

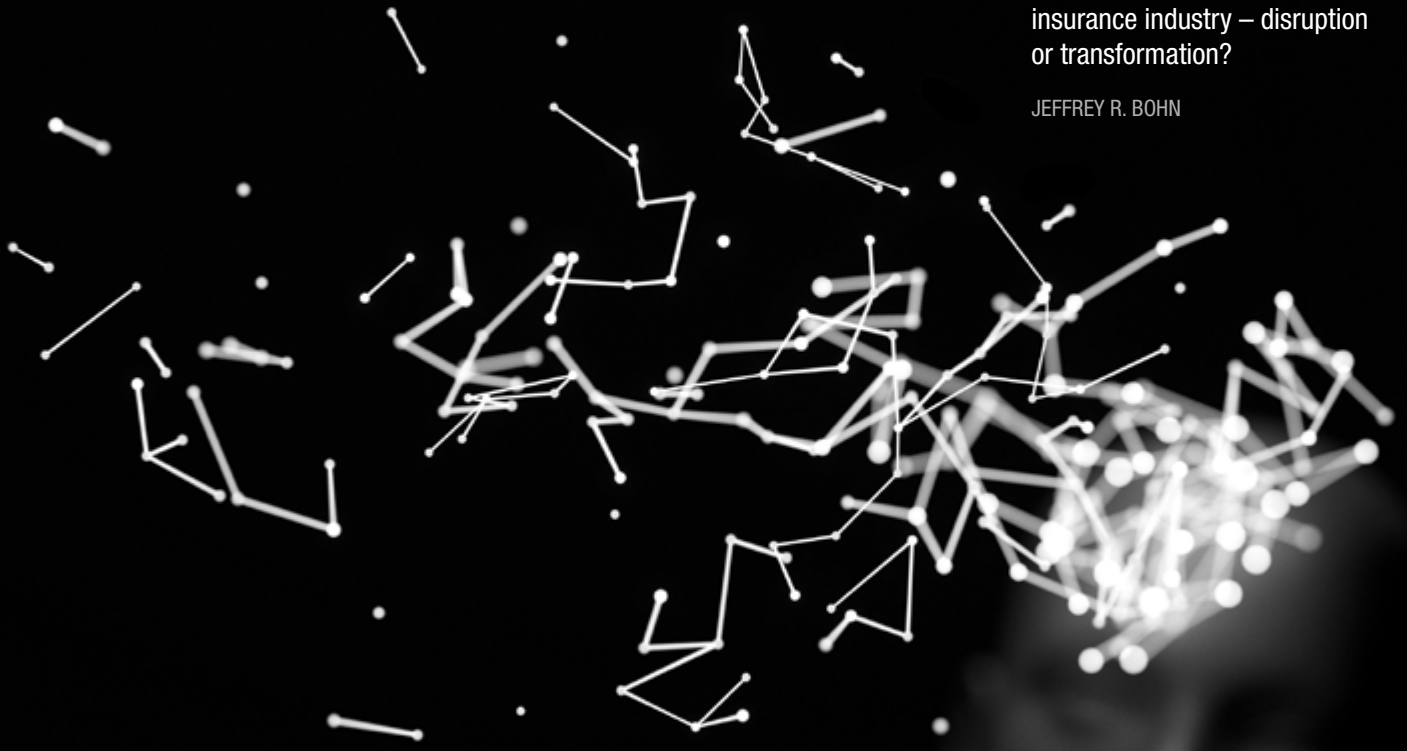
THE CAPCO INSTITUTE  
**JOURNAL**  
OF FINANCIAL TRANSFORMATION

**TRANSFORMATION**

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Digitally-driven change in the insurance industry – disruption or transformation?

JEFFREY R. BOHN



**DESIGN THINKING**

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**DEAR READER,**

Design thinking, a collaborative, human-focused approach to problem-solving, is no longer just for the creative industries. It has become an important management trend across many industries and has been embraced by many organizations. Its results are hard to ignore. Indeed, design-driven companies regularly outperform the S&P 500 by over 200 percent.<sup>1</sup>

To date, the financial services industry has not led in adopting this approach. However, leaders are recognizing that important challenges, such as engaging with millennial customers, can be best addressed by using design thinking, through the methodology's exploratory approach, human focus, and bias towards action. This edition of the Journal examines the value of design thinking in financial services.

Design thinking introduces a fundamental cultural shift that places people at the heart of problem-solving, which is critical in a technology-driven environment. If the customer's real problems are not fully understood, technological solutions may fail to deliver the desired impact. In this context, design thinking offers a faster and more effective approach to innovation and strategic transformation.

The case studies and success stories in this edition showcase the true value of design thinking in the real world, and how this approach is an essential competitive tool for firms looking to outperform their peers in an increasingly innovation-driven and customer-centric future. At Mastercard, design thinking has become a part of almost all organizational initiatives, from product development, research and employee engagement to solving challenges with customers and partners. Meanwhile, at DBS Bank in Singapore, a data-informed design model has been firmly embedded into the bank's culture, enabling them to successfully move from being ranked last among peers for customer service in 2009, to being named the Best Bank in the World by Global Finance in 2018.

I hope that you enjoy the quality of the expertise and points of view on offer in this edition, and I wish you every success for the remainder of the year.

A handwritten signature in black ink, appearing to read 'Lance Levy', with a stylized, flowing script.

**Lance Levy, Capco CEO**

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<sup>1</sup> <http://fortune.com/2017/08/31/the-design-value-index-shows-what-design-thinking-is-worth/>

# DIGITALLY-DRIVEN CHANGE IN THE INSURANCE INDUSTRY – DISRUPTION OR TRANSFORMATION?

JEFFREY R. BOHN | Head, Swiss Re Institute<sup>1,2</sup>

## ABSTRACT

While technology continues to insinuate itself into all facets of financial services at an exponential rate of change, the insurance industry, in contrast, faces a slow-motion parade of promise, possibilities, prematurity, and pared-down expectations. Digitization, the birth of insurtech, machine intelligence, which incorporates multiple tools that explore and exploit data, and the collection and curation of (orders of magnitude) more structured and unstructured data are changing (and will continue to change) the industry in material ways; and not always in line with specific predictions but with developing general capabilities that are fairly predictable. An interesting case in point is the first wave of unsuccessful attempts made by technology firms to disrupt the insurance industry in recent years.

This article describes, from a large (re)insurer's perspective, the trends and challenges related to how technology and society's digitization are irrevocably changing risk markets and insurance. Based on the described trends, I will suggest one nuanced response to the question of whether insurance is being disrupted and/or transformed, while highlighting the trends in the insurance industry catalyzed by society's digitization.

