Swiss Re Institute

Digitally-driven changes to insurance

February 2018

Abstract

As technology continues to insinuate itself into all facets of financial services, the insurance industry faces a slow-motion parade of *promise, possibilities, prematurity,* and *pared-down expectations*. Digitization, the birth of InsurTech, machine intelligence, and the collection & curation of (orders of magnitude) more structured & unstructured data are changing (and will continue to change) the industry in material ways—not always in line with predictions. This presentation describes (from a large insurer's perspective) trends and challenges related to how technology and society's digitization are irrevocably changing risk markets and insurance. Based on the described trends, one nuanced answer will be suggested to the question of whether insurance is being disrupted or transformed.

Background: Useful knowledge

- Digital drivers invoke structural, persistent change when it results in *useful knowledge*
- Requires both scientific knowledge & artisanal (i.e., practical & applied) knowledge
- Useful knowledge may not necessarily be useful to all market participants depending on dynamic capabilities defined by:
  - Infrastructure
  - People
  - Access to, and understanding of, data & tools
  - Organizational adaptability

Background: Genomic metaphor

- A, C, T, G explains (relatively) small amount of variation
  - Epigenomics
  - Transcriptomics
  - Proteomics
  - Microbiomics
  - Metabolomics
- Phenotypic stasis may cover for genotypic changes over subsequent generations: Result is infrequent discontinuous or punctuated changes moving the phenotype to radically different stasis.
- Potential metaphor for thinking about digitally-driven change

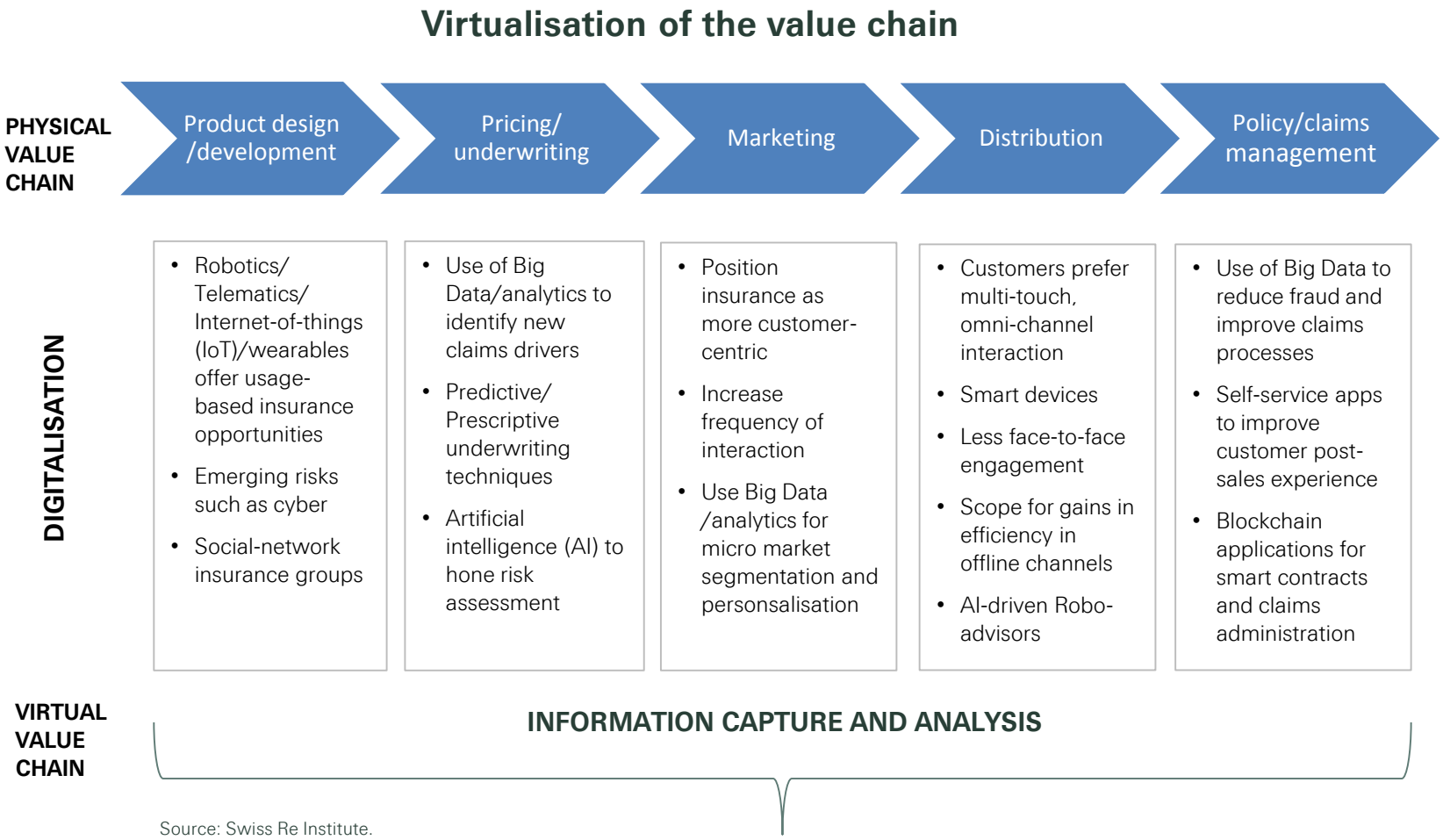
Background: Financial services' technology weaknesses

- Why are financial services behind?
- Why does insurance lag other financial institutions in terms of adopting technology?
- What might make insurance different from other industries?
  - Tail risk
  - Regulation
  - Trust/brand
  - Decision-making complexity

Insurance share-value channels and digitization

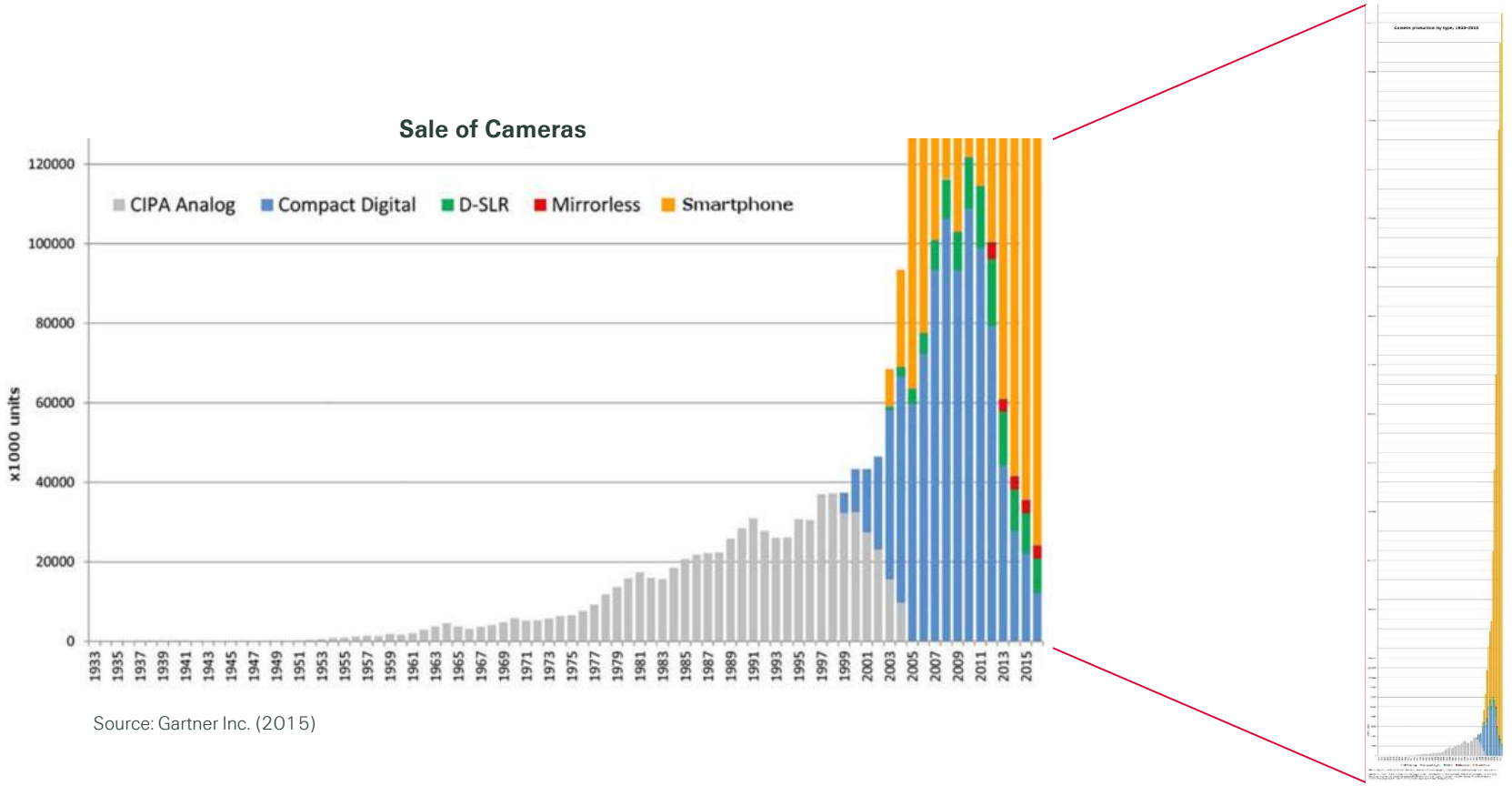
- Business steering
  - Leverage network and know-how
  - Identify, collect, and curate data
  - Find new business lines
  - Avoid material risks
- Capital allocation
  - Strategic asset allocation
  - Alpha capture
  - Liability portfolio allocation
  - Risk selection and pricing
- Commercialization
  - Improve marketing
  - Reduce client-acquisition costs
  - Increase client “stickiness” with products/services, support, and thought leadership
- Efficiency
  - Improve distribution
  - Improve policy administration/ renewals
  - Reduce claims processing costs
  - Reduce overall cost footprint
- Data as a business

Technology is affecting the insurance value chain



Source: Swiss Re Institute.

