

sigma

Advanced analytics: unlocking new frontiers in P&C insurance

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Executive summary

Data generated inexpensively and non-intrusively is growing exponentially.

The amount of digital data in the world is growing exponentially alongside the widespread expansion of sensor networks and digital platforms. Successive generations of new analytical tools and techniques can analyse structured and unstructured data, yielding useful insights about individuals and businesses, and also the impact of man-made and natural disaster events, inexpensively and non-intrusively. By augmenting internal data with external semi-structured data sources, Property & Casualty (P&C) insurers are able to price new markets and risk classes.

Data and advanced analytical tools can help insurers target markets and improve understanding of consumers.

Data analytics can support four important business needs. First, analytics can enable growth by providing insights into untapped opportunities, helping inform go-to-market strategies and improve understanding of the attractiveness and size of business in newer segments. Overlaying portfolio data on the results of market analytics helps identify and validate segments of opportunity with reference to current portfolio structure. Second, insurers can use analytics to understand and engage customers more effectively. Many insurers have successfully used behavioural economics to improve targeting, bidding and engagement. Small, inexpensive modifications based on such behavioural insights can have a big impact.

They can also improve risk selection and pricing, and operational efficiency.

Third, insurers are able to augment their own portfolio data through multiple linkages with external datasets, thereby deriving insights for accumulation and portfolio steering. Our interviews with industry executives suggest that insurers are targeting a 2–5% improvement in loss ratios under real trading conditions. And finally, analytics are used to improve efficiency by automating underwriting and claims processing functions. The industry can trumpet many examples where automating repetitive knowledge tasks such as the processing of low-value, high-frequency claims, and where the deployment of bots to assist claims teams have improved expense ratios.

Challenges exist, however, such as time needed for integration and institutional inertia.

Most insurers aim for a 33% hit ratio for operationalisation of pilot programmes. Building a business case for analytics is complex since return on investment (ROI) is often dependent on the willingness of users to embed new tools into operational workflows. Also, achieved ROI is sometimes lower than hoped for because of delayed or missed opportunities to take decisions based on new insights. On average, 6–12 months is the minimum time required for rapid deployment. Wider business integration and achieving larger scale efficiencies can take longer.

Personal lines had a head start on analytics, but commercial insurers are benefiting now too.

Commercial lines continue to lag personal lines insurance in the implementation of advanced analytics techniques. This is because personal line insurers have had access to better data quality and higher transaction volumes. Now larger and more stable commercial lines such as property are also benefitting from the explosion in data. They are seeing early signs that incorporating new data sources can reduce the length of risk assessment and improve risk selection. Combining multiple data sources in new ways can fine-tune risk appetite and underwriting strategy.

The outlook is promising but patience will be needed to see the full value materialise.

The outlook is promising as analysts expect spending on data and analytics across all industries to rise at a compound annual growth rate (CAGR) of 13% over the next four years, and we encourage insurers to keep pace. However, patience is crucial due to the inherent complexity of the insurance value chain. Major challenges remain in the form of legacy systems, traditional mind sets and scarce talent at the intersection of data science, risk knowledge and technology. We believe that as more insurers seek out differentiating capabilities, the ongoing development of industry-specific infrastructure, resources and knowledge will help unlock the full potential of analytics in insurance.

Insurers investing in advanced analytics

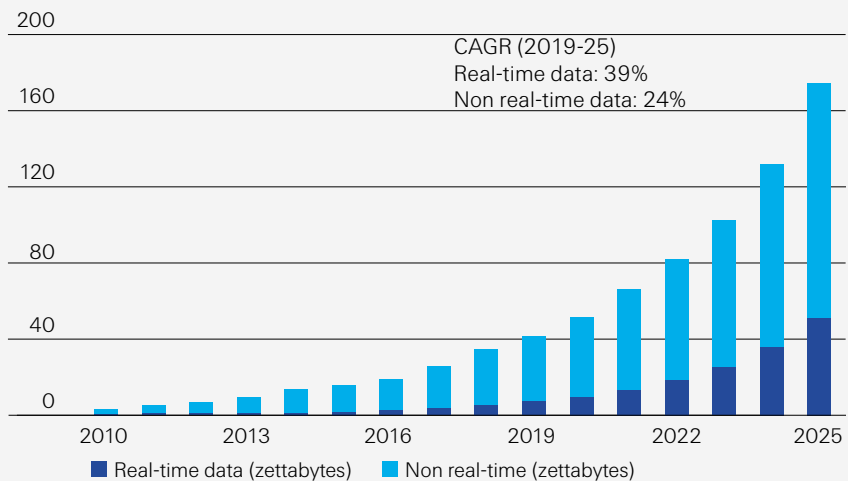
After a slow start, insurers are investing more time and resources into Big Data and analytics initiatives. We see four broad areas of application of advanced analytics to enhance business value in insurance: to enable growth, better engage customers, optimise liability portfolio performance and to improve operational efficiency. Analytics helps P&C insurers better price new risks and unlock material value trapped in inefficient risk segmentation.