## 1. INTRODUCTION

In the early 1990s, I sat in a graduate-level econometrics class learning about asymptotic theories related to estimators. I remember raising my hand and asking, "How many observations does one need to be close enough to infinity to rely on these asymptotic estimators?" The professor didn't skip a beat and answered, "40." He

had done a fair amount of work in the area of empirical macroeconomics and 40 observations constituted a large dataset at that time (most indicators were only available annually with a few available quarterly.) Fast-forward almost a decade to when I worked as a credit risk quant and developed a corporate-bond pricing model. In that project, I had nearly one million observations. I thought that was a large dataset; however, this dataset was nothing compared to what has become known as "big data." Financial quants eventually gained access to many millions of observations and "big data" was born.

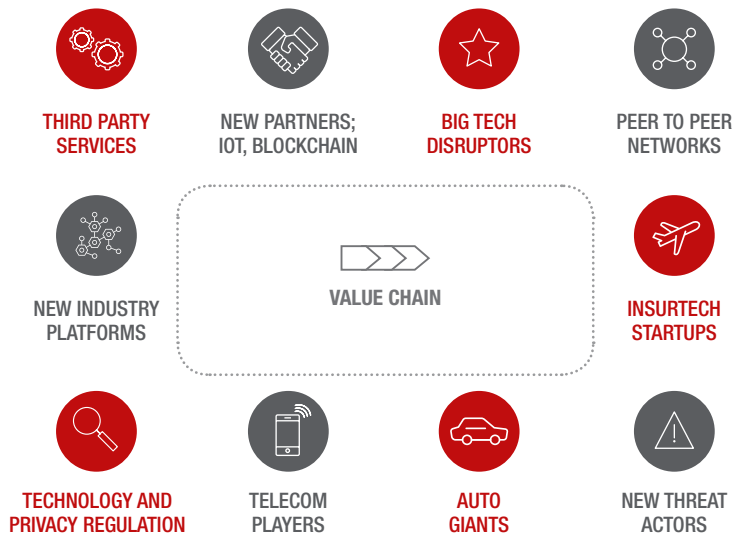
It turns out that "big data" eventually gave way to "data science" and today data-related work is often subsumed by the worlds of artificial intelligence and machine learning.<sup>3</sup> One popular technique in this arena is called deep learning. I am aware of the details of deep-learning

<sup>1</sup> Also affiliated researcher, U.C. Berkeley

<sup>2</sup> Many thanks to Jonathan Anchen, Darren Pain, and Binay Biswal for their extensive help on this article and to Leslie Sheppard for helpful comments. The views expressed in this article are those of the author and do not in any way represent those of Swiss Re or its affiliate companies.

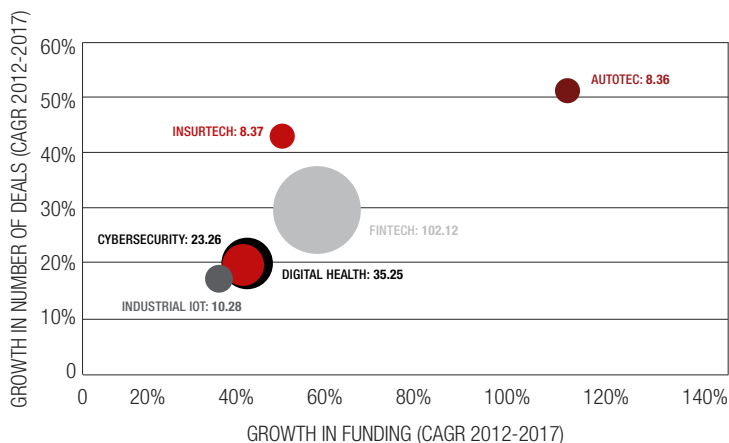
<sup>3</sup> As an aside, I first studied "statistics" in the early 1990s. This became "big data" and then "data science." As computational power increased exponentially, the same type of work came to be known as "machine learning." At some point, "artificial intelligence" supplanted "machine learning." As I will discuss later in this article, I prefer the term "machine intelligence." I heard recently that within some academic arenas, the field of ingesting, cleaning, analyzing, and visualizing data to support decision making is now called "statistics" once again. Unfortunately, the lack of clear and concise definitions of any of these terms continues to sow confusion. Later in this article, I will define these terms.

Figure 1: Impact of technology on the wider ecosystem



Source: Swiss Re Institute

Figure 2: Global tech start-up financing trends, 2012-2017



Sources: CB Insights, Swiss Re Institute

<sup>4</sup> Artificial intelligence  
<sup>5</sup> Graphical processing units  
<sup>6</sup> These observations arise from my personal experience across banking, asset management, and insurance. My comments in this context or in this article generally should not be construed as reflecting the views of Swiss Re or its subsidiaries. I am describing the typical circumstances found within financial services. While a few institutions will be outliers in terms of early and successful adoption of new technologies, the financial services industry as a whole has typically been slow to adopt new technology. I am drawing conclusions from many years as a leader of R&D units within large financial institutions and numerous advisory projects at the interface of technology and portfolio risk management, regulatory compliance, and business strategy development.  
<sup>7</sup> Sometimes Microsoft is swapped for Netflix to produce FAMGA (Facebook, Apple, Microsoft, Google, and Amazon). Now that Google is part of Alphabet, it is harder to find a clever acronym that has three "As". I like FAANGs given its interesting contrast with the Chinese BATs discussed later.  
<sup>8</sup> Lemonade Insurance Company is a property & casualty insurance company distributing insurance via online platforms without insurance brokers. They also claim to implement insights from behavioral economics using machine intelligence to improve efficiency in risk selection and claims processing (see [www.lemonade.com](http://www.lemonade.com)).

research projects using billions of observations – this is truly “big” data. An even more interesting twist to this increasing availability of data results from applying tools such as natural language processing (NLP) to unstructured data (e.g., text, audio, and video), which launches us into a world of unimaginably big data. (We should find another adjective to replace “big.” Maybe “huge”?)