Lessons from technological change in a different industry



Source: Gartner Inc. (2015)

Insurance (and financial services) are still in technological stasis

- *Promise* still unfulfilled: Market structure is approximately the same as 40 years ago
- *Possibilities* still vaporware: Data systems continue to be…
  - fragmented
  - poorly curated
  - mostly short histories of structured with little unstructured
  - hard to use
- *Premature* discussion on new tools: Much talk about machine intelligence/blockchain with virtually no profitable implementations
- *Pared-down* expectations: Business model changing very slowly– technology discussions are focused mostly on improved efficiency (e.g., robotic process automation [RPA])

Spoilers

- Data continue to show that insurance is being transformed-- not disrupted.
- Insurers continue to invest in tech start-ups. Most InsurTech start-ups do not want to go to war with incumbents. They focus on leveraging technology to create value within the insurance value chain – not collapsing it.
- For insurers, comparative advantage in wielding technology is key: This could lead to an arms race among insurers.
- Compared to developed markets, tech giants are now more forcefully expanding into insurance in China.
- Amazon's potential entry into health care is new. This could be transformative and disruptive.
- Regulators are becoming more vocal (e.g., FSB's report on financial stability implications of artificial intelligence and machine learning published in Nov 2017)

Outline

- Data, technology, and analytics trends
- Insurance from a technology perspective
- Insurtech
- Insurance companies meet insurtech
- Bigtech and insurance
- Final remarks

Developing ecosystem connecting data, technology and analytics

DATA, TECHNOLOGY, AND ANALYTICS TRENDS

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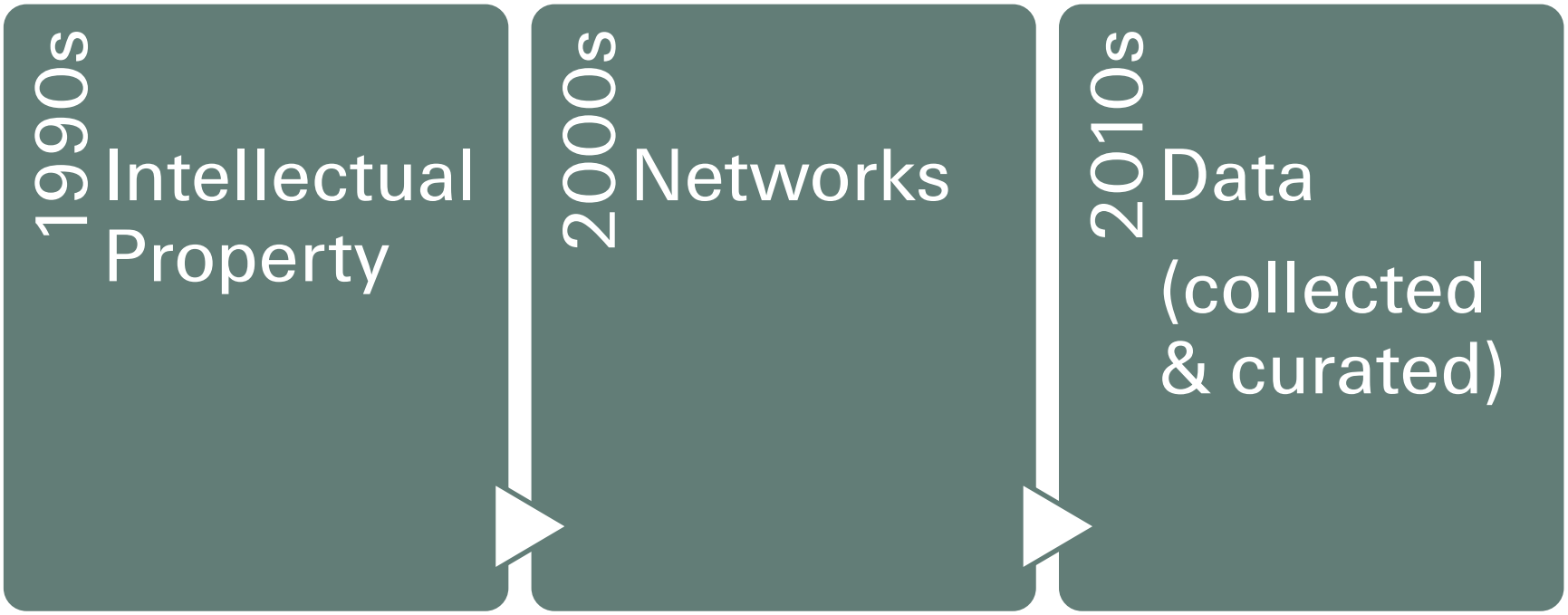
Drivers of value in the technology sphere



Capacity opportunities and challenges

- Moore's law: Processing speed doubles every 18 months– *reaching physical limit*

- Kryder's law: Storage capacity doubles every 12 months– *actual increase may be more like 15% per year– but likely to accelerate*

- Nielsen's law: Bandwidth doubles every 21 months

Collecting, curating, and coordinating data have replaced processing data as the binding constraints on evidence-based R & D efforts.

Open-source algorithms are relatively less valuable than data access & insight.

Data is the new "oil"– extract, refine, distribute

- Collect
  - Structured: Time series
  - Unstructured: Text, audio, and video
  - Moore's law gives way to Kryder's & Nielsen's laws as binding constraint
  - *Key is finding novel data*
- Curate
  - Manage heterogeneous formats
  - Address noisy & missing data
  - *Key is ensuring data is reliably retrievable in the future*
- Contemplate
  - Beware quantifauxcation (assigning a meaningless number, then pretending that since it's quantitative, it's meaningful– Stark [2015])
  - Address cognitive biases
  - *Better to be approximately correct than precisely wrong*

Final, and crucial, step is communication

Contemporary challenges of managing massive data growth

- Volume: Size of managed data
- Velocity: Speed of data arrival and processing
- Variety: Types of data including structured and unstructured
- Veracity: Accuracy, precision and relevance of data

Assessment of data along these dimensions should inform technology architecture, process, and model choices

Marrying finance and technology

- Fintech
- Insurtech
- Regtech [Both compliance and supervision]
- Robotic process automation (RPA) [Processtech?]

Trust, brand, & regulations continue to hinder small startups.

Data access, management, & understanding continue to be critical.

Machine intelligence: Finding, then replicating patterns

- Categories of machine intelligence
  - Artificial general intelligence
  - Artificial intelligence
  - Augmented intelligence
  - Deep learning
  - Machine learning
  - Natural language processing
  - Process automation
- Primary challenge is quality of data– biased, insufficient for training, rendered obsolete by regime/structural changes
- Noise is not always a problem– depends on its attributes

Deep learning

- Relies on multi-layered relationships
- Limited by training data availability
- Operates as a black box
- Model validation approach will have to change to accommodate
- Supervised deep learning may have more application in risk management than unsupervised deep learning
- Success to date has been limited; however, may eventually have successful applications

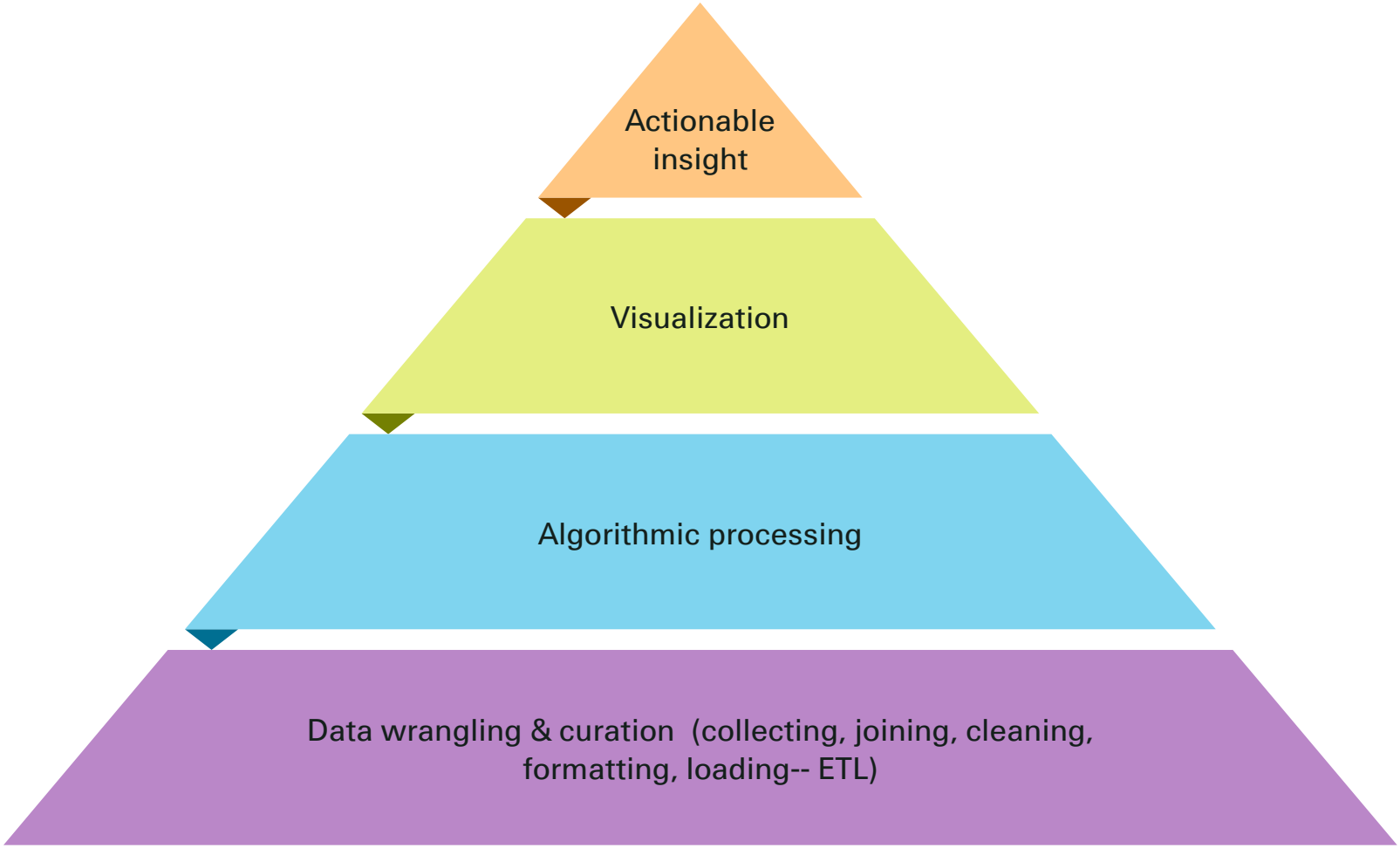
Marrying qualitative and quantitative data

- Roughly 90% of available data are qualitative and unstructured e.g., articles, blogs, e-mail, regulatory filings, slide presentations, social media, etc.
- Quantitative data may not reflect all forward-looking risks (e.g., Environment, Social, Governance-- ESG)
- Transforming qualitative data into indicators and combining in some way (e.g., shading, weighted combinations, etc.) with quantitative data may be a path to improving existing models

Analytics-based demands tend to outstrip capacity

- Longer, richer and more robust time series
- Faster computation– especially simulations (reduce hours/days to minutes/seconds)
- Larger, noisier datasets
- Machine intelligence (NLP, Deep learning, etc.) requires more data, more storage and more compute power