Change and digital transformation

Technology advances are fuelling an explosion in data, generated inexpensively and non-intrusively.

The amount of data being generated globally is increasing exponentially as the range of devices capable of sending and receiving digital information over the internet continues to grow. At the same time, hardware and maintenance costs have fallen significantly due to cloud storage. By 2025, worldwide data will grow by 27% from today's levels to 175 zettabytes, a third of which will be real-time (Figure 1).¹ By way of context, a zettabyte is 10^{21} (1 followed by 21 zeroes) bytes.² Much of this digital data will be generated automatically, inexpensively and non-intrusively by sensors, transaction records and social media platforms.

Figure 1
Forecast of data growth



Source: IDC, Swiss Re Institute

However, to date there has been underinvestment in insurance data collection and curation.

Competitive advantage will go to those insurers able to use Big Data and advanced analytics to identify early signals for emerging risks, to gain insights into customer behaviour and to make operations more efficient. However, the ability to gain useful predictive insights from the ever-increasing amounts of data is challenging. Insurers have large amounts of unstructured claims data, but to date they have under-invested time and resources into data curation. Further, most new data are not created for insurance specifically (eg, marine data are aggregated for operational purposes). The owners of information may neither understand insurance nor what needs to be done to make data usable for insurers.

Insurers need specialised talent to process structured and unstructured data...

Here exists a clear role for specialised talent: data scientists and engineers brought together to bridge the gap between data and what insurers use data for. Insurers already familiar with data-intensive modeling are working with new tools and experts to reconcile and combine data sources in ways not possible before. Processing power is available aplenty and in a soft market, insurers are looking at every opportunity for competitive advantage.

¹ See D. Reinsel, J. Gantz and J. Rydninghe, *Digitization of the World, From Edge to Core*, International Data Corporation (IDC), November 2018.

² 1 000 Megabytes = 1 Gigabyte, 1 000 Gigabytes = 1 Terabyte, 1 000 Terabytes = 1 Petabyte, 1 000 Petabytes = 1 Exabyte, 1000 Exabytes = 1 Zettabyte. See "The Zettabyte Era Officially Begins (How Much is That?)", *blogs.cisco.com*, 9 September 2016.

...and most now have initiatives for advanced analytics.

Insurers plan to spend more on analytics as they complete core system upgrades.

They will likely avoid large-scale projects and instead start with smaller, iterative initiatives.

Insurers' spending on analytics could be more than USD 20 billion annually (industry-wide).

Insurers are growing increasingly interested in analytics

Till now, the insurance industry has been slower than many others in adopting new technologies. That is set to change with many insurers planning to make more use of data analytics. Most P&C insurers (92% according a recent survey in the US) have planned initiatives around Big Data and advanced analytics.³ However, the existence of data silos means that many insurers are only at the early stages of building out the foundations for analytics initiatives as they are still ironing out legacy system challenges.⁴

Although industry IT spending has remained constant over the last few years (around 4% of premiums), analysts expect a realignment within static budgets as many insurers complete core systems updates and allocate more funds to newer initiatives like digital and analytics.⁵ The extent of investment will likely vary. Back in 2016, data and analytics leaders at global insurers said they were investing as much as USD 80 million in data analytics each year, and most said they planned to increase spending.⁶ IDC forecasts spending on Big Data and analytics solutions across all industries to grow at a CAGR of 13.2% through 2018–2022, and we encourage insurers to keep pace.⁷

Larger insurers with global footprints spend more. For example, in 2015 Generali said it would reinvest EUR 1.25 billion (USD 1.42 billion) in technology and data analytics through 2018.⁸ However, insurers are less likely to invest in very large-scale projects since managing and harvesting benefits can be difficult.⁹ Most insurers have a range of carefully prioritised projects, and often start with narrow use cases that can be operationalised quickly so that value add is easier to demonstrate. For instance, QBE reports that its analytics teams managed to complete over 100 projects in 2018, and that its main focus remains on applying associated learnings to underwriting and claims.¹⁰

Estimates suggest that in the US, data and analytics projects will account for around 15% of P&C insurers' IT spending in 2019 (see Figure 2). It is hard to estimate a figure for global spend on data and analytics alone due to differences between markets. Gartner forecasts global insurer IT spending to reach USD 220 billion in 2019 (both P&C and L&H)¹¹ and we conservatively estimate that 8–10% of that (USD 18–22 billion) will be annual outlay on data and analytics. This accounts for around 3% of the insurance industry's expense base (expense ratio assumed to be 15% of global premiums of USD 5.3 trillion in 2019).¹²

³ M. Breeding, K. Pauli, *AI is changing the game in workers' comp*, Strategy Meets Action, 12 April 2018.

⁴ K. Harris-Ferrante, *2019 CIO Agenda: Insurance Industry Insights*, Gartner, 15 October 2018.