As the empirical research community races ahead to ingest and analyze quantities of data unthinkable 25 years ago, the parallel digital revolution that is transforming society in terms of how we shop, read news, investigate new topics, and find partners has been surprisingly slow in changing financial services in general and insurance in particular. This said, the past few years have been marked by a level of hype (not seen before) regarding technological change for banking, asset management, and insurance. Consultants, reporters, and CEOs throw around words like “AI,”<sup>4</sup> “blockchain,” “platforms,” “cloud computing,” and “GPUs”<sup>5</sup> as if their institutions have already embraced a new “tech utopia.” The reality on the ground is a mix of confusion as to what new technology tools to implement, constraints arising from legacy systems, capability deficits in terms of staffing, and concerns that digitization may have more costs than benefits.<sup>6</sup>

For readers who recall the tech bubble of the late 1990s, successful transformation of any industry almost never follows a straight, upwardly sloped line (in terms of improved efficiency, decreased cost, and increased productivity). The internet itself represents an excellent example of a technologically transformative platform that followed a complex path that ended up opening doors for large technology companies (aka Big Tech) sometimes known as the FAANGs (Facebook, Apple, Amazon, Netflix, and Google).<sup>7</sup> The windy path of how to make use of new tools like machine intelligence and productively exploit the growing pools of data will have dead ends, setbacks, and confusing forks. While this non-linear path causes stagnation and cynicism to build as a new world offers promise without productivity, the pay-off to patient and thoughtful implementers will most likely match or exceed the benefits we enjoy from similar technology-driven societal transformations (e.g., railroads, expressways, personal computers, telecommunications, internet, etc.)

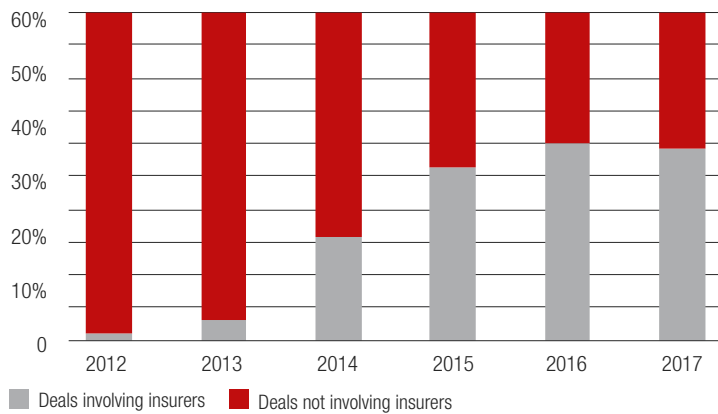
With this background, I will describe in this paper how society’s ongoing digitization in the context of the (re) insurance industry has produced an interesting mix of promises and pitfalls.



Several years ago, the seeds of the insurance-industry disruption had seemed to be sprouting as new online insurance companies, such as Lemonade<sup>8</sup> (founded in New York City in 2015), appeared as data tools and machine intelligence were sweeping the world (or at least the technology world). Figure 1 shows that the impact of these tools seemed to extend beyond the insurance value chain itself to the whole business ecosystem in which (re)insurers operate. The combination of new business models, machine intelligence, piles of data, and a customer base ready for change seemed to imply an inevitable disruption to the (re)insurance industry.

Today, the picture looks the same in terms of promise; however, the path to digital insurance utopia appears - and here is a spoiler with respect to the end of this paper and the primary conclusion - to have shifted from wholesale disruption via a bevy of insurtech startups to insurance value-chain transformation via an informed collection of industry incumbents. Insurtechs are most definitely part of this mosaic. Figure 2 shows that even though insurtech investment is still dwarfed by fintech investment, it is on a faster growth path. The barriers to entry for building insurance franchises have forced most insurtechs to shift toward the more reliably lucrative path to riches (in the insurance industry), which lies in facilitating transformation from within a large (re)insurer. This does not mean that would-be disruptors will not continue to fight the good fight; but rather, capital cushions, digital trust, brand awareness, and, most importantly, compliance with regulatory requirements create a daunting set of hurdles for a stand-alone startup to clear. Transformed incumbents have an overwhelming advantage. Figure 3 supports this conclusion as the increasing insurtech investments also reflect an increasing proportion of established (re)insurers' participation. The insurance ecosystem has added insurtechs as increasingly important members.

**Figure 3:** Proportion of investments in insurtech startups with (re)insurer involvement

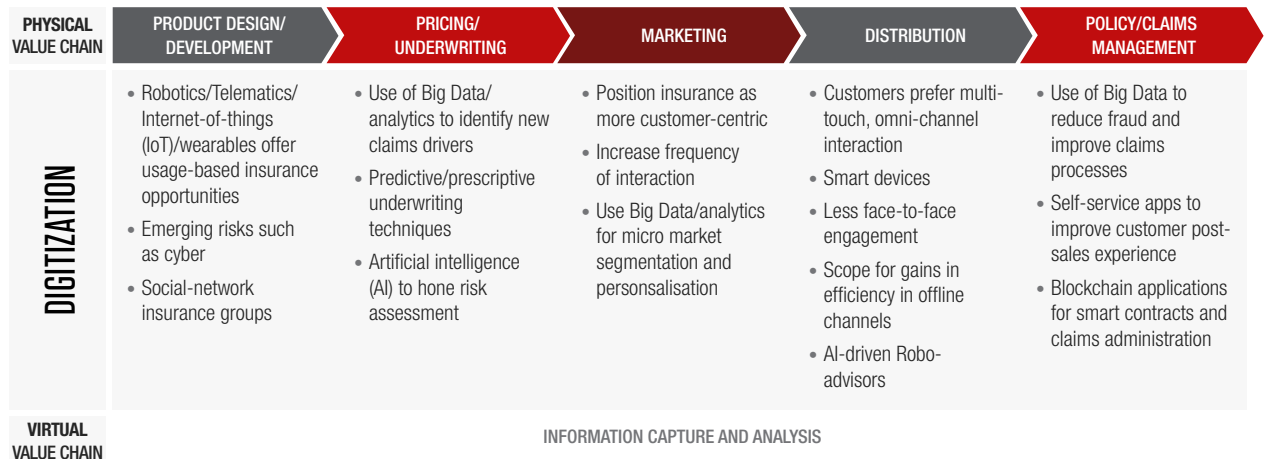


Source: CB Insight data on 600 insurtech deals

## 2. FRAMING THE DISCUSSION

One useful framework to determine whether digitally-driven changes to the insurance industry are disruptive or transformative focuses on the insurance value chain (see Figure 4).

**Figure 4:** Insurance value chain



Source: Swiss Re Institute

<sup>8</sup> Lemonade Insurance Company is a property & casualty insurance company distributing insurance via online platforms without insurance brokers. They also claim to implement insights from behavioral economics using machine intelligence to improve efficiency in risk selection and claims processing (see [www.lemonade.com](http://www.lemonade.com)).