Insight pyramid



Technology themes in insurance

INSURANCE FROM A TECHNOLOGY PERSPECTIVE

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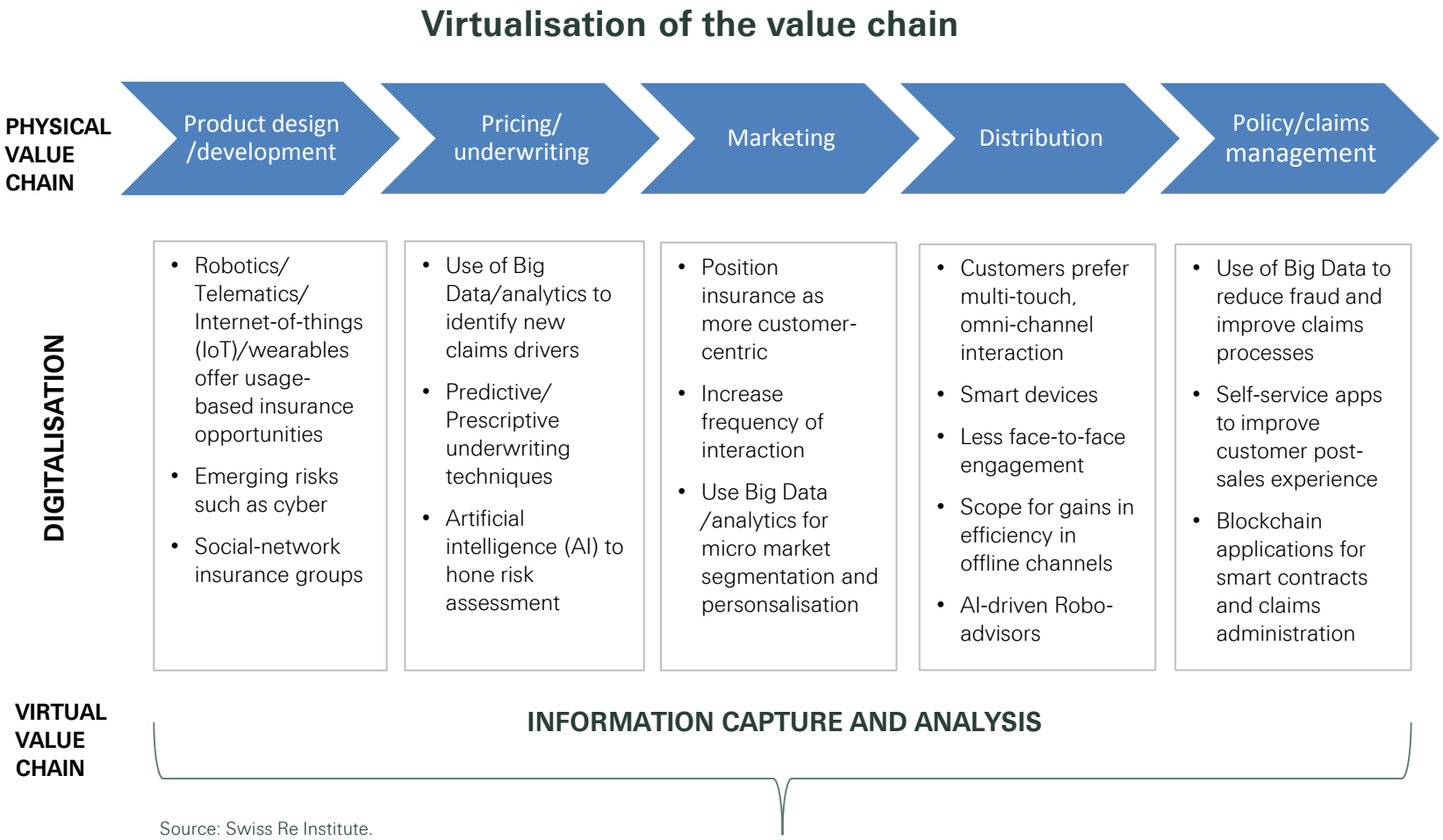
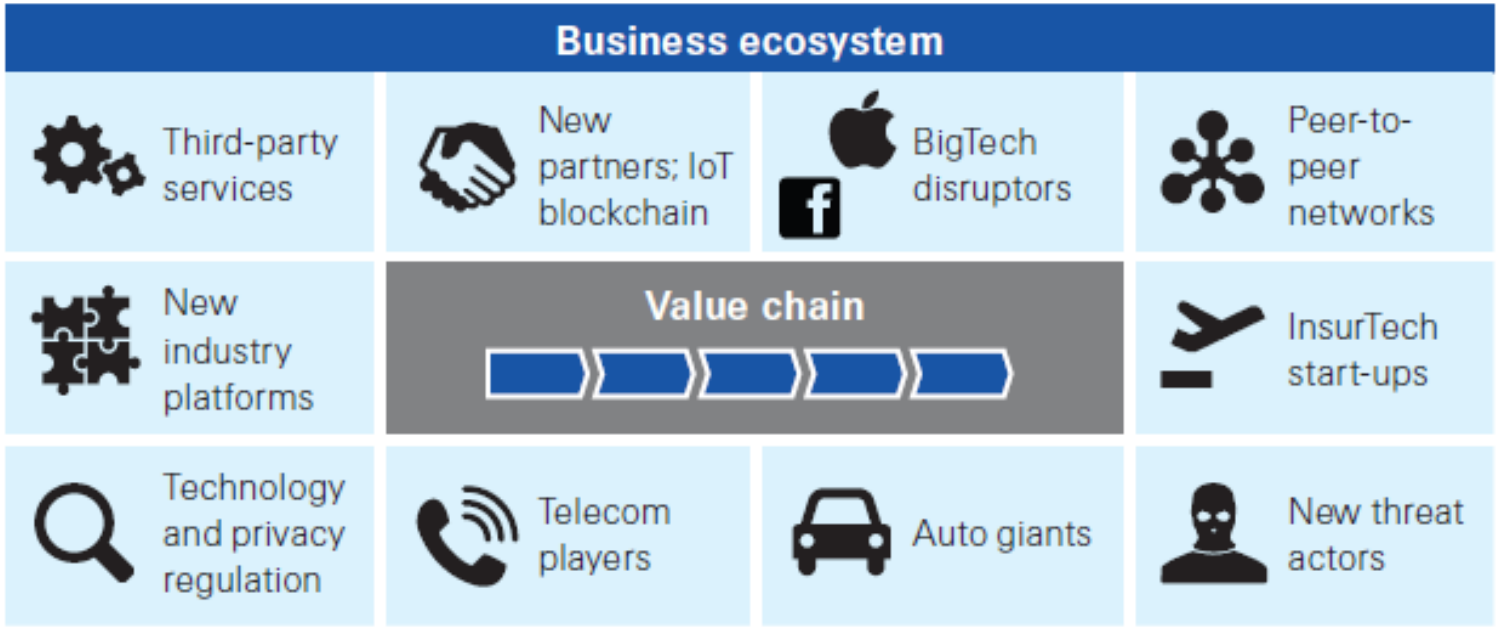
Technology is affecting the insurance value chain



Source: Swiss Re Institute.

Digitalisation not only affects the value chain but also impacts the wider business ecosystem



Source: Swiss Re Institute.

Black swans, gray rhinos, and perfect storms create discontinuities

- Defining extreme-downside, scenario categories:
  - Black swans: Unknowable given current information set and virtually impossible to predict
  - Gray rhinos: Highly probable and straightforwardly predictable given current information set, but neglected
  - Perfect storms: Low probability and not straightforwardly predictable given the outcome results from interaction of infrequent events
- Scenario-based analyses vs. forecasts
- Deeper analyses of underlying assumptions, relationships, and data
- More focus on tools/processes to manage multiple sets of scenarios and analyses across time
- Renewed efforts to enforce *preproducibility, reproducibility,* and *out-of-sample testing*
- Process management systems with robust audit logs are more important than ever

Regulatory challenges

- Managing/maintaining multiple, fragmented, and varying databases for validation and audit
- Open source tools
- Concerns about the Cloud
- Black-box nature of machine intelligence creates challenges for validation
- Data privacy rules (differs across jurisdictions)
- Cyber-security

Marrying insurance and technology

INSURTECH

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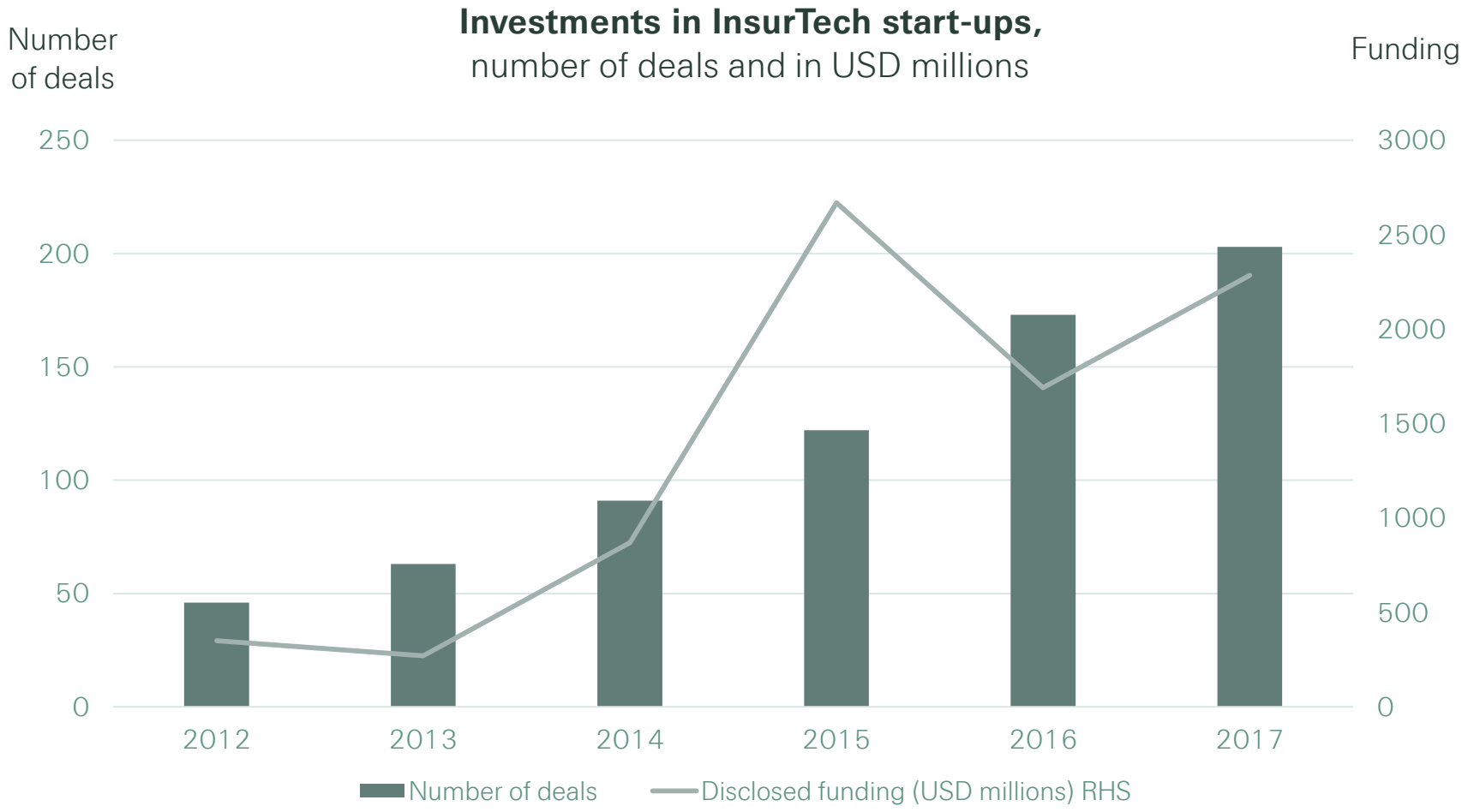
Investments in high-tech start-ups in insurance (InsurTech) have grown rapidly over the last five years.