⁵ *Insurer IT Budgets and Projects 2019*, Novarica, October 2018.

⁶ R. Balasubramanian, K. Kaur, A. Libarikian, N. Narula, *Raising returns on analytics investments in insurance*, McKinsey, July 2017.

⁷ *IDC Forecasts Revenues for Big Data and Business Analytics Solutions Will Reach USD 189.1 Billion This Year with Double-Digit Annual Growth Through 2022*, IDC, 4 April 2019.

⁸ L. Laurent, "Technology Is Ultimate Savior of Insurance Industry: Opinion", *insurancejournal.com*, 10 March 2017.

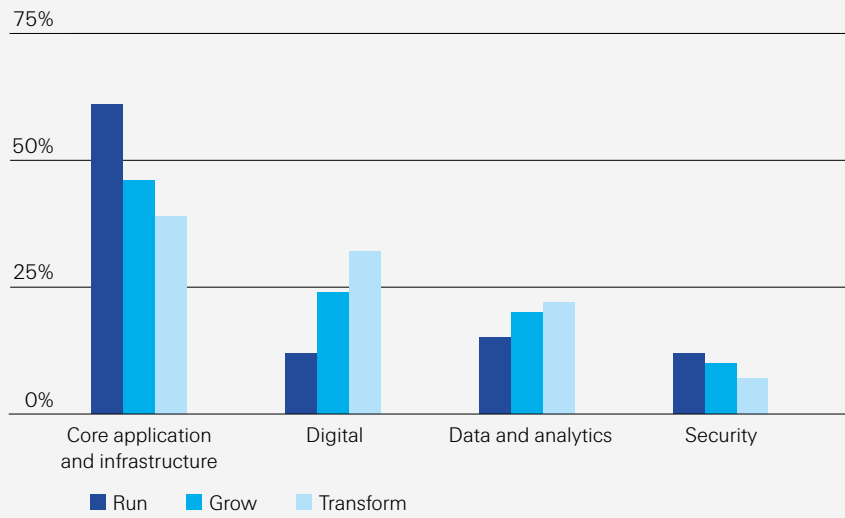
⁹ J. Mayes, "Zurich to Cut Spending on Large Tech Projects as Part of Cost Saving Plan", *insurancejournal.com*, 17 January 2017.

¹⁰ *Group Sustainability Report*, QBE Insurance Group Limited, 2018.

¹¹ J. Ingham, R. Narisawa and V. Liu, *Forecast: Enterprise IT Spending for the Insurance Market, Worldwide, 2016–2022, 4Q18 Update*, Gartner, 10 February 2019.

¹² The average expense ratios for P&C operations of large listed global carriers.

Figure 2
Estimates of IT spending split at P&C insurers, 2019



Source: Novarica, Swiss Re Institute

Analytics uses traditional and non-traditional data to generate actionable business insights.

What is advanced analytics in insurance?

We define advanced analytics as the coming together of data science, extensive risk knowledge and industry expertise to generate actionable business insights that help insurers grow, optimise existing portfolios and become more efficient. Data analytics involves the use of both traditional and non-traditional data sources, and also combines established actuarial methods with computational statistical methods.

Table 1
Difference between traditional and advanced analytics

Traditional analytics	Advanced analytics
Highly structured processes, informed by experience, where the inputs and outputs are largely pre-determined.	Versatile process, guided by subject matter expertise to discover previously unknown relationships within data.
<ul style="list-style-type: none"> ■ Financial reports ■ Experience studies ■ Cash flow models 	<ul style="list-style-type: none"> ■ Predictive insights and marketing models ■ Combining structured and unstructured data ■ Text mining, automation of processes
Problem structure: <i>Known problems with known solutions</i>	Problem structure: <i>Known problems with unknown solutions</i> <i>Unknown problems with unknown solutions</i>

Source: Swiss Re

Big Data and the use of advanced analytics has given rise to concerns about data privacy.

Data protection regulation might impact the use of data for insurance purposes.

Insurers have developed structured processes and safeguards to assess risks.

Data privacy regulations: insurers need to keep up-to-date

New tools and approaches, however, also bring challenges for which insurers will need to implement new risk management procedures. Regulators are growing more familiar with advanced analytics initiatives and have approved “pilot” programmes in different regions. However, regulators are also raising questions, particularly around the impact on consumers and the use of consumers’ personal data. Insurers will need to monitor and adapt to regulatory changes with respect to the use of new sources of data and analytics, especially in underwriting and claims.

The General Data Protection Regulation (GDPR) in Europe has created momentum for broad sweeping data protection regulation in other jurisdictions. GDPR describes key principles by which personal data should be collected and processed in the age of Big Data, cloud, IoT and social media. It enhances existing rules set out in Data Protection Directive 95/46EC. In other words, many of the duties imposed by GDPR are not new, but the regulation does make some significant changes which impact how insurers demonstrate compliance.