To date, the primary focus of rapid development within the insurance industry and within insurtech startups is distribution. How customers buy insurance and manage their claims requires some kind of interface. In the successful digitization transformation of other industries, such as consumer retail, many useful and productive advancements in how customers interact with an interface is most straightforwardly transferred to insurance. Thus, most insurtech startups focus on this part of the value chain. The relative importance of attacking the entire value chain (and consumer experience), not just distribution, marks an important reason why insurtech startups have been forced to become part of transforming incumbents rather than radically re-defining the industry.

### 3. DATA, MACHINE INTELLIGENCE AND BLOCKCHAIN

Before drilling into the insurance industry's value-chain foundation to understand how digitization is producing transformation, a short detour into the current state of technology and data offers important insights into the changing digital landscape.

#### 3.1 Data

Returning to the discussion of data: the capacity and tools available today to process structured (e.g., quantitative indicators) and unstructured (e.g., text documents, e-mail, etc.) data open new doors of opportunity. Data constitutes the new oil. As such, all industries, and especially insurance, should carefully consider the infrastructure, organization, and talent needed to monetize data. The comparison can be described as follows:

OIL	DATA
EXTRACT	COLLECT
REFINE	CURATE/COMPUTE
DISTRIBUTE	COMMUNICATE

Some efforts are underway within the insurance industry to collect data beyond what is already a data-intensive process to feed insurance pricing models and improve risk selection. This said, (re)insurers have an unimaginable amount of useful – but currently unexplored and unexploited – data scattered throughout their organizations and business networks. In particular, unstructured data, such as text and voice, constitute a potential treasure trove of insight-generating resources. Using the oil metaphor, these data lie dormant in the

metaphorical ground (i.e., business ecosystem) until they can be collected, curated, computed (i.e., processed in the context of an algorithm), and communicated.

A disproportionate amount of investment in the data arena has focused on algorithm development, i.e., the compute step where the data are transformed into usable nuggets of insight. We now have an amazing array of data science tools. Unfortunately, not enough time and resources have been focused on the data collection and curation steps. It is as if most companies have developed a high performance auto, but ignore impurities in the fuel that regularly cause engine failure. In IT-speak, the extract, transform, load (ETL), plus cleaning process has been mostly neglected.

The regulatory constraints regarding the collection and use of data creates a significant barrier to entry for a company newly entering the insurance industry. While the information technology (IT) infrastructure necessary to exploit the panoply of data science flooding the technology ecosystem are mostly not in place at large (re)insurers, a tremendous amount of new investment is flowing in this direction. Big Tech, startups, and new data science teams at large (re)insurers are part of these efforts to build modern data platforms that can handle huge datasets that are both structured and unstructured.

#### 3.2 Machine intelligence

A critical part of any plan for digitizing insurance includes new technologies; specifically those related to machine intelligence, which I will use as an umbrella term for the following overlapping terms often bandied about:

- **Artificial intelligence:** computer systems designed to undertake tasks that usually require human intelligence.
- **Artificial general intelligence:** computer systems that can perform any intellectual task that can be performed by a human (and maybe has even become self-aware).
- **Machine learning:** computer systems that can observe and learn tasks rather than being explicitly programmed.
- **Deep learning:** a type of machine learning where a system can learn (infer) from data without ex-ante assumptions as to models or underlying frameworks.
- **Meta-learning:** another type of machine learning where the algorithm focuses on the learning process itself, i.e., learning how to learn based on estimating meta-parameters.

- **Cognitive computing:** computer systems that simulate the processes in the human brain (can become one basis for machine learning.)
- **Augmented intelligence:** computer systems that assist humans in a set of intellectual tasks or tasks that support intellectual tasks.
- **Expert systems:** computer systems that use databases of knowledge to provide advice.
- **Robotic process automation:** tools and systems that can replicate or “roboticize” repetitive back-end processes currently performed by employees.

These technologies tend to be data intensive, though sometimes a machine intelligence can learn via simulation once it understands a set of semantic rules. However, in many cases the rules are not understood or cannot be written down in a comprehensive manner, making a simulation approach impossible to implement in most cases. Every algorithm within this space does not work for every use case. Many current failed implementations arise from mis-matching algorithms and use cases.

### 3.3 Hype cycle

The Gartner Hype Cycle (GHC) [see Panetta (2017) for details] provides an interesting lens into where we sit today in general (not just in insurance) with respect to machine intelligence.

First a quick explanation of this interesting framework for analyzing hype and expectations:

- **Innovation trigger:** a new technology is developed, and expectations begin rising.
- **Peak of inflated expectations:** as media, venture capital, consultants, academics, entrepreneurs, and practitioners dive into understanding and trying to deploy the new innovation, expectations quickly rise, and the hype reaches a climax. Often along the way, proofs-of-concept fail as the new technology does not live up to the hype.
- **Trough of disillusionment:** multiple failures, failed companies, and the media stories that follow puncture the bubble and the pendulum typically swings too far toward pessimism with respect to the new technology’s promise.
- **Slope of enlightenment:** a few brave souls pick through the wreckage and find the diamonds of insight to figure out how to realize the technology’s potential.
- **Plateau of productivity:** with more reasonable workplans and more patient stakeholders, the

technology is molded into something useful that leads to productive implementations and sometimes substantively changes an industry.

In a recent Gartner publication [Panetta (2017)], most of the machine-intelligence-related categories they define are listed as having moved past the (hype) peak of inflated expectations and are now well on their way into the trough of disillusionment. Here are a few examples:

- Deep learning
- Machine learning
- Cognitive computing
- Cognitive expert advisors

The GHC-based analysis summarized above reflects perception with respect to emerging technologies across all industries. Within financial services in general and (re) insurance in particular, we are just starting to tip into the trough of disillusionment. In a recent panel session at an AI in Fintech conference (held in February, 2018) where I was a moderator, I asked a broad range of financial services executives with technology responsibilities where, in their respective companies, they had seen any useful and profitable implementation of machine intelligence. Only one executive raised a compelling example with a narrow segment of work his team does related to customer analytics. Since machine intelligence has mostly seen its recent successes in the social media space, this example makes sense. I expect to continue to see in the short term many successful machine-intelligence enabled implementations to support better customer interaction. Unfortunately, the promise of these new technologies across the entire insurance value chain has still not been realized. Interestingly, my experience, and the experience of a broad range of financial executives, suggest we are still waiting for the slope of enlightenment as the industry slides into the trough of disillusionment.