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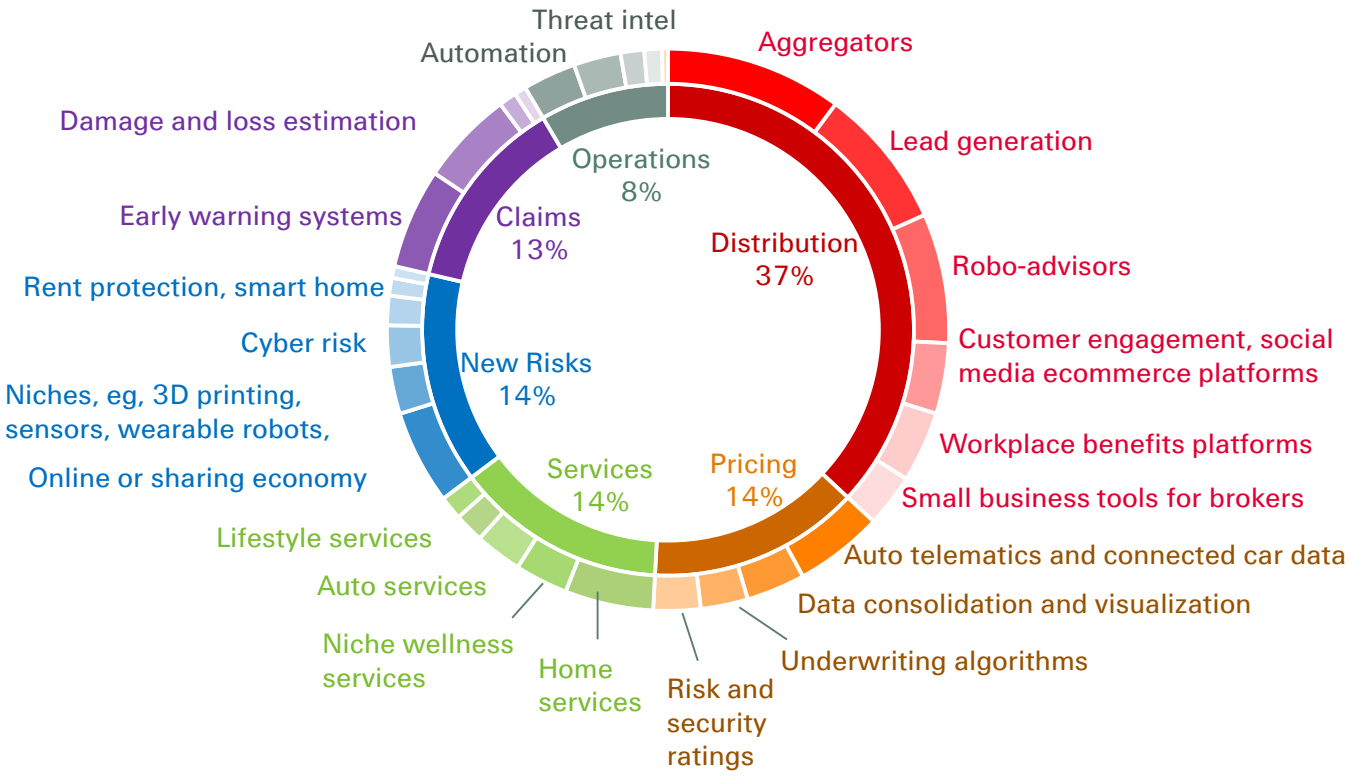
Source: *Quarterly InsurTech Briefing Q1 2017,* Willis Towers Watson Securities, Willis Re, CB Insights, April 2017

Technology applications in distribution, services, and new risk pools are of greatest interest to insurers

Investment focus in InsurTech (% share by number of start-up investments), 2014-2016



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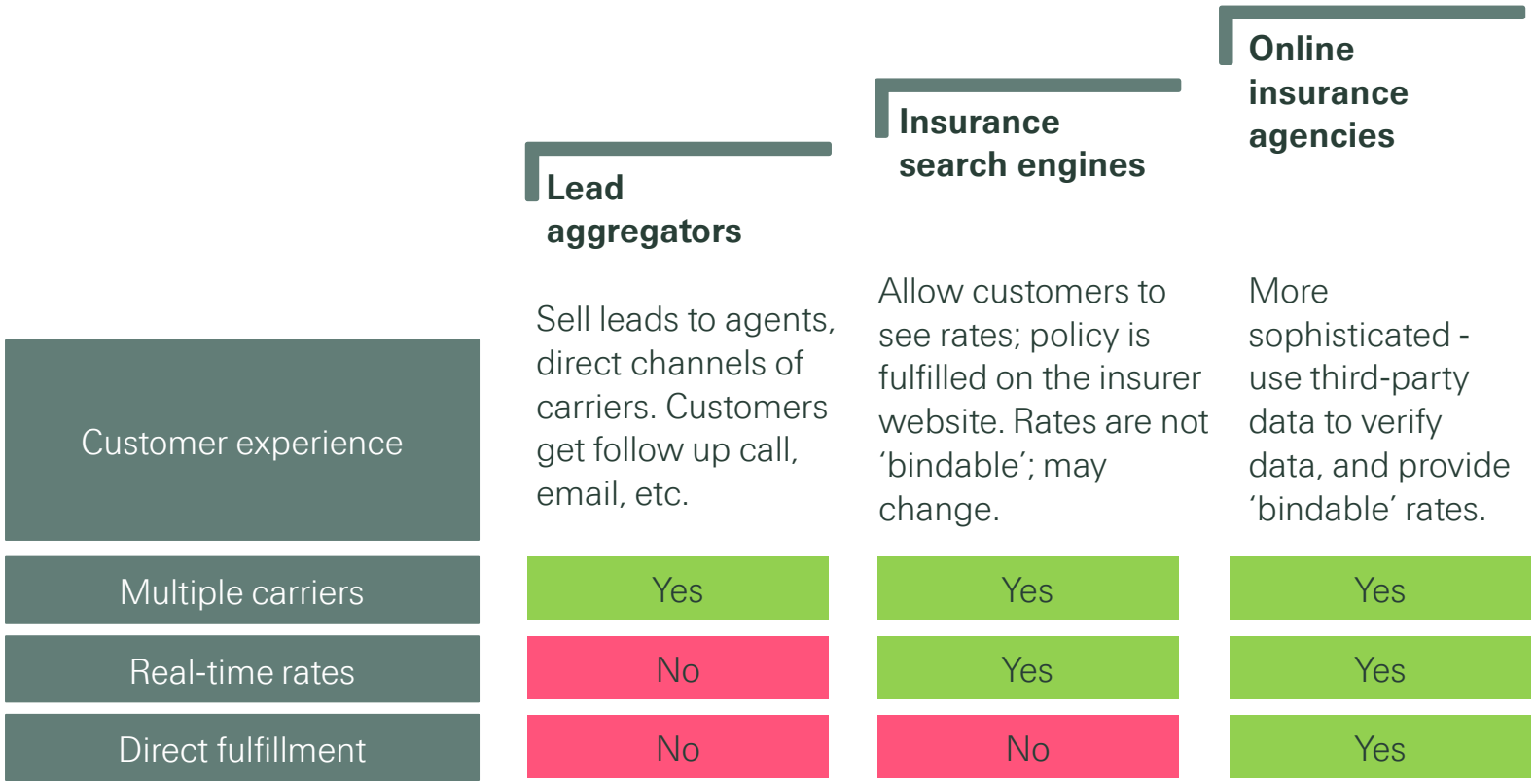
Note: Data relate to a sample of 300 of the best-known and well-funded InsurTech start-ups.
Source: Swiss Re Institute, based on information from company websites and media reports.

InsurTech start-ups offer consumer-friendly digital broker platforms for small & medium enterprises (SMEs)

Levels of sophistication among InsurTech agencies that distribute small business insurance



Swiss Re Institute

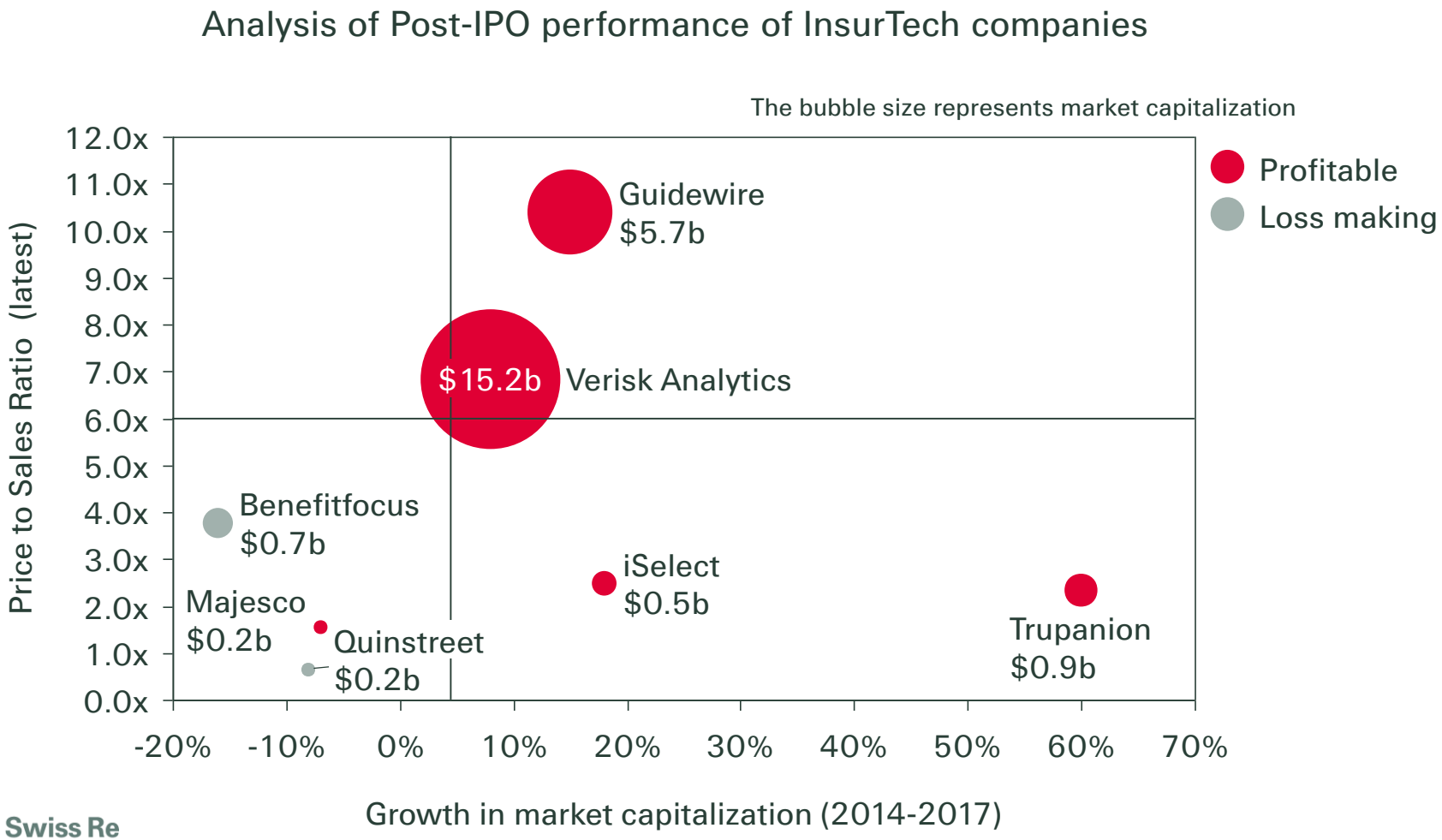
Source: Swiss Re Institute, based on information from company websites and media reports.

In commercial lines, InsurTech firms are developing a range of applications (activity is lower than personal)

Line of business	Use cases InsurTech in commercial insurance	Examples of start-ups
Workers compensation	• Monitor incidents via posture devices, wearables. • Real time alerts, behavior modification. • Telemedicine; lower time to return to work.	humancondition SAFETY, Argo Risk Tech
Industrial equipment	• Enabling devices to control hard-to-reach machines. • Data intelligence on productivity, preventative maintenance.	waygum, relayr.
Commercial real estate	• Smart buildings and equipment monitoring. • Noise monitoring and reporting, property management platforms.	QUIETYME, Airware
Commercial auto	• Reward better driving among fleets. • Fleet performance, vehicle servicing	THE FLOOW, lightfoot Rewarding better drivers
Group health and benefits	• Move employer-owned benefits to private programs. • Other benefits, eg, student loan contribution. • Treat productivity issues, eg, heavy drinkers.	TUITION.IO STUDENT LOANS MADE SIMPLE, Hixme
Cyber risk	• Threats related to the wireless workplace. • Information sharing – breach data.	BITSIGHT, CYENCE

Source: Swiss Re Institute, based on information from company websites and media reports.