A complexity here is that insurers are often required to comply with regulation developed in response to general rather than insurance-sector specific tech based innovation. In our interviews with industry executives, we heard that many insurers have, by design, set up safeguards to ensure privacy. They have detailed processes to identify data providers that are willing to invest in developing solutions to address regulatory requirements, such as transparency to end users about what will happen to their data. Insurers will also need to bear in mind other regulatory aspects, such as competition law, as well as any contractual restrictions on the handling of client data. On the other hand, plenty of Big Data and analytics opportunities exist in the insurance context where personal data is not even needed.

Applying analytics in insurance: four areas

Analytics can support important business needs.

Insurers can look at analytics from the point of view of business capabilities rather than technologies. Data analytics can support several important business needs. These include enabling growth by understanding new market opportunities and helping inform go-to-market strategies. Insurers can also leverage analytical techniques, especially in personal lines, to understand and engage customers more effectively. Third, insurers are able to augment their own portfolio data through multiple linkages with external datasets, and thereby derive insights for accumulation and portfolio steering. And finally, analytics is used to improve efficiency by automating underwriting, actuarial and claims processing functions.

Figure 3
Four application areas of analytics in insurance



Source: Swiss Re Institute

Insurers need granular market analysis and segmentation as they expand into new territories.

Enabling growth

In the pursuit of profitable growth opportunities, insurers with access to analytical expertise can build detailed risk evaluation models. This is of particular value when moving into markets where they lack underwriting expertise. For example, an insurer seeking to expand into the small and medium enterprises (SME) segment in eastern Europe would need to combine many fragmented data sources to assess the different risks faced by SMEs operating in diverse industries. This complex task would likely require risk approximations at the level of business, industry and post code, and the collection of multiple relevant factors (eg, physical footprint, revenue bands, number of employees) to arrive at an appropriate risk scoring methodology.

Statistical analysis can facilitate better understanding of demand patterns and partner networks.

Any strategy would need to compare the results of these market risk analyses with the insurer's existing portfolio. Analytical dashboards can bring together an insurer's exposure data, competitor pricing analysis, growth estimates per industry and customer segmentation data. Continuous enrichment of such analysis with qualitative expertise can help shape optimal strategies for accessing new opportunities. For example, an insurer can compare geographical demand patterns for products with the potential distribution capacity of different partner networks to inform an optimal distribution solution.

Applying behavioural analytics can help improve understanding of consumer behaviour.

Engaging with customer behaviour

Insurers can use behavioural science and predictive models to engage both customers and employees. For example, by applying learnings from behavioural science, insurers can better understand consumer behaviour, and how selective nudges can improve multiple outcomes to the benefit of both insurers and their customers. For instance, QBE used open data alongside internal data to identify profitable target segments, and improve targeting, bidding and engagement.¹³ This resulted in an 80% reduction in cost per click. Meanwhile, the Behavioural Research Unit at Swiss Re is helping many insurers evaluate the impact of different behavioural biases through A/B tests in the context of sales, underwriting, claims and retention.¹⁴ Many of these tests are run in the digital space where modifications to the customer journey can be made rapidly and monitored closely.

Small changes can drive benefits, such as higher renewal rates.






Small, inexpensive modifications based on such behavioural insights can have a big impact. For example, one insurer found that subtle re-wording of a button labelled "Request a pamphlet" to include the words "If you don't know how much cover you need, request a pamphlet", led to significant increase in clicks. Behavioural tests reveal the power of context as compared to rational factors (such as the product, price or the information provided). Widespread sharing of these learnings across the industry is encouraging insurers to amplify, and even replace traditional customer research methods with focused studies that identify context-specific drivers of customers' insurance-related behaviour.¹⁵

Insurers can develop new risk appetite matrices and guidance for underperforming portfolios...

Optimising balance sheet liability portfolio performance

Insurers often carry underperforming portfolios where the root causes of poor profitability and high volatility are unknown.¹⁶ Analytics can help investigate trends in underlying loss drivers, while data enrichment using external data can help refine segmentation and underwriting strategy (see Table 2 for examples). For instance, to predict future claims, detect loss drivers and identify attractive risk profiles, AXA XL has begun accessing external data from websites, news and public datasets to capture insights about risks that commercial clients face.¹⁷

Table 2
Examples of analytics pilots in portfolio optimisation

Line of business	Country	Benefit
 Motor	Japan	In an experiment, an insurer achieved 78% accuracy in predicting large-loss traffic accidents using machine learning.
 Motor	Italy	A 20% reduction in loss frequency on risk adjusted basis using telematics. Also used for risk selection and providing value-added services.
 Property	Australia	An 18% reduction in loss ratio by leveraging data analytics to base underwriting on market-wide experience of the risk.
 Marine Hull	UK	A 7% reduction in the loss ratio by combining internal and external data for behavioural and situational analysis of the portfolio.
 Liability	Global	A 6% reduction in loss ratio by leveraging data analytics to explore the impact of various portfolio steering decisions.

