become CGA members. John Di Meo, FSA, CERA, MAAA; Ravi Bhandari, FSA, MAAA; and I represent the SOA on this review panel.

#### A Review of the Global CERA Syllabus

From time to time, the CGA reviews its syllabus, which covers seven learning areas:

The CERA Global Association (CGA) grants actuarial organizations the right to award the CERA credential to actuaries who satisfy the requirements documented in the CERA Global Treaty. Therefore, the SOA's CERA pathway must conform to the CGA's requirements.

A board, made up of representatives from each of the actuarial associations that offers the CERA credential to its members, governs the CGA. Kathy Wong, FSA, CERA, MAAA, is currently representing the SOA and is serving a three-year team on the board.

Additionally, a review panel, made up of volunteers from the member associations, supports the board by periodically

- 1 | Enterprise risk management (ERM) concept and framework
- 2 | ERM process
- 3 | Risk categories and identification
- 4 | Risk modeling and aggregation of risks
- 5 | Risk measurement and assessment
- 6 | Risk management tools and techniques
- 7 | Capital assessment and allocation

The most recent syllabus review took place in 2018. The CGA Board established the Terms of Reference for the 2018 review, which included these areas of focus:



- » **International Actuarial Association (IAA) education syllabus.** The CERA pathway for each member organization must meet the learning objectives from the IAA education syllabus. The recently updated IAA syllabus includes a comprehensive ERM section that provides a thorough introduction to all aspects of ERM. The review was to consider if any changes were needed to the CERA syllabus because of the change.
- » **Emerging risks.** The review was to consider how the wording of objectives could be improved to highlight the importance of emerging risks.
- » **Governance and strategy.** The review was to ensure the syllabus addressed the questions: *How does ERM affect or drive organizational strategy?* and *What is good governance following ERM principles?*
- » **Financial vs. nonfinancial organizations.** The review was to consider how to address a perceived bias toward financial enterprises vs. nonfinancial organizations.
- » **Technical vs. conceptual weighting.** The review was to consider the right balance between technical and conceptual topics.

A working group made up of several members from the CGA Review Panel was formed to make recommendations for changes to the global CERA syllabus. Bhandari represented the SOA and was part of that working group, which spent several months thoughtfully reviewing the existing syllabus and recommending changes considering the Terms of Reference.

### Suggested Syllabus Changes

After review, the working group did not recommend a fundamental rewriting of the syllabus; however, there were a significant number of suggested edits. The majority of the suggested changes were intended to address the Terms of Reference and to improve the clarity of the syllabus wording.

The areas of focus in the Terms of Reference were addressed as follows:

- » **IAA education syllabus.** The CERA syllabus is intended to cover each aspect of ERM in detail and, generally, at a higher cognitive level than the IAA education syllabus. The working group did not believe a change to the CERA syllabus was required to reflect the IAA syllabus update.
- » **Emerging risks.** The working group recommended expanding the number of learning outcomes that specifically address emerging risks from one to two.

However, the working group did not believe it was appropriate to include details of specific risks viewed as

emerging today, since emerging risks can change rapidly over time and the syllabus should be flexible enough to cover the future changing landscape.

- » **Governance and strategy.** The working group decided the existing CERA syllabus addressed the governance and strategy questions posed by the board and only suggested some wording edits to add clarity.
- » **Financial vs. nonfinancial organizations.** The working group recommended changes throughout the CERA syllabus to ensure there is not an undue bias toward risks that are relevant only to financial organizations. For example, a learning outcome related to risk identification and analysis previously listed multiple specific financial risks. It was reworded to cover “financial, environmental, operational, legal, reputational and strategic risks” to eliminate perceived bias toward financial services companies.
- » **Technical vs. conceptual weighting.** The working group performed a high-level analysis of the balance between technical and conceptual topics and determined that the current balance, which has slightly more conceptual topics than technical, was appropriate.

The CGA Board approved the working group’s recommendations with only minor changes.

### Implications for SOA Candidates

Why does this matter to SOA candidates pursuing a CERA designation? It means the SOA’s CERA pathway will be modified as necessary to comply with the new global CERA syllabus.