Few InsurTech firms are listed, of which larger profitable ones command higher price-to-sales ratios; acquisition by insurers is also a possible option



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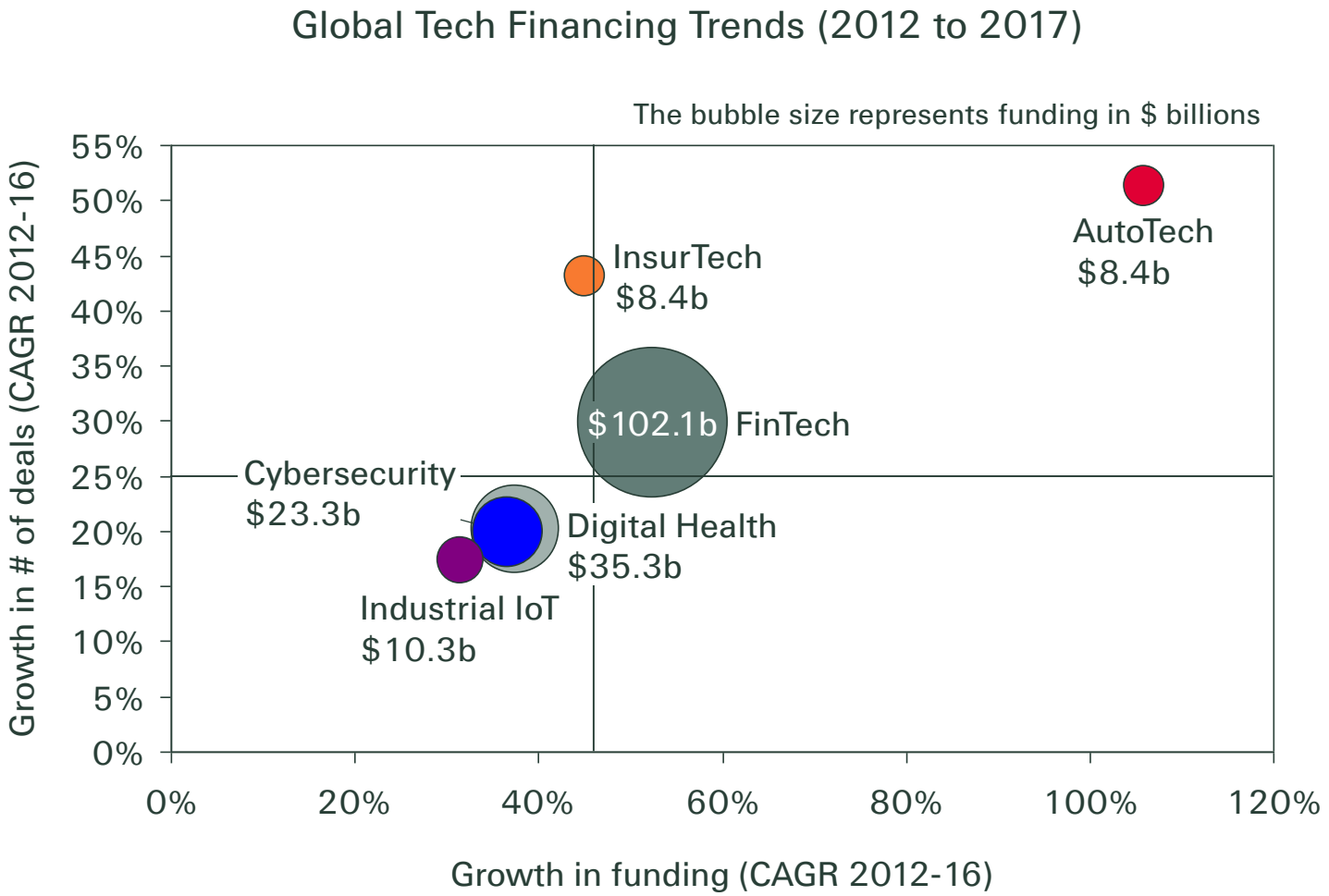
Source: Thomson Reuters, CB Insights, Swiss Re Institute

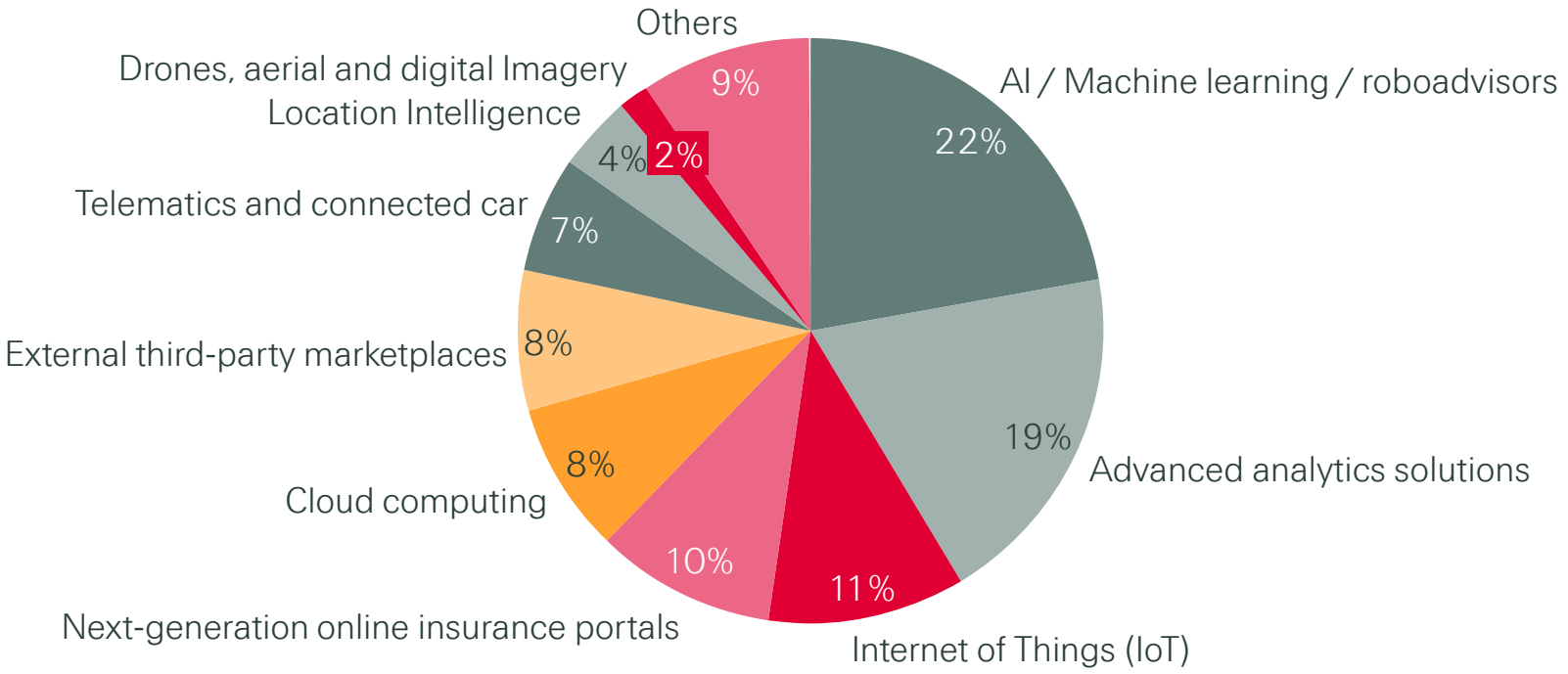
Venture investors put $102B into FinTech related startups over the last six years, of which $8.4B was in InsurTech



Source: CB-Insights, Tech Review Report 2016, Swiss Re Institute

Lead technology of the InsurTech startups and their application across the value chain

Technology areas that InsurTech start-ups are focusing on
(% share by number of start-up investments), 2014-2016

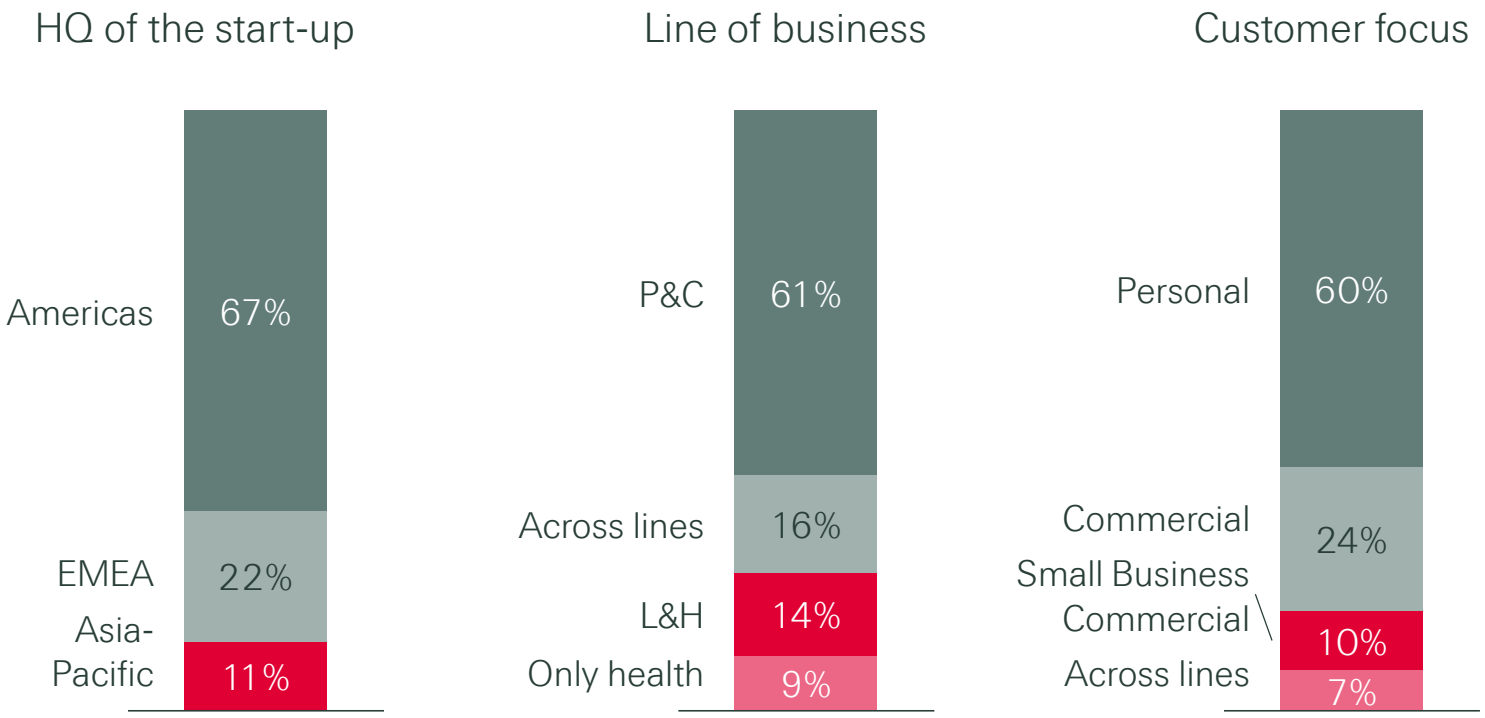


Swiss Re Institute

Note: Data relate to a sample of 300 of the best-known and well-funded InsurTech start-ups.
Source: Swiss Re Institute, based on information from company websites and media reports.

Geographically, over 65% of InsurTech investments and partnerships were in start-ups headquartered in the Americas (predominantly the US)

HQ, LOB and customer focus of InsurTech start-ups,
2014-2016



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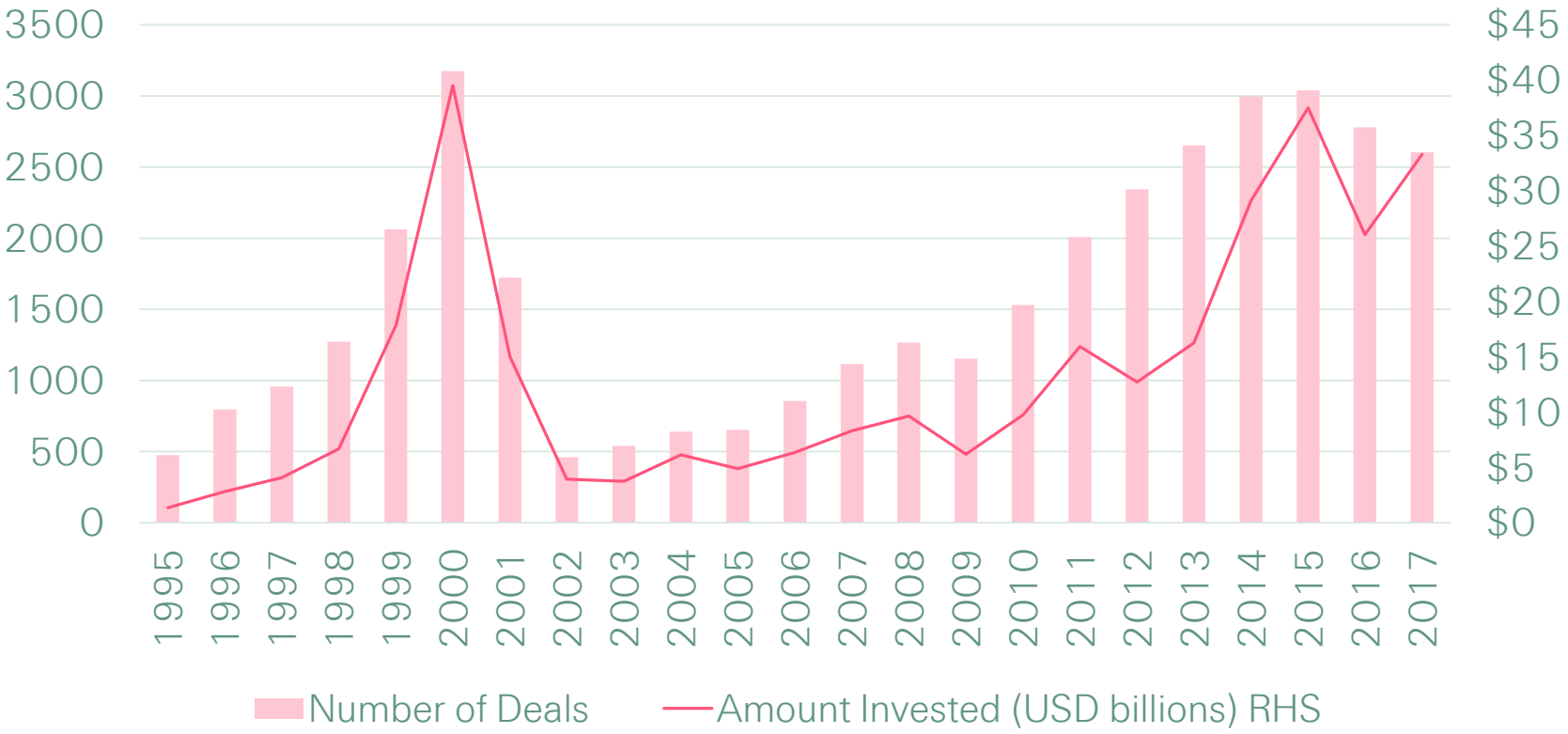
Source: Swiss Re Institute, based on information from company websites and media reports.

The pace of expansion in technology-led investments over recent years has echoes of earlier episodes

Venture capital investments in the U.S. to the Internet and software sector, 1995-2016



Swiss Re Institute

Source: PwC/CB Insights MoneyTree Explorer, https://www.pwc.com/us/en/technology/moneytree/explorer.html#/

Insurance industry response to technological change

INSURANCE COMPANIES MEET INSURTECH

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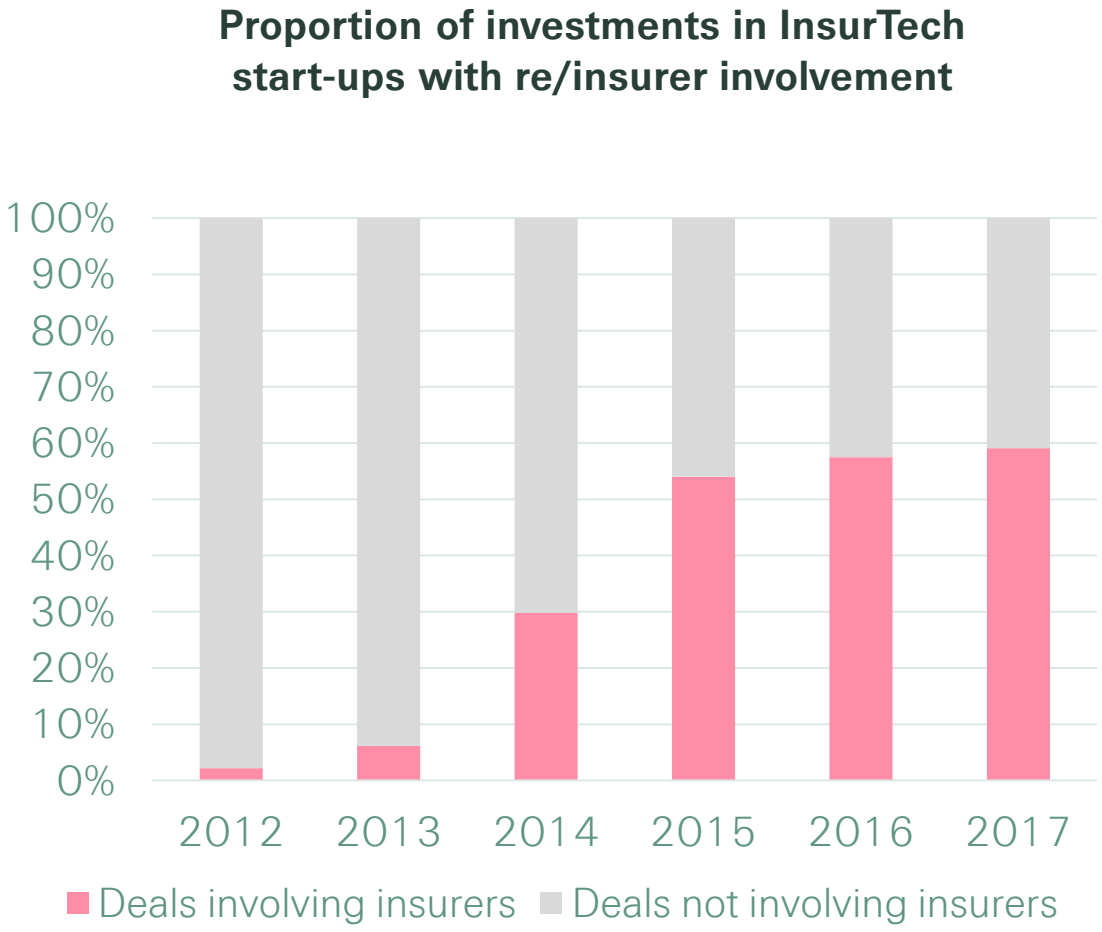
There are signs that the industry is repositioning to technological change

Insurers' technology strategies

Venture investments	Invest in InsurTech start-ups with a proven business model, product, customers, first revenues
Start-up partnerships	Insurers run pilots with InsurTech start-ups, act as capacity providers, and offer claims management expertise
Innovation labs and accelerators	Nurtures in-house teams, and less mature InsurTech start-ups. Turn ideas into business applications. Insurers support with initial funding and networks
Contracts with large tech vendors	Consulting for business model innovation. Multi million dollar projects to tap expertise in business processes, tech and integration

Source: Swiss Re Institute.

Insurers are investing in or partnering with InsurTech start-up firms

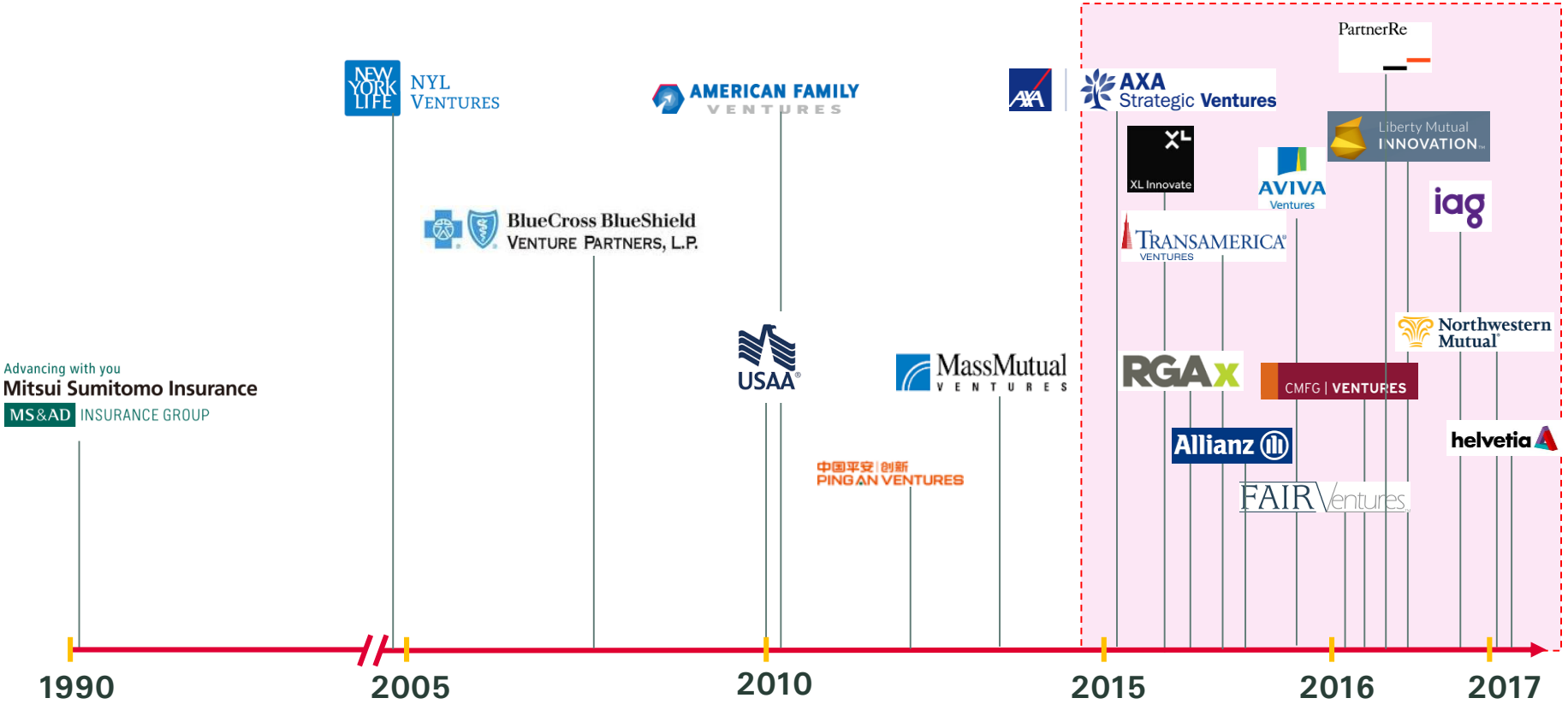


Swiss Re Institute

Note: This is based a wider sample of approximately 500 InsurTech deals compiled by CB Insights.
Source: CB Insights data.