Source: Swiss Re Institute compilation of specimen pilots reported by insurers, brokers, consulting firms and technology vendors.

¹³ *Digital Fingerprint Case Studies – Using open data to supercharge online targeting and distribution KPIs*, Digital Fingerprint, 2018.

¹⁴ A/B tests compare two versions (A and B) of a customer experience using two different sets of users, eg, an insurer might show 50% of site visitors a green 'ask for quote' button and the other 50% a blue button. A comparison of user responses can support data-driven decision making.

¹⁵ 35% of insurers planned to use human behaviour extensively to guide development of new customer experiences. See *Technology Vision for Insurance 2017*, Accenture, 18 April 2017.

¹⁶ See A. Chester, S. Ebert, S. Kauderer, C. McNeill, From art to science: *The future of underwriting in commercial P&C insurance*, McKinsey, 13 February 2019.

¹⁷ *XL Catlin partners with Artificial Intelligence start-up Cytora*, AXA XL, 2 October 2017.

Insurers investing in advanced analytics

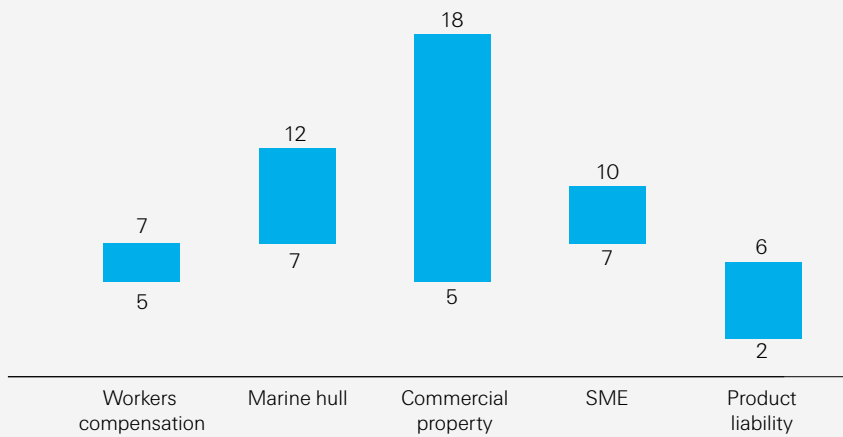
...and leverage analytics to identify the underlying causes of accidents and/or injuries.

It is too early to be able to measure the benefits of analytics, especially in underwriting results.

Inadequate or out-of-date customer segmentation may also be a cause for portfolio underperformance, especially if the portfolio mix is not adjusted to respond to changes in market loss trends. For example, insurers trying to meet the demand for flexible cover from new micro-mobility and transport ecosystems may find that while the volume of claims resulting from accidents involving electric scooters and bicycles are just a small fraction of the total, they could represent a growing share of total claims costs.¹⁸ Analytics can reveal that accounts with certain features face larger losses, and with more granular segmentation insurers can take remedial action.

While early signs of benefits have surfaced, most executives we interviewed as part of this study cautioned against expecting large quantitative benefits in the near term, especially with respect to improvements in loss ratios. There is anecdotal evidence of the early benefits but it is difficult to quantify the overall impact, unlike A/B tests in simpler areas like automation. Pilots across several lines of business do indicate healthy loss ratio improvements (see Figure 4) but for various reasons, results in real-time trading conditions may vary. All told, most insurers seem to be targeting around 2-5% improvement in loss ratios under real trading conditions.

Figure 4
Range of loss ratio improvement in pilot conditions (%) across insurance lines of business



Note: The chart represents the range of loss ratio improvements in pilot conditions. Since these are results from independent pilots, benefits in one line of business cannot be compared against another.

Source: Press releases, publications and interviews by insurers, brokers, consulting companies and technology vendors.

Even partial automation of claims handling can result in significant (time) savings.

Improving operational efficiency and effectiveness









Insurers have made significant headway in automating underwriting and claims management processes (see Table 3). For example, Allianz Global Corporate & Specialty is automating low-value, high-frequency commercial claims (60-70% of volume) to start paying simpler claims in a single day: the current industry average is a matter of weeks.¹⁹ Others have deployed bots to assist claims teams (eg, by cross checking customer emails with claims records). AXA has deployed processing bots in many lines of business. One in its property claims function completed tasks in 42 seconds: humans needed on average 4 minutes to complete the same task.²⁰

¹⁸ "States Treat Electric Scooters as Bikes Even as Injuries Appear to Rise", *insurancejournal.com*, 1 April 2019.

¹⁹ Between 60-70% of the firm's claims are under EUR 10 000 (USD 11 300) in value. See *Global claims Review, Allianz Global Corporate & Specialty (AGCS)*, 13 December 2018

²⁰ Harry, Bert and Lenny: *AXA deploys new AI bots to handle admin work*, AXA, 28 January 2019.