While the changes to the global CERA syllabus are important, they are not dramatic. However, when the SOA publishes the learning objectives and learning outcomes for the Fall 2020 ERM Exam, they will look quite a bit different. That is because the SOA has decided to adopt the wording of the global CERA syllabus going forward. While the current ERM Exam learning outcomes comply with the meaning and intention of the global CERA syllabus, some of the wording is unique to the SOA CERA pathway.

Adopting the global CERA syllabus wording will streamline the process going forward. This is the first change that candidates for the CERA credential will see. Changes to FAP and the ERM Module may also be required to ensure compliance with the new global CERA syllabus. ■

### ABOUT THE WRITER

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# The Cost of the Opioid Epidemic

Q&A with R. Dale Hall

**T**he Society of Actuaries (SOA) Managing Director of Research, R. Dale Hall, FSA, CERA, MAAA, discusses the SOA's report, titled "Economic Impact of Non-Medical Opioid Use in the United States," which was published in October 2019. The report has received attention from the press.

## What are the overall findings of the analysis on opioids?

**Hall:** The SOA issued this report to analyze the cost of non-medical opioid use in the United States. We estimate the economic cost to be at least \$631 billion from 2015 to 2018. To develop this research, our Project Oversight Group worked with the authors from Milliman to review a wide range of public and proprietary data sources. These included peer-reviewed literature, administrative claims data, federal surveys, databases and reports.

In addition to the economic consequences, these cost estimates helped identify the human toll of the opioid crisis. By our estimates, there were as many as four million people in the United States with opioid use disorder in 2019. That means nearly one out of every 80 Americans may suffer from some form of opioid addiction, and it also notably has an impact on the health of their families.

### What are the leading costs from the opioid epidemic?

**Hall:** While there are several financial areas to consider, we focused this research analysis on the following costs: health care spending, mortality, criminal justice, assistance programs and lost productivity in the workforce.

For example, we estimate that \$205 billion is attributed to health spending for people with some form of opioid use disorder. Additionally, we estimate nearly \$253 billion in mortality costs arising from premature deaths due to opioid disorders, \$39 billion from costs associated with police and legal, and another \$39 billion for government-funded assistance programs. This is aside from the estimated \$96 billion of lost productivity, including from disability benefits and absenteeism.

We also have projected costs for the opioid epidemic in 2019 based on three different scenarios, depending on how the crisis unfolds. We anticipate costs ranging from \$172 billion up to \$214 billion for 2019.

### How does this project align with the SOA's strategic research programs?

**Hall:** This research analysis on opioids was part of the broader research on longevity topics from the SOA Mortality & Longevity Strategic Research Program. We unveiled this opioid research as part of the program launch in October. This project builds on existing research that examines the factors affecting mortality models and predictions, including the analysis of longevity trends.

Since then, we also have released updates to the joint Actuaries Longevity Illustrator from the SOA and the American Academy of Actuaries, as well as the final reports for mortality tables for privately sponsored retirement plans. Stay tuned for further research as part of this mortality and longevity program. ■

#### ABOUT THE WRITER

**R. DALE HALL**, FSA, CERA, MAAA, is SOA managing director of Research. He can be reached at [dhall@soa.org](mailto:dhall@soa.org).



Visit [SOA.org/research/about-research](https://www.soa.org/research/about-research) for the latest updates on new research opportunities, data requests, experience studies and completed research projects.

## RELATED LINKS

### Economic Impact of Non-Medical Opioid Use in the United States

[bit.ly/SOA-Opioid](https://bit.ly/SOA-Opioid)

### Mortality & Longevity Strategic Research Program

[SOA.org/programs/mortality-longevity](https://soa.org/programs/mortality-longevity)

### Actuaries Longevity Illustrator

[LongevityIllustrator.org](https://LongevityIllustrator.org)

## RESEARCH READS

### Pri-2012 Mortality Tables

The SOA published updated private sector mortality tables, Pri-2012, providing a new basis for mortality assumptions for U.S. pension plans. The research looks at pension liabilities, life expectancy and mortality predictors.