Insurers have launched venture funds in order to get an early insight into the application of new technology...

Timeline of corporate venture fund announcements
by selected insurers



Swiss Re Institute

Source: Insurer websites, press releases, Swiss Re Institute

... and have also entered into several new partnerships in smart home, distribution, and elsewhere

Start-up	Description of partnership
UNDERSTORY	The insurer and the **weather sensor** data startup aim to improve claims handling
carma	Insurance coverage for Carma's **carpooling** and car-sharing programs
Airware	Airware selects and customizes **drones** and pilots that the insurer uses
openbay	Allows policyholders to receive multiple price quotes and schedule **auto repairs**
indico	Text and image analysis to enhance **machine learning** in investment decisions
BITSIGHT	Provides **security ratings** to a specific group of policyholders
censio	Sensor technology to measure **driving habits** and in-car smartphone usage
CYBERDYNE	Develop insurance for users of **wearable robots** for rehabilitation and work
bitFlyer	**Cryptocurrency insurance** protects losses at the exchange and customer levels
GamaSec	Insurers support the limited warranty issued with its **website security** offering

Swiss Re Institute

Source: Insurer websites, press releases, Swiss Re Institute

Re/insurers' have also sought to design new tech-led products and introduce process improvements in-house

Insurers	Extract of selected patent keywords (not exhaustive)
Progressive	Mobile insurance platform, Customizable insurance, Motor vehicle monitoring system for determining cost of insurance, Rich claim reporting system
Hartford Fire	Telematics based underwriting, Analysing sensor data, Using mobile devices for medical monitoring, Geocoded insurance processing using mobile devices
Allstate	Driving analysis using vehicle-to-vehicle communication, Assistance on the go, Route risk mitigation, Feedback loop in mobile damage assessment & claims
State Farm	Providing driver feedback using a handheld mobile device, Automated texture data analysis, Grid-based insurance rating
MetLife	Use of drones for underwriting related activities, Visual assist for insurance facilitation processes, Sensor-enhanced insurance coverage & monitoring
Tokio Marine	Mobile road-assist system, Attribute forecasting system, System and method for supporting provision of rating related service
Sompo Japan	Generating index for evaluating driving, Information processing apparatus, Vehicle-mounted device, Method for analysing damage of products

Swiss Re Institute

Source: Google patent search, Swiss Re Institute

Insurers are also seeking partners for new and innovative risk protection products

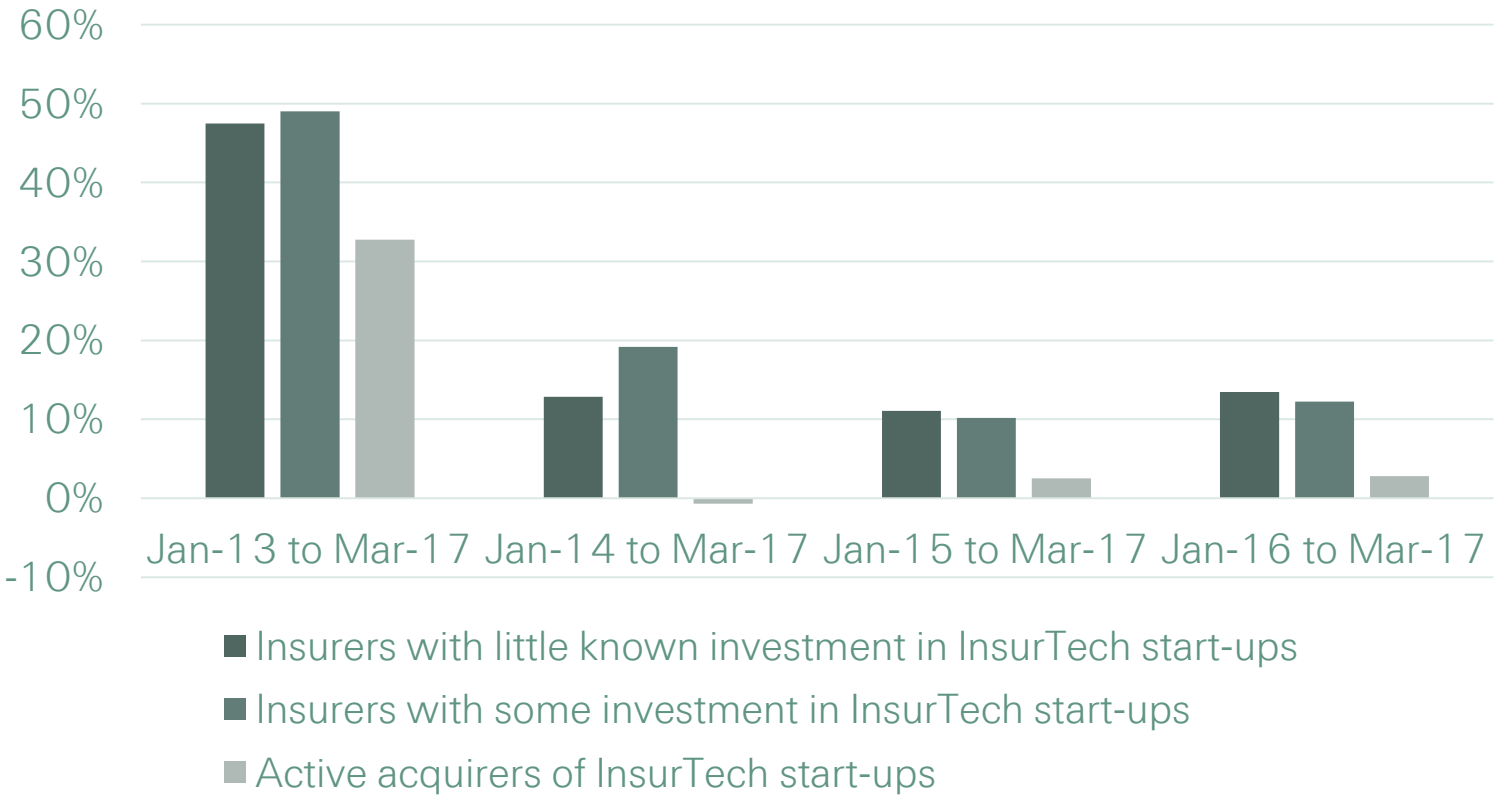
Examples of emerging risks that start-ups are addressing with insurer backing

Type of insurance	Examples of start-ups	Short description of the risk being covered
Liability for sharing economy contractors	recomN.com, bunker. next	Insurance for small business (eg pop-up stores, contractors like personal trainers, photographers) covers exceptions or limitations
Coverage for home sharing economy	safe share, Slice, ShareCover	Insurance cover for sharing houses for short stays, Blockchain-based property insurance for the sharing economy
Coverage for car sharing economy	drivy, carma	Insurance coverage for carpooling and car-sharing programs
Cybersecurity bundled with insurance	MYDIGITALSHIELD, ARGUS CYBER SECURITY	Support for software's data breach guarantee, Identity theft detection, protection and fraud resolution combined with insurance
On demand insurance for short-term use	Verifly, ZOZR	On-demand drone insurance for recreational and commercial flights, Insurance for short-term rental for heavy equipment market
Property lease guarantor services	LeaseLock, TheGuarantors	Property lease guarantor services - helps individuals secure acceptance to lease an apartment or house
Liability for new technology	NEW ENERGY RISK, relayr., bitFlyer	Customized insurance for new technology. eg, IoT infrastructure guarantees, Clean Tech performance warranty, Liability for wearable robots, 3D printing liability, cryptocurrency exchanges

Source: Insurer websites, press releases, Swiss Re Institute

Market reaction to engagement with InsurTech start-ups is mixed (1)

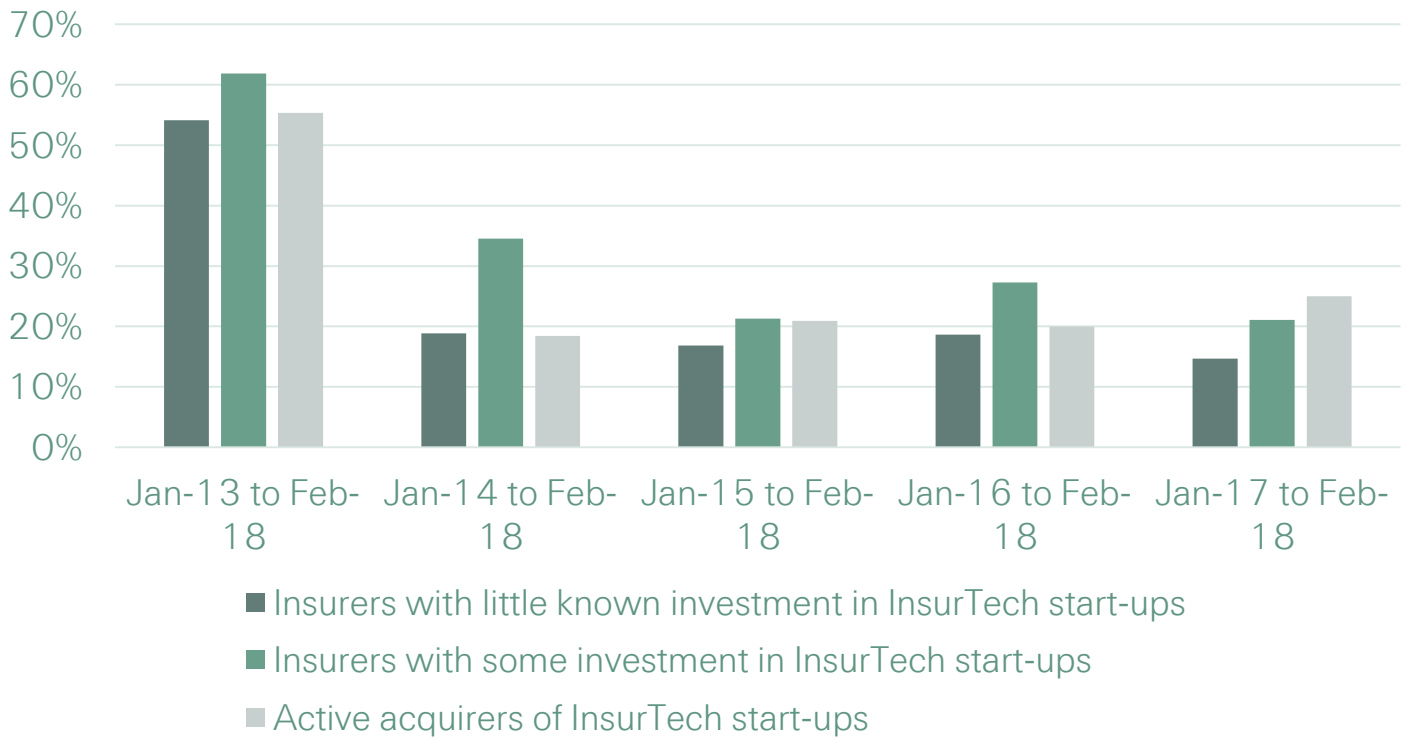
Share price appreciation for insurers, classified by InsurTech strategy,
2013-2017 (cumulative)



Note: Does not include insurers that are mutual or member owned (eg, USAA, Mass Mutual).
Source: Reuters, Swiss Re Institute

Market reaction to engagement with InsurTech start-ups is mixed (2)