Table 3
Examples of analytics pilots in efficiency generation













Line of business	Country	Benefit
 Motor	Germany	Up to 50% reduction in claims processing costs by using artificial intelligence (AI)-based claims validation tools.
 Motor	Turkey	USD 5.7 million savings by an insurer in fraud detection and prevention by using AI-based predictive analytics.
 Property	Australia	8% improvement in conversion rate for submissions by using data analytics to identify target portfolio segments.
 Property	US	Over 50% reduction in physical inspection costs by using machine learning to analyse remote sensed imagery to create insights about surveyed risks.
 Property	Global	An insurer saved almost 17 000-man hours of annually by deploying bots for data entry tasks in its property claims department.
 Property	Global	Estimated 50% savings in engineers' time at an insurer through natural language processing to extract critical information from risk engineering reports.
 SME	UK	60% savings in SME underwriting expenses by using data analytics for portfolio pruning and targeting preferred risk segments.
 Liability	Global	Savings of 40 000 hours of manual work by via reducing medical report assessment time from an hour to few seconds. Overall run rate benefits were USD 5 million per year.

Source: Swiss Re Institute compilation of specimen pilots reported by insurers, brokers, consulting firms and technology vendors.

New tools can streamline review of policy wordings by identifying deleted, inserted or modified clauses.

The wide variety of policy wordings (eg, manuscript, regulatory, market wordings) often put insurers in a difficult position, particularly in a soft market, as underwriters must quickly evaluate what has changed in each policy, both in terms of risks and limits. In doing so, they may miss changes in key definitions, leading to unexpected and unanticipated significant claims. Text mining tools can streamline the review of policy wordings, and help identify where clauses were deleted, inserted or modified. The use of such tools can achieve significant time savings in comparing, drafting and reconciling policies (see Table 4).

Table 4
Employee time savings for tasks before and after introduction of text-mining solutions

Tasks	Before	After	Saving
Comparing policies			50%
Drafting policies			26%
Drafting endorsements			36%
Searching policies			30%
Reconciling policies			36%
Total			34%

Source: Swiss Re Institute

Extracting data from submissions can improve understanding of propensity to bind.

Features extracted from incoming broker submissions can be used to build predictive models based on profitability, to triage submissions and identify those originating from high-quality brokers and those fitting into an insurer's underwriting appetite. Often, due to resource constraints underwriters do not track submissions that fail to convert into business, and lose the opportunity to learn from these unsuccessful cases. With the use of document intelligence tools, insurers can look for trends, dependencies and additional information to enhance the propensity to bind.

The extended time lag between underwriting and a notional claim makes it hard to measure ROI.

Deploying analytics can be just as difficult as any technology implementation at a large carrier.

Executives say three to five years is a realistic time frame to find out more about bottom-line impact.

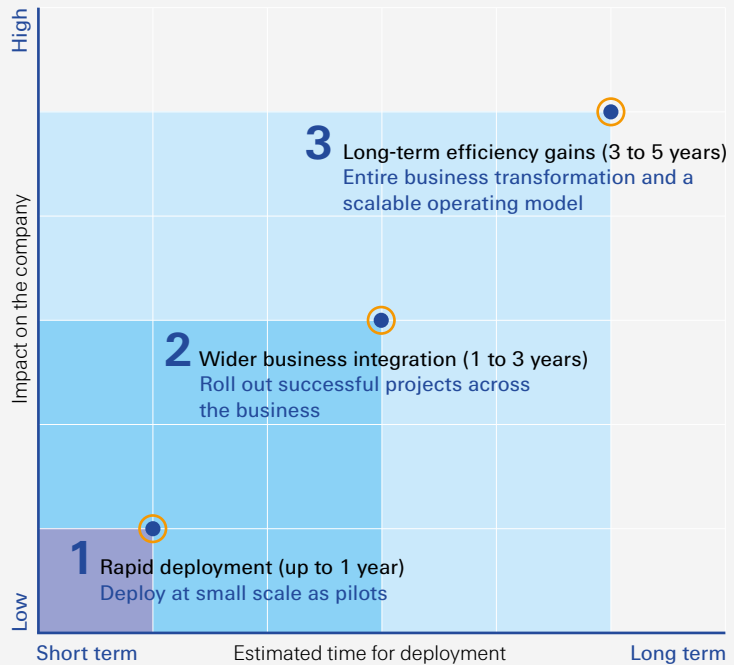
Implementing analytics: operational considerations

Building a business case for analytics projects is complex because the near-term benefits are not obvious. One analytics leader protested that even if his recommendation was accepted by an underwriter (eg, an exclusion for a certain risk), the time lag between inserting an exclusion and a related claim can be so long that when the benefit accrues, there is little recall of why the exclusionary clause was inserted in the first place. At a practical level, if underwriters value the new tool, insurers often fund the investment on the basis that it would more than pay for itself if it avoids one or two large losses.

