Analyze / Adopt

Adapt / Act
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
Drivers of value in the technology sphere

1990s: Intellectual Property

2000s: Networks

2010s: Data (collected & curated)
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

- **Actionable insight**
- **Visualization**
- **Algorithmic processing**
- **Data wrangling & curation** (collecting, joining, cleaning, formatting, loading -- ETL)
Technology themes in insurance

INSURANCE FROM A TECHNOLOGY PERSPECTIVE
Technology is affecting the insurance value chain

Virtualisation of the value chain

**Physical Value Chain**
- Product design/development
- Pricing/underwriting
- Marketing
- Distribution
- Policy/claims management

**Digitalisation**
- Robotics/Telematics/Internet-of-things (IoT)/wearables offer usage-based insurance opportunities
- Emerging risks such as cyber
- Social-network insurance groups
- Use of Big Data/analytics to identify new claims drivers
- Predictive/Prescriptive underwriting techniques
- Artificial intelligence (AI) to hone risk assessment
- Position insurance as more customer-centric
- Increase frequency of interaction
- Use Big Data/analytics for micro market segmentation and personalisation
- Customers prefer multi-touch, omni-channel interaction
- Smart devices
- Less face-to-face engagement
- Scope for gains in efficiency in offline channels
- AI-driven Robo-advisors
- Use of Big Data to reduce fraud and improve claims processes
- Self-service apps to improve customer post-sales experience
- Blockchain applications for smart contracts and claims administration

**Virtual Value Chain**

**Information Capture and Analysis**

Source: Swiss Re Institute.
Digitalisation not only affects the value chain but also impacts the wider business ecosystem.

![Business ecosystem diagram](image)

Source: Swiss Re Institute.
Perfect storms and black swans

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

Investments in InsurTech start-ups, number of deals and in USD millions

Number of deals

Funding

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

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

<table>
<thead>
<tr>
<th>Customer experience</th>
<th>Lead aggregators</th>
<th>Insurance search engines</th>
<th>Online insurance agencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple carriers</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Real-time rates</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Direct fulfillment</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Sell leads to agents, direct channels of carriers. Customers get follow up call, email, etc.

Allow customers to see rates; policy is fulfilled on the insurer website. Rates are not ‘bindable’; may change.

More sophisticated - use third-party data to verify data, and provide ‘bindable’ rates.

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)

<table>
<thead>
<tr>
<th>Line of business</th>
<th>Use cases InsurTech in commercial insurance</th>
<th>Examples of start-ups</th>
</tr>
</thead>
</table>
| Workers compensation     | • Monitor incidents via posture devices, wearables.  
                          • Real time alerts, behavior modification.  
                          • Telemedicine; lower time to return to work.                      | human condition       |
|                          |                                                                                                                | 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              |
| Group health and benefits| • Move employer-owned benefits to private programs.  
                          • Other benefits, eg, student loan contribution.  
                          • Treat productivity issues, eg, heavy drinkers.                          | TUITIONJO              |
|                          |                                                                                                                | Hixme                  |
| Cyber risk               | • Threats related to the wireless workplace.  
                          • Information sharing – breach data.                                        | BISTSIGHT              |
|                          |                                                                                                                | 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.

Analysis of Post-IPO performance of InsurTech companies

The bubble size represents market capitalization.

- **Guidewire**: $3.9b
- **Verisk Analytics**: $13.5b
- **Benefitfocus**: $0.9b
- **Majesco**: $0.2b
- **Quinstreet**: $0.2b
- **iSelect**: $0.3b
- **Trupanion**: $0.4b

Source: Thomson Reuters, CB Insights, Swiss Re Institute
Venture investors put $57B into FinTech startups over the last five years, of which $6B was in InsurTech.
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

- AI / Machine learning / roboadvisors: 22%
- Advanced analytics solutions: 19%
- Internet of Things (IoT): 11%
- Next-generation online insurance portals: 10%
- Cloud computing: 8%
- External third-party marketplaces: 8%
- Telematics and connected car: 7%
- Drones, aerial and digital Imagery: 9%
- Location Intelligence: 4%
- Others: 2%

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**

**HQ of the start-up**
- Americas: 67%
- EMEA: 22%
- Asia-Pacific: 11%

**Line of business**
- P&C: 61%
- Across lines: 16%
- L&H: 14%
- Only health: 9%

**Customer focus**
- Personal: 60%
- Commercial: 24%
  - Small Business: 10%
  - Across lines: 7%

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.
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**


![Graph showing venture capital investments in the U.S. to the Internet and software sector, 1995-2016.](https://www.pwc.com/us/en/technology/moneytree/explorer.html#/)

- **Number of Deals**
- **Amount Invested (USD billions)** (RHS)
Insurance industry response to technological change

INSURANCE COMPANIES MEET INSURTECH
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

Proportion of investments in InsurTech start-ups with re/insurer involvement

Note: This is based on 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

Source: Insurer websites, press releases, Swiss Re Institute
... and have also entered into several new partnerships in smart home, distribution, and elsewhere

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

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.

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

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

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

Source: Insurer websites, press releases, Swiss Re Institute
The market remains to be convinced that insurers derive competitive advantage by engaging with InsurTech start-ups.

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

- Insurers with little known investment in InsurTech start-ups
- Insurers with some investment in InsurTech start-ups
- Active acquirers of InsurTech start-ups

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
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)

- Consumers that would trust social media firms with their data (KPMG survey)
- European consumers who would buy insurance from firms like Facebook/Google (Fujitsu survey)
- Gen Y likely to buy insurance from tech brands like Google (Capgemini survey)
- Gen Y who would consider buying insurance from Google or Amazon (Accenture survey)
- US consumers that would trust Google to keep personal data private (Politico survey)

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)

- Technology firms like Google/Facebook (Willis Towers Watson survey)
- Established companies from outside insurance (Accenture survey)
- Amazon (Capgemini survey)
- Google (Capgemini survey)

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)**

<table>
<thead>
<tr>
<th>Tech firms</th>
<th>Role in insurance industry</th>
</tr>
</thead>
</table>
| **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)

<table>
<thead>
<tr>
<th>Tech firms</th>
<th>Role in insurance industry</th>
</tr>
</thead>
</table>
| **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.  
             • 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!
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