Share price appreciation for insurers, classified by InsurTech strategy, 2013-2018 (cumulative)



Swiss Re Institute

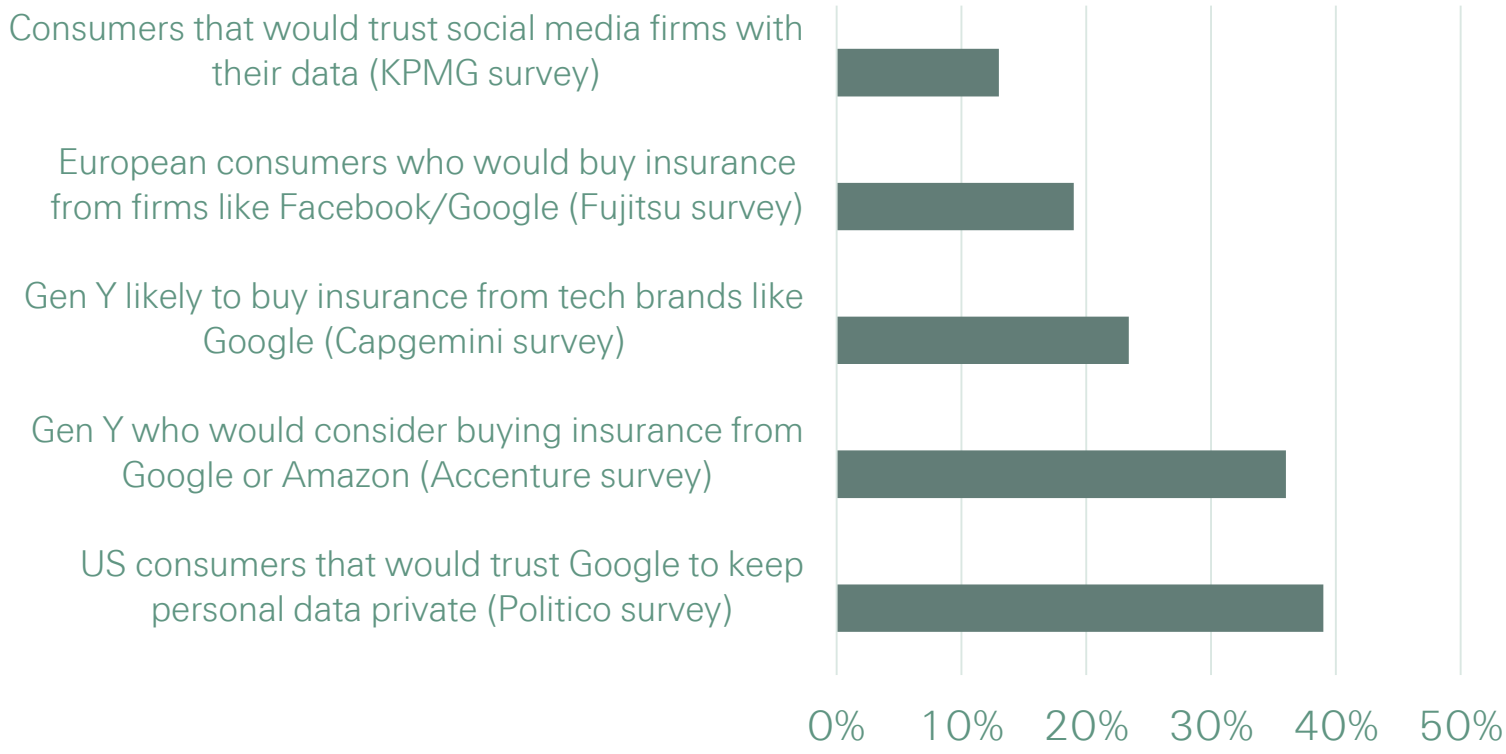
Note: Does not include insurers that are mutual or member owned (eg, USAA, Mass Mutual).
Source: Reuters, Swiss Re Institute

Bigtech (FAANGS & BATS) may constitute a bigger threat to insurance

BIGTECH AND INSURANCE

Coupled with strong brand appeal to younger generations BigTech players may actually represent a more credible competitive threat to incumbent insurers than InsurTech

Summary of surveys about how consumers perceive BigTech
(% of respondents)



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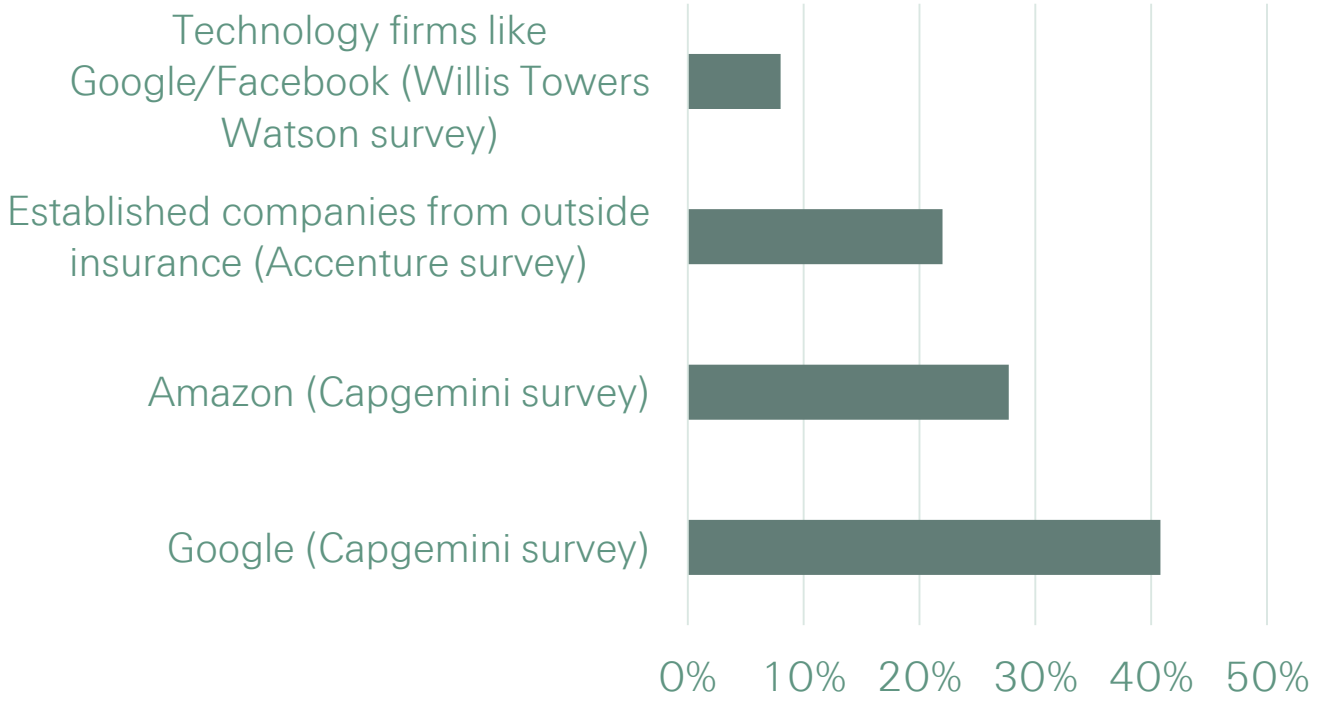
Source: KPMG (2016), Fujitsu (2016), Capgemini (2016), Accenture (2016), Politico (2017)

Among the tech giants, Google and Amazon are seen as a particular threat given their access to vast amounts of data on prospective customers

Insurers' perceptions of the threat from new entrants in the insurance industry
(% of respondents)



Source: Willis Towers Watson (2016), Accenture (2016), Capgemini (2016)

BigTech companies already have some experience of insurance, albeit largely in niche markets

Selected tech giants' recent forays into the insurance industry (US, and EMEA)

Tech firms	Role in insurance industry
Google / Alphabet	• Mar-17: Insurers experimenting with the voice-activated speaker, Google Home as a channel for offering advice. • Sep-16: At Monte-Carlo asked for partners to develop bundles that blend tech. and hardware with insurance. • Sep-16: Launched an 'Advanced Solutions Lab' for insurers to work with its machine learning experts. • Jun-15: Partnerships with insurers through its Nest product line and investments in start-ups that use wearables. • Mar-15: Briefly experimented with its own auto insurance comparison portal 'Google Compare' in the US.
Facebook	• Mar-17: Chatbot platform on Messenger used as an ecosystem to distribute and service insurance offerings. • Nov-16: Facebook blocked insurer's car insurance discount plan. • Ongoing: Fraud investigators independently use Facebook to unearth the 'real' truth behind claims.
Amazon	• Mar-17: Lloyds offers loss-of-income policies for sellers suspended from Amazon; Amazon is not involved. • Sep-16: Promoting the possibilities of its assistant (Alexa) as a serious business tool in insurance. • Apr-16: Partners with insurer on own-brand insurance, 'Amazon Protect' for electronics sold on its website.
Apple	• Mar-17: Consumers combine iPhone camera, Messages, and Apple Pay to buy insurance sold by start-ups. • Sep-16: Insurers distribute Apple watches to encourage policyholders to exercise. • 2016 : Relies on insurers to underwrite a warranty service for its devices (AppleCare+ is backed by AIG). • Sep-14: Partnership with health insurers to offer mobile data on steps walked, calorie and heart rate data.

Source: Website articles, press releases, CB Insights, Swiss Re Institute

BigTech companies already have some experience of insurance, albeit largely in niche markets

Selected tech giants' recent forays into the insurance industry (Asia)

Tech firms	Role in insurance industry
Baidu	• Jun-16: JV with China Pacific Property Insurance to design new products for auto insurance. • Jun-16: Testing its self-driving cars and expects to start mass production of such cars in coming five years. • Nov-15: JV with Allianz to launch Bai'An, a new "scenario-based" insurer eg, ticketing and takeout delivery. • Jan-15: Teamed up with Launch Tech and Ping An to launch vehicle telematics device Golo.
Tencent	• Jan-17: To develop an insurance company in Hong Kong with Aviva to focus on digital insurance. • Nov-15: Tencent-backed online bank Webank launched its first insurance product with Guohua Life Insurance. • Sep-15: A joint-venture with state-run CITIC Guoan set up an online life insurance firm. • Jun-15: Alibaba and Tencent-backed Zhong An raised $931M from investors. • Dec-14: Pony Ma of Tencent, and Jack Ma of Alibaba were among investors in $4.7B stake in Ping An Insurance. • Mar-14: Tencent collaborated with Taikang Life to offer WeChat users health insurance protection.
Alibaba	• Sep-15: Alibaba's Ant Financial agrees to invest $188M for 60% of China insurance firm Cathay Insurance. • Jul-15: eBaoTech partners with Alibaba to launch an insurance cloud infrastructure platform • Jul-15: Alibaba Health partners with CPIC Allianz on health reform, to explore commercial insurance services.

Source: Website articles, press releases, CB Insights, Swiss Re Institute

Process trumps algorithms and the future is hard to predict

FINAL REMARKS

Trends in data, models, and decision support

- Data (particularly unstructured) is available in ever increasing quantities
- Data regulation has become much more complicated
- Data are plentiful, but noisy– often noise characteristics are misunderstood
- Non-linear, self-reinforcing processes under more scrutiny
- Averages less important than distributions
- Behavioral studies have become a focus, feature, and a fear-monger
- Model validation is different & difficult in a machine-intelligence-based world

Thus...

Inference to the best explanation can be hard to implement in practice and data-intensive models are often hard to validate plus...

tech does not address every challenge! *This said...*

digitization is gradually transforming insurance with periodic discontinuities.

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