While there is a honeymoon period where funding is seen as a protracted investment, executives indicated that three to five years is a realistic time frame to expect some impact on the bottom line. Executives underscored the importance of patience, especially in complex activities like underwriting. A related challenge is that executives often come up with a bloated list of deliverables and requirements that may derail projects. Successful practitioners recommend defining clear scope and understanding of what success looks like from the outset.

Six to 12 months is typical for rapid deployment (see Figure 5). Wider business integration and achieving larger-scale efficiencies can take longer. Analytics heads bemoan that business leaders sometimes see analytics as a magic remedy, with results automatically implemented into business processes. Deploying analytics can be as difficult as any technology implementation at a large carrier. Legacy systems, organisational inertia and cost pressures all contribute to what can often be prolonged deployment.

Figure 5
Time horizon for benefits to show



Source: Swiss Re Institute, based on interviews with industry executives.

The success ratio depends on the use case and executive sponsorship from the business.

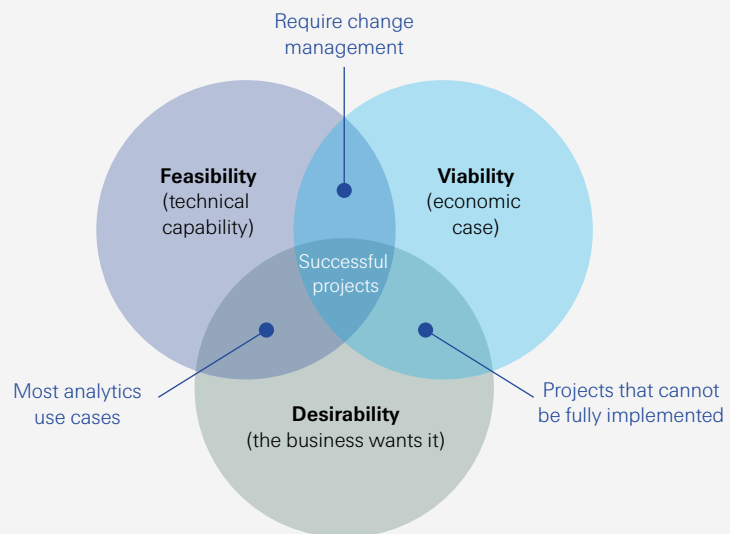
Insurers should consider the technical feasibility, desirability and business viability of projects.

Given the rush of experimentation, it is difficult to get a clear view of the proportion of pilot projects that reach operationalisation. A recent survey shows that making time available for experiments and obtaining support from senior management are the two leading challenges for introducing a data-driven way of working, even more challenging than recruiting data scientists.²¹ Most insurers we spoke to aim for a 33% success (hit) ratio for operationalisation of pilots. Some prefer to get nearer 100%, but that is likely to mean the use cases are not challenging enough.

Successful implementation of analytics projects begins with asking the right questions and selecting the right focus areas. One useful framework to determine the value of projects is to evaluate across desirability, feasibility and viability (see Figure 6). Insurers should focus initially on areas where there is high potential on all three fronts.

- **Desirability:** Is there a clear value proposition? Does it address a key pain-point? Adoption is key, so any solution must fulfil a specific need.
- **Feasibility:** Can it be done with existing operational capabilities? Is the necessary data available? How long will the project take? Are there regulatory restrictions?
- **Viability:** Is the project economically attractive? Does it have a strong business case? Can an insurer at least 'directionally' validate the business concept?

Figure 6
Analytics project assessment framework



Source: Ideou, Stanford d.school, Swiss Re Institute

Key advantages that external vendors offer are specialisation and data curation capabilities.

External versus internal staffing for analytics projects

Involving specialist externals makes sense when they are at the cutting edge of emerging fields and have deeper risk knowledge in areas where an insurer cannot justify large internal investments. For example, in 2018 QBE partnered with Jupiter, a firm that has a Nobel Prize winning expert in climate predictions (see *Working with InsurTechs*).²² At times externals possess better curated data from both public and private sources.²³ Others may specialise in standard use cases across industries (eg, anti-money laundering). Involving reputed partners can bring a sense of urgency, and increase employee involvement around a project.

²¹ *Driven By AI: Benchmark for the Data-Driven Enterprise*, Data Survey 2018/19, Go Data Driven, September 2018.

²² "QBE: Partnership with Jupiter will boost our climate risk conversations", *insurancebusinessmag.com*, 23 August 2018.

²³ *StarStone named Celent Model Insurer of the Year 2017*, StarStone, 5 April 2017.

Insurers investing in advanced analytics

Insurers prefer to focus on highly condensed data as input for their predictive models.

On the other hand, sometimes vendors bundle large volumes of data in their offerings, which insurers can find overwhelming. In our interviews, insurers often said they prefer a phased approach (ie, start with a few intuitive data points to assess predictive power and correlation to claims). Where correlation is successful, insurers look to explain results in a clear and concrete manner, before buying additional data. Insurers are unlikely to invest in data curation operations directly but prefer to buy highly condensed data with predictive features as input for their models. How the data is used in models usually remains an insurer's intellectual property.