### 3.4 Finding value in “boring”

One useful consequence of this inevitable technology cycle relates to what is sometimes called the “boring” components of end-to-end data systems that support machine intelligence - namely, data collection, curation, and processing. One emerging area in this “boring” arena is robotic process automation (RPA). Related to RPA is augmented intelligence, where repetitive activities that support human-generated analyses (e.g., sifting through many documents, analyzing large datasets,

reviewing previous analyses, etc.) can be automated to augment insight discovery. For example, a simple application of natural language processing can help to machine-read thousands of pages of legal documents to direct an analyst to those parts of the documents that have substantive information. These technologies target pain points in a financial firm's back office and in the data preparation process in a financial firm's R&D team. Most data analysts spend unproductive time collecting, diagnosing, cleaning, and filtering data. This curation step can be materially improved with the right kind of machine intelligence.

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**“Despite its novelty, the core of distributed ledger technology has proven to be solid. It combines the best of distributed computing, consensus algorithms, cryptography and smart contracts.”**

---

### 3.5 Digitizing ecosystems

At the industry-wide level, the trajectory shift from disruption to transformation coincides with digitizing ecosystems themselves following this GHC framework. In the past few years, the (re)insurance industry has found itself sliding into the trough of disillusionment with respect to digitization as new technologies have not had as large an impact as expected. This does not mean digitally-driven change will not materially change the industry – it will – but the speed and path taken will not be so easy to predict or navigate. Consumer retail, transportation, and manufacturing have already been materially transformed due to digitization. (Re)insurance and financial services in general have digitally lagged behind and have not followed as quickly or as straightforwardly. An under-appreciated barrier to entry for new (re)insurance entrants lies in the tacit knowledge that is typically diffused throughout a large (re)insurer. This knowledge relates to building and maintaining the portfolio of insurance contracts, defining R&D agendas, building customized solutions, complying with regulations, and managing through tail-risk (i.e., low probability, high severity) events.

#### 3.5.1 BLOCKCHAIN

Another technology family that has been heavily hyped without results (except in the context of cryptocurrencies) is blockchain. This technology also finds itself alongside the machine-intelligence technologies sliding into the trough of disillusionment [Panetta (2017)]. That said, the core technology, especially when expanded to include computerized transaction protocols (often called “smart contracts”), points to a decentralized technology future, which will most likely radically transform the insurance industry and commerce more generally.

While most readers will have heard about blockchain, I will cite a concise definition to make this discussion clearer: “A blockchain is essentially a distributed database of records, or public ledger of all transactions or digital events that have been executed and shared among participating parties. Each transaction in the public ledger is verified by consensus of a majority of the participants in the system. Once entered, information can never be erased” [Crosby, et al. (2016)].

Building on a blockchain, conditions can be embedded as part of the computerized protocol. This becomes a “smart contract,” which enables a contractual agreement to make payments among participating entities/parties once pre-programmed conditions are met. The generalization of this technology makes it applicable to a wide range of transactions including those involving insurance.

B3i is an insurance industry initiative focused on blockchain. As one of the initiative's participants has pointed out:

“Despite its novelty, the core of distributed ledger technology has proven to be solid. It combines the best of distributed computing, consensus algorithms, cryptography, and smart contracts. At B3i we keep assessing different platforms, the likes of Hyperledger, Corda, Quorum, and are now quite comfortable that technology will do the job. The much bigger revelation was that, creating an industry-wide, enterprise-grade distributed ledger solution for insurance, requires rock solid inter-company collaboration. The more technology takes care of the basics, the more people and co-operatives count” [Meeusen (2018)].

In many ways, blockchain is more of an organizational and behavioral science challenge than a technological one. Like machine intelligence, the lack of working business models using blockchain in the insurance

space does not temper the enthusiasm of those who understand the promise of this technology in changing the way insurance is sold and managed.

An important point to remember specifically in the context of insurance is the huge amount of assets and lives that are not insured. This is called the insurance protection gap. Some estimates place this in the order of tens of trillions of dollars.<sup>9</sup> One barrier to providing insurance more broadly is the high cost of instantiating in a new or developing insurance ecosystem the current value chain to handle emerging risks, insure risks in developing countries, or insure smaller exposures (sometimes called microinsurance). Blockchain can dramatically reduce the cost of distributing insurance coverage and managing claims (particularly in contexts where existing insurance platforms are inchoate). Consider the possibility of shifting completely away from paper to a mobile-device enabled, digitized insurance product. The positive consequence of this technology will likely be much wider adoption of insurance and a material reduction of the insurance protection gap.

With the insurance value chain as the framework and an initial understanding of the current state of data, machine intelligence, and blockchain, we can assess where digitization is taking the insurance industry. We first consider its promise(s).

#### 4. PROMISE(S)

Digitally-driven change to the (re)insurance industry offers some intriguing benefits that define the promise of this new digitized world. This promise focuses on the following areas:

- Dramatic reduction of cost to distribute & manage (re)insurance.
- Increased customization of insurance due to more data and better analytics.
- Networked connectivity across individuals and things (often referred to as the “internet of things” or IoT) leading to many new technology-led innovations in light of the data and better analytics.

<sup>9</sup> For details, please refer to the articles in the references section published by Swiss Re and the Swiss Re Institute.

<sup>10</sup> Note that (re)insurers that do not keep pace with data-related infrastructure investment will not only be at a disadvantage with respect to their competitors, they may also be inadvertently creating more vulnerabilities to cyber attacks.

- Improved data protection as (re)insurers invest in better data-related infrastructure to manage the increasing amounts of available data.<sup>10</sup>

As digitization continues to permeate our society, the actual insurance model will transform. If we place the insurance value chain in the context of the changing business ecosystem, digitization’s promise encompasses an even larger range of possibilities (to be discussed in the next section) as the insurance business model radically transforms. In Figure 3, above, we see that large (re)insurers are responsible for an increasing proportion of the increasing total investment in insurtech startups. These trends imply a number of possibilities.

### 5. POSSIBILITIES

As the overall insurance premia have fallen in recent years, (re)insurers have looked to a variety of strategies to differentiate their products and services. Digitally-enabled changes constitute an important driver of new possibilities in the following areas:

- Reducing the insurance protection gap using data and technology.
- Customizing insurance products and services.
- Reducing the cost of marketing, distributing, and managing insurance.

Identifying and developing new products and services that leverage (re)insurers’ know-how, platforms, and networks.

#### 5.1 Reducing the insurance protection gap

The majority (70%) of existing economic losses to valuable assets in the world are not insured [Swiss Re (2015)]. In the event of large natural disasters (e.g., earthquakes in Christchurch, New Zealand, Tohoku, Japan, and L’Aquila, Italy) the difference in economic recovery is heavily influenced by the extent to which valuable assets are insured. In countries and markets where traditional insurance infrastructure supporting the insurance value chain is not available, digital platforms such as mobile apps with insurance contracts eventually instantiated in blockchain could dramatically reduce the cost of entering or expanding a market. Regulatory compliance and proper liability portfolio diversification (i.e., capital allocation optimization) are still important barriers to entering new markets; however, large incumbents will be much more willing to go after these new opportunities with a digitally-driven lower cost base.

Parametric insurance contracts, where claims are paid on the basis of an objectively measured indicator (e.g., typhoon insurance where payout depends on a typhoon's reported severity on an externally transparent measurement scale) become much more feasible with data platforms. Again, blockchain could be an essential part of a parametric insurance contract, further reducing the cost of managing insurance claims. The computerized transaction protocol embedded in distributed ledgers could create a relatively automated way to monitor relevant indicators and trigger claims payments per the conditions defined in the protocol.

New and still emerging risks suffer from difficulties in collecting, curating, and analyzing data relevant to insurability. These emerging risks typically face questions with respect to categorizing the risk, estimating relevant probability of downside events, estimating the severity of the downside event, and developing a claims process that has a reasonable cost profile. Expanding insurance product possibilities often lies in addressing these questions related to insurability. Examples of new and emerging risks include insuring natural assets (e.g., coral reefs, mangrove swamps, urban forests, and deep-sea ecosystems) and cyber-risk.

Many new risks arise out of society's increasing reliance on digital systems. While the risk of cyber attacks is likely at the top of the digitally-related priority risk list for most executives, operational vulnerabilities that arise from the increasingly complex mix of overlapping digital systems and networks that constitute the backbone of our digitizing society should not be ignored. I expect to see notions of algorithmic malpractice develop as software engineering becomes more integral to all aspects of human life. If core components of code in an enterprise-wide software system for a company, piece of critical infrastructure (e.g., airport, shipping port, power grid, etc.), or government is poorly devised and implemented, the downside risk could become increasingly material. Just as we hold medical doctors to a higher standard of conduct for their work, software engineers involved in system critical code development should be held to a higher standard of conduct. As standards and regulations develop regarding coding and software engineers, identification of vulnerabilities will likely

lead to new insurance opportunities. This constitutes a new and emerging risk that will most likely have insurance implications.

New data platforms that process both structured and unstructured (e.g., text, audio, and video) data become resources for solving these insurability questions. Machine-intelligence-enabled tools can become essential to extracting the right mix of information to facilitate the development of new insurance contracts to cover new and emerging risks.

## 5.2 Customizing insurance

Internet of things (IoT) reinforces a trend to attach insurance to products as opposed to focusing on individuals in the context of how insurance is purchased. Furthermore, insurance can be customized by leveraging the data conveyed from a product using IoT. For example, auto insurance can be embedded into the purchase of the car. This contrasts with the currently common process where an individual buys an auto insurance policy separately from the purchase of the auto. With IoT, the insurance value chain focuses more on the item to be insured and less on the individual independent of his/her interaction with the insured item. For example, with auto telematics,<sup>11</sup> insurance pricing can be dynamically changed based on how the car is actually driven. The important possibility to highlight in this context arises from the shift of assessing an individual's risk (often with incomplete data with respect to a driver's risk profile) as a driver to assessing on a much more objective basis the risk of how an insured item is handled. The combination of machine-intelligence enabled algorithms to relate actual driver behavior captured via auto telematics with empirical estimates of probabilities of loss events and loss severities creates the possibility of building much better performing insurance portfolios.

New insurance products can also be developed as any IoT-enabled item can be tracked and insured in a similar way. For example, expensive equipment used on an infrequent basis (e.g., underwater camera equipment, mountain bikes, etc.) could be linked via sensors to parametric insurance contracts that only charge premia when the equipment is used. Mobile devices such as smartphones further reduce the cost, and increase the marketability, of these kinds of use-based insurance products. The opportunity in this trend arises from the combination of most aspects of the new digital economy: mobile devices, inexpensive sensors, connectivity, data

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<sup>11</sup> Telematics deals with the long-distance transmission of computerized information. Most cars now transmit data real time on driver behavior. Even without this functionality built into the car, a mobile device can provide the same kind of tether to transmit information.



collection, machine intelligence, and some kind of digitally-enabled smart contracts. The result is a higher degree of possible customization without materially changing (probably even reducing) the underwriting and claims-processing costs.

### 5.3 Reducing costs

Much of the insurance value chain requires obtaining and processing data. Insurers use data to develop models, price risk, and decide whom to target in their marketing efforts. Then applicants enter data for evaluation and processing. Once a contract is finalized, an insurance company typically monitors the environment and the insured. When disaster strikes, claims require interaction between insurer and insured. Again, data are entered and processed. Along this path, regulatory compliance, data privacy protection, and legal review regularly add additional layers of processing complexity. All these processes are costly.

In order to reduce costs, paper can be replaced with bits stored in a computer network, and monitoring, reviewing, and evaluating can be replaced with machine-intelligence-enabled (or more likely, augmented-intelligence-enabled) algorithms. An important aspect of this process relates to the data-ingestion step where data should be filtered, formatted, pre-processed (e.g., missing data filled in, outliers evaluated for plausibility, and underlying data relationships evaluated for likelihood and plausibility), and reviewed. Much of the promise of machine intelligence relates to the nature of data available to an algorithm for “training.” Better data ingestion will improve the viability and success of machine-intelligence enabled algorithms. Machine intelligence and better data infrastructures may require fixed costs up front, but will most likely reduce costs associated with operational failures downstream. Furthermore, these types of investments facilitate new data analyses that make it feasible to assess process efficiencies and potentially identify new opportunities to expand an existing revenue line or develop new businesses.

As discussed previously, many processes in the insurance value chain rely on expensive teams involved in repetitive and tedious data-related and reliability-ensuring processes. RPA offers the possibility of replacing any repetitive, data-intensive, and manual process with an automated system. The result is most often reduced cost and increased efficiency. Blockchain-instantiated computerized transaction protocols can substantially

reduce the cost of offering insurance in segments and markets where existing insurance value-chain is inadequate or non-existent. In particular, developing countries without the network and infrastructure to sell and manage conventional insurance can suddenly facilitate rapid development of new insurance markets using mobile devices. This further reduces the global insurance protection gap.

### 5.4 Identifying and developing new products and services

As (re)insurers shift to a fully digital ecosystem, the process of identifying emerging risks and developing products to insure previously uninsurable risks will become much less costly. More importantly, new data, better-curated data, and new technology tools (e.g., machine intelligence) facilitate insuring emerging risks and previously ill-defined risks. A few examples illustrate these new opportunities.

Returning to the parametric insurance space (previously highlighted as a means to reducing the insurance protection gap), new, customized products become feasible. For example, business interruption insurance contracts tied to typhoon indicators or wind-speed measures could be further customized to cover particular days of the week or particular times of the day. That is, a payout would be triggered only if the typhoon hit on days and times when the business generates the bulk of its revenue. Other examples include flight-delay insurance and highly focused insurance. Imagine a product tied to a smart watch that doubles as a dive computer so that a customer only pays for coverage when the insurer’s system detects the customer is actually in the water diving. Thus, the contract could cover risks to equipment and/or the health of the diver only when they are actually diving. The point here is data and technology create opportunities to personalize insurance and make pricing and coverage more dynamic.

## 6. PREMATURITY

While the possibilities portend an amazing new range of insurance products and a dramatic transformation of the insurance value chain, optimism has been premature. For example, auto telematics have been around for quite some time without influencing the way auto insurance is priced, distributed, or managed. This said, recent reports suggest it may just be a matter of time, as the data connectivity for cars is predicted to grow from 12.4

million in 2016 to 61 million in 2020 [Gartner (2016)]. At the very least, the optimism for changes in terms of months, or a few years, has been off target. This said, the optimism is probably on target over a longer time horizon (probably on the order of another five to ten years). In the case of auto insurance, the change to auto insurance will likely coincide with the shift to self-driving cars, which is an entirely different insurance proposition; frequent, low-value accident claims will transform into infrequent, high-value accident claims. These intertwined trends in the auto insurance arena highlight confounding factors that make confident trend predictions premature. That is, society's digitization may introduce structural changes to the way we work and live, such that not only does the way we insure a particular risk type (e.g., auto, life, health, etc.) change, but the actual risk profile of that segment may have materially changed also. In this context, forecasting trends becomes much trickier.

The slow changes to auto insurance are still faster than what we see in other insurance segments. Selling and managing life and health insurance continues to be inefficient, overly bureaucratic, and needlessly complicated. A few companies have introduced discounts for using wearables that measure certain types of exercise. The gap is still large between what is technologically feasible and supported by objective evidence (in terms of how a particular intervention, such as measuring number of daily steps taken with a wearable, can be applied). Moreover, many insurance companies still exhibit excessive risk aversion in rolling out new approaches that may be demonstrably better based on pilots and other research. In this context, what we can say with confidence is that many more experiments are needed to figure out what technologies and/or behavioral changes actually improve an insurable risk. This type of research continues to be a high priority for the insurance industry.

An interesting trend depicted in Figure 3, above, reflects an increasing number of startup deals undertaken in collaboration with a (re)insurer. In the early days of insurtech, the startup community appeared to follow a path focused on disrupting the industry in a way that displaced incumbent companies. They did not succeed. One likely explanation is that insurance industry regulatory constraints made incumbents investing in digital technologies the drivers of change. Whatever the cause, technology-induced transformation of the insurance industry now follows a path of digitally-aware

incumbents working both with startups and internal teams to change the insurance value chain. Naturally, the speed of change slows when large companies lead the transformation. That said, partnerships and collaborations among large (re)insurers and technology firms appear to show the way forward. Insurtech's optimism was premature; however, the vision may have been correct when technologies are instantiated within incumbents with the proper regulatory compliance infrastructure, client network, market know-how, and strategic understanding. There have been very few IPOs in insurtech, suggesting that startups are keen to build long-lasting relationships with their investing insurers, conscious of the sector expertise the latter bring. For the few insurtech companies that have publicly listed, equity markets are demanding proof of a clear path to profitability. An analysis (see Figure 5) of firms that have listed in recent years shows that the few firms that are already profitable command better valuations. This leads to a more realistic assessment of today's opportunities, reflecting pared-down expectations.

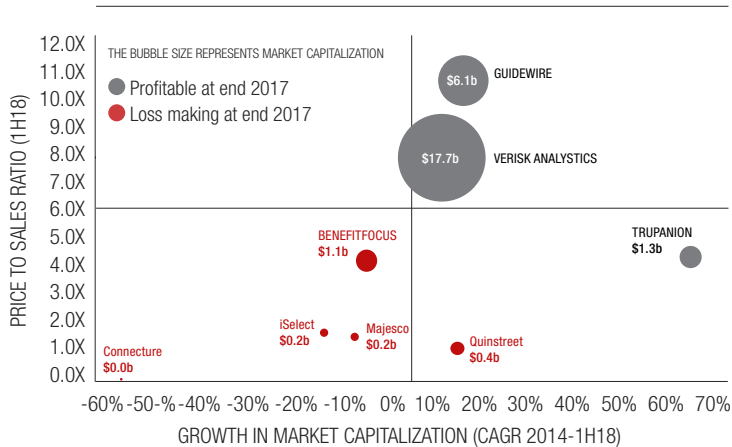
## 7. PARED-DOWN EXPECTATIONS

A critical theme woven throughout this article relates to the promises and possibilities with the availability of a growing deluge of data; however, the systems, processes, algorithms, and know-how necessary to make this data deluge valuable are currently inadequate, making optimism premature. In particular, (re)insurance companies' IT infrastructures have not kept up with data availability. While most companies have constellations of projects focused on remedying this shortfall, the industry is mostly at the beginning of this path and still has far to go.

Expectations for customized insurance and the expectations for the plethora of promised machine-intelligence-enabled tools, products, and services have been pared down as the industry struggles with (and waits for) the completion of new technology platform developments. Fortunately, the advent of the cloud massively reduces the capital investment necessary to build new data platforms. Despite that, system architecture and proper tool choice become even more important to realize the productivity and product promise. Not all platform development teams are up to the difficult and complex task of designing, choosing components, and deploying a new enterprise-wide data platform. These new platform deployments now constitute a



Figure 5: Analysis of post-IPO performance of insurtech companies



Note: Growth in market capitalization for Majesco and iSelect is from 4Q15.

Source: Thomson Reuters, CB Insights, Swiss Re Institute

critical component of a strategy to navigate the digitally-driven changes over the next several years.

Digitally-enabled regulatory compliance presents a double-edged sword. On one side, RPA and machine intelligence (especially NLP) can lead to lower cost and more comprehensive regulatory compliance operations. Digitally-enabled regulatory compliance is often called Regtech. Insurance companies who invest in Regtech synchronized with regular dialogues with their respective regulators should see their costs decrease as their ability to regularly submit reports, respond rapidly to ad-hoc requests, and deal quickly with new requirements will materially improve.

On the other side, regulators will likely demand a higher degree of digital transmission and reporting. Many insurance regulators are already anticipating new reporting capabilities and developing proposals to expand the scope and depth of the data they require. This could lead to a more stable global system as regulators could potentially react much faster to systemically destabilizing circumstances that start with one or two institutions before these forces lead to a global crisis. This real-time reporting could also lead to difficulties for individual companies if errors creep into the transmission or regulators overreact to a particular day's set of reports. Companies that do not make sufficient investment, or make the wrong investment, in digital architectures may find their costs of regulatory compliance skyrocket as new requirements multiply.

The speed and investment in platforms throughout the industry are quite variegated. Despite the wide range of circumstances, these digital platform development projects share a few common characteristics: continual delays, failed enterprise-wide project implementations, and plenty of consultant-facilitated navel gazing. Reduced expectations appropriately track the continued inefficiency of insurance-industry IT. For example, Figure 6 shows that the lack of positive share price reaction for insurers that have been active acquirers of startups, relative to the less acquisitive insurers, implies the market remains to be convinced that insurers automatically derive significant competitive advantage by engaging with insurtech startups.

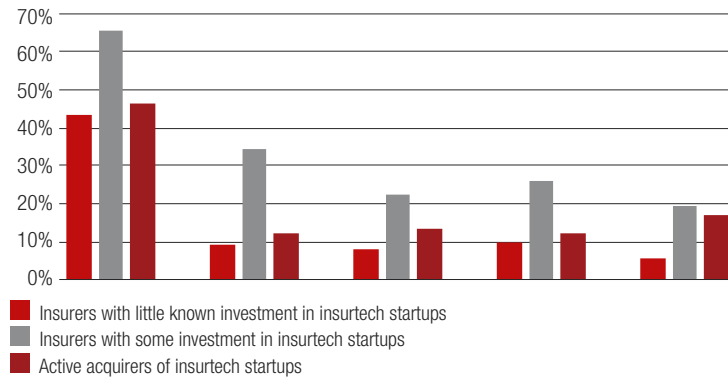
This problem plagues all financial services and is well recognized by most senior financial services executives. Eventually, these platforms will be built, and the data-driven projects will see a sudden injection of productivity and creativity from the new digital-ecosystem toolset. If history is any guide, the accumulation of years and years of gradual changes will suddenly reach a critical threshold and a sudden burst of non-linear improvement will lead to the realizing of these new technologies' promise. Despite the many false starts across the industry, leading incumbents are slowly moving forward. As I have explained above, I expect big and small technology firms will be a critical component of this incumbent-led industry transformation, also.

## 8. TENTATIVE CONCLUSIONS

In this article, I have described the recent past and current trends as digitization rolls through each aspect of the insurance value chain. Given how quickly environments and the digitally-enabled insurance industry ecosystem changes, I will finish with several tentative conclusions. Some trends have a long arc and will most likely continue on their current trajectories; other shorter-term trends could change quite quickly. Interaction effects and the rapid pace of innovation that deliver new tools and new business models on a nearly continuous basis creates drivers that can render a number of these conclusions obsolete in short order. This said, we can say something useful about these trend developments based on the information we have today. With these caveats in mind, I have identified four trends that illustrate this paper's tentative conclusions:

1. Leading (re)insurers have consolidated their position with respect to startups and now lead efforts to digitize the

**Figure 6:** Share price appreciation for insurers, classified by insurtech strategy, Jan-2013 to Aug 2018 (cumulative)



Note: Does not include insurers that are mutual or member owned (e.g., USAA, Mass Mutual).

Source: Thomson Reuters, Swiss Re Institute

insurance value chain, often partnering with or acquiring startups with useful technologies in the digital space. This trend shifts the leadership in adapting to digitization from disruptive startups to transformative incumbents.

2. Data have become paramount in any strategy to navigate digitization. While larger time series of structured data and efforts to find novel data continue to be an important component of this narrative, unstructured data (e.g., text, audio, and video) have become a new opportunity not fully exploited. Incumbents with proper tools and organization will differentiate themselves as novel data become a component of their competitive edge.

3. Machine intelligence and blockchain/smart-contracts are two over-hyped technology areas that have yet to be implemented in a materially profitable and useful way within the insurance value chain. That said, the collections of tools that fall into these two broad categories will continue to evolve. Eventually, a properly pruned subset of these technologies will trigger a discontinuous change in the way insurance is marketed, distributed, and managed. Much work remains in the realm of figuring out what specific tools in these spaces should be deployed. Both (re)insurers and their technology partners will benefit from deep investment and experimentation with machine

intelligence and blockchain. The time horizon of successful deployment may be longer than originally promised, but the future will most likely include both of these technology families.

4. Regulatory compliance will continue to be a critical component of any strategy to leverage data and digital tools. This aspect of the insurance industry differentiates it from other industries in the sense that total disruption via a yet-to-be created startup is extremely unlikely. One area in this context that will be particularly onerous for any firm expanding its use of data, particularly in the area of personalization and customization – relates to data privacy. As an example of the challenges in the data area, the E.U. has rolled out a new set of rules for data privacy [called Global Data Privacy Regulations (GDPR)], in May of 2018. These types of new regulations will continue to come at a fast and furious pace furthering the advantage of large (re)insurers already equipped to manage compliance. Effective implementation of technology tools to facilitate compliance will be an important differentiator for forward-thinking (re)insurers.

Digital trust and brand reliability are intertwined with all four trends. As (re)insurers become the focus of clients at the time of processing claims, building a trusted brand becomes essential to maintaining and growing a sustainable insurance franchise. This “trust” will encompass how data are managed, how customer needs are met, the extent to which regulators are satisfied, and how a firm manages its capital. Digitally-informed brand strategies are another important investment for (re)insurers looking to navigate successfully the changing marketplace as technology permeates the insurance value chain. Deriving actionable insights from data with machine intelligence will be an important underlying differentiator for insurance companies struggling to adapt to the changes in the developing insurance digital ecosystem. Today, this transformation is led by informed-incumbents. While tomorrow could bring a new set of disrupters, the relentless onslaught of change will not go away: eventually every corner of the insurance industry’s ecosystem will have to cope with society’s digitization wave.

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