[bit.ly/Pri-2012](https://bit.ly/Pri-2012)

### Weather Extremes

This monthly report series examines North American weather extremes, including single-day and multiday weather events. One of the recent reports looked at rainfall totals involving Hurricane Dorian and dry spells in the Southeast United States.

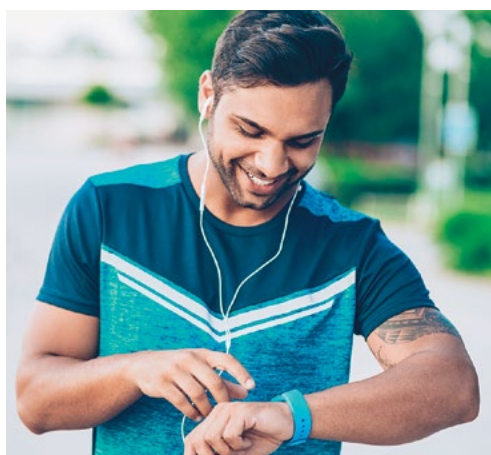
[bit.ly/Weather-Extremes](https://bit.ly/Weather-Extremes)

### Insurance Implications for Low Growth

The SOA released a report about growth rates in the past and future expectations in relation to the insurance industry and pensions.

[bit.ly/SOA-Pension](https://bit.ly/SOA-Pension)

# COEXISTING WITH TECH



## Insights

### Mining Data From Behavior and Psychology

Technology and psychology have always had a symbiotic relationship. Dorothy Andrews, ASA, MAAA, CSPA, began her media psychology Ph.D. two years ago to further connect the two. Now, she advises life insurance companies on how to use data from wearable devices to create personalized policies and wellness incentives. Read how Andrews applies this data in her actuarial work at [bit.ly/SOA-MiningData](http://bit.ly/SOA-MiningData).

## News

### In the Headlines

While machine learning can process information rapidly, actuaries have the skills and experience to analyze data for trends and insights, which informs strategies for health organizations.

Yi-Ling Lin, FSA, FCA, MAAA, principal at Terry Group, says, “Actuaries have a depth of insight that machines—and other types of data analysts—can’t replicate.” For more of her perspective, read the article in *Modern Healthcare* at [bit.ly/2JwwDY8](http://bit.ly/2JwwDY8).

*MarketWatch* highlights retirement planning insights from actuary Steve Vernon, FSA, MAAA, and the SOA’s retirement research. Read the story at [bit.ly/SOA-RetirementPlanning](http://bit.ly/SOA-RetirementPlanning).

## Tools and Resources

### SOA Regulatory Change Web Resource

Organized by practice area, this resource serves as a hub for links to primary sources related to regulation. See the resource at [bit.ly/SOA-RegulatoryResource](http://bit.ly/SOA-RegulatoryResource).

### Actuarial Toolkit

Take a look at the updated Actuarial Toolkit for a glossary of actuarial terms, common tools and computations, and mobile device applications that other actuaries found useful. Check it out at [bit.ly/ActuarialToolkit](http://bit.ly/ActuarialToolkit).

## Meetings

### Mark Your Calendar

2020 Life & Annuity Symposium  
St. Louis  
May 4–5  
[bit.ly/SOA-Symposium](http://bit.ly/SOA-Symposium)

Health Meeting  
Chicago  
June 8–10  
[bit.ly/SOA-HealthMeeting](http://bit.ly/SOA-HealthMeeting)

## UPDATED 2018 KAGGLE INVOLVEMENT PROGRAM WINNERS

Congratulations to the Society of Actuaries (SOA) members who placed in the top 10 percent of competitors worldwide in Kaggle competitions.

The Kaggle Progression System allows participants to earn medals for achievements and compete for data science glory on live leaderboards. There are five performance tiers that can be achieved in accordance with the quality and quantity of work produced in Kaggle competitions: novice, contributor, expert, master and grandmaster.

*Kaggle is a time commitment, but the skills you gain are worth it.*

—Carlos Brioso, FSA, CERA, director, Center for Data Science and Artificial Intelligence, New York Life

### Kaggle Competitions Master

Member	Final Placement (96,011 competitors)	Percentile Rank
Carlos Brioso, FSA, CERA	578	0.602%*

\*Rank as of 2/6/2019

### Competition: Airbus Ship Detection

Member	Final Placement (843 competitors)	Percentile Rank
Maria Wellen, ASA	61	7.236%

### Competition: Santander Value Prediction

Members	Final Placement (4,484 competitors)	Percentile Rank
Michael Francis, ASA	215	4.795%
Kailan Shang, FSA, ACIA	309	6.891%
Joseph Cook-Shugart, FSA	389	8.675%

### Competition: Home Credit Default Risk

Members/Teams	Final Placement (7,198 competitors)	Percentile Rank
Carlos Brioso, FSA, CERA	15	0.208%
Nicholas Garcia, ASA	70	0.972%
Joseph Cook-Shugart, FSA	112	1.556%
Matthew Emery, FSA, CERA, MAAA Allen Gonczol, FSA, MAAA Corey Lutz, ASA, CERA, MAAA	385	5.349%
Yu Lin, FSA, ACIA Kailan Shang, FSA, ACIA	390	5.418%
Michael Francis, ASA	512	7.113%
Almas Rymov, FSA, CERA, ACIA	647	8.988%

### Competition: TGS Salt Identification

Member	Final Placement (3,234 competitors)	Percentile Rank
Kailan Shang, FSA, ACIA	304	9.400%

Competitor rankings were originally published in the June/July 2019 issue of *The Actuary*. Rankings have since been updated.

# Timeless

THE PAST, PRESENT AND FUTURE OF THE SOA

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**1995**

Let's turn the calendar back almost 25 years. Jim Toole, FSA, CERA, MAAA, was reading an article in *The Wall Street Journal* about an accounting fiction publication.

"My first thought was, 'Well, isn't all accounting fiction?' And my second thought was, 'Surely actuaries can do better!'" says Toole. At his prompting, the Society of Actuaries' (SOA's) Speculative Fiction Contest took shape. From inception to today, the contest highlights the creativity and imagination of the actuarial mind.

In honor of National Science Fiction Day (Jan. 2)—which corresponds with the birthdate of famed science fiction writer Isaac Asimov—we're celebrating the Speculative Fiction Contest, now sponsored by the Technology Section, the Actuary of the Future Section, and the Predictive Analytics and Futurism Section.

More than 100 writers have submitted entries to this ever-popular and ever-growing writing contest. Toole ran the contest initially, but handed the baton to Carol Marler. Gary Lange, FSA, MAAA, currently shepherds the creative entries that grace his desk every contest season and, in a few words, runs the show.

The judge for the contest is Dr. Bob Mielke, a professor of English who teaches science fiction writing at Truman State University. "[Dr. Mielke] continues to enthusiastically judge our contests, and recently declared himself the world's leading expert in actuarial speculative fiction!" jokes Lange.

"We are given the treat of hearing a plethora of futuristic ideas and actuarial dreams that cross the entire range of science fiction and dazzle us with creativity at the same time," Lange adds.

For your reading pleasure, we are highlighting winners and entries from the 12th and 13th contests. Enjoy!

## **12th Contest**

[SOA.org/sections/2016-speculative-fiction-contest](https://soa.org/sections/2016-speculative-fiction-contest)

## **13th Contest**

[SOA.org/sections/2019-speculative-fiction-contest](https://soa.org/sections/2019-speculative-fiction-contest)

Send information about SOA historical artifacts that highlight our organization's past and serve as a springboard for future growth. Write to [theactuary@soa.org](mailto:theactuary@soa.org) and share.



# MARK YOUR CALENDAR FOR KEY 2020 SOA EVENTS

## **ReFocus Conference**

March 1–4 | Las Vegas, NV

## **Valuation Actuary Symposium**

Aug. 31–Sept. 1 | New Orleans, LA

## **Life & Annuity Symposium**

May 4–5 | Saint Louis, MO

## **Annual Meeting & Exhibit**

Oct. 25–28 | Seattle, WA

## **Health Meeting**

June 8–10 | Chicago, IL



For an updated listing of professional development opportunities,  
visit [SOA.org/Calendar](https://www.soa.org/Calendar).



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