Insurers' involvement with start-ups for data and analytics seems to be waning.

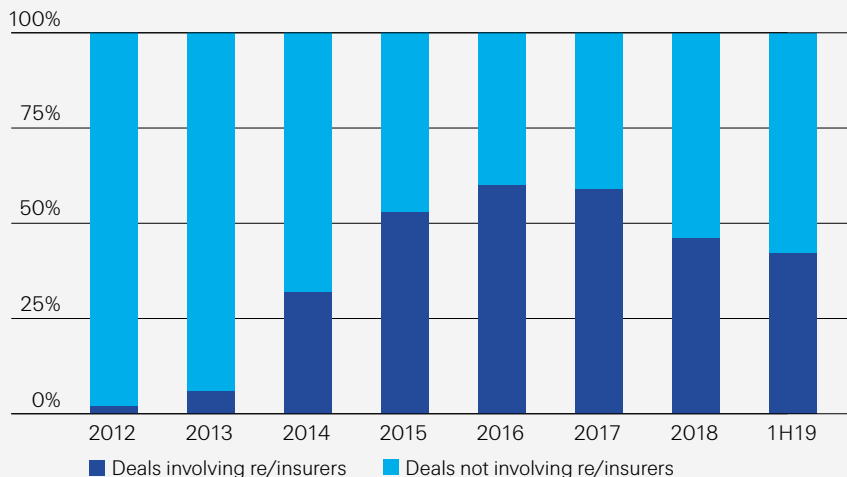
Working with InsurTechs

During our interviews, we gathered that some insurers follow the path of investing in or partnering with external start-ups to access deeper analytical expertise. The underlying aim is to gain early appreciation of the opportunities offered by new technologies, understand emerging trends and access new talent pools. In 2018, re/insurers were involved in 118 of over 250 InsurTech investments, down from previous years. The number dipped slightly further in the first half of 2019 (see Figure 7). Perhaps insurers are taking time to deploy results of first pilots as part of a focus on improving existing processes.

Muted equity market reaction to such involvement in InsurTech underscores the challenges.

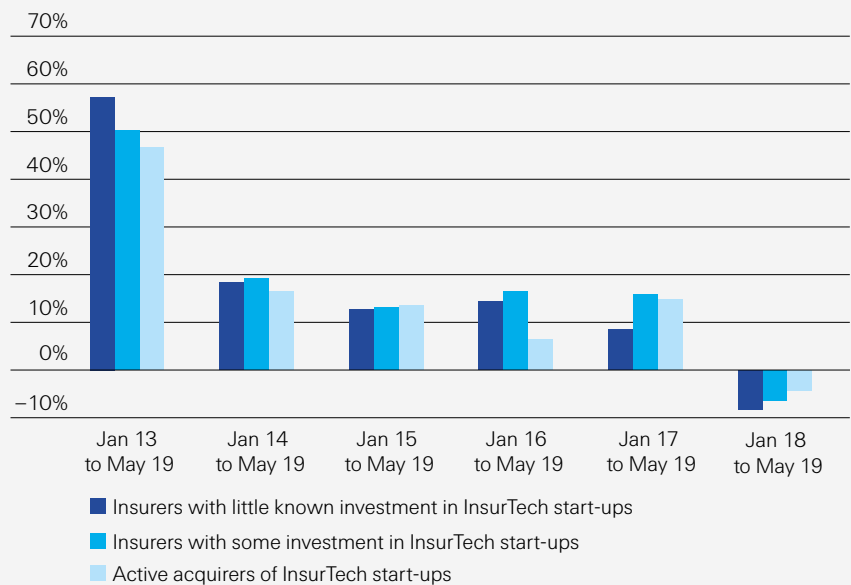
Also, simply investing in InsurTechs is no guarantee of success. Overall, there has been an absence of positive share price reaction for insurers that have been active acquirers of start-ups relative to the less acquisitive. This implies the market remains to be convinced that engagement with start-ups automatically brings competitive advantage (see Figure 8). As with any strategic investment, insurers need to work hard to ensure effective collaboration when culture and working practices may not align.

Figure 7
Proportion of investments in InsurTech start-ups with re/insurer involvement



Source: CB Insights, Swiss Re Institute

Figure 8
Changes in insurers' share prices between select dates, classified by InsurTech strategy



Source: Thomson Reuters, Swiss Re Institute

Specific conditions must be met for success to translate across borders.

Analytics teams find different dynamics across countries, especially in areas like fraud.

The application of analytics in emerging markets is limited by the extent of available data.

Regional differences in the adoption of analytics

Analytics leaders running projects across multiple markets paint a nuanced picture of successes and failures. They recommend that executives avoid taking narrow success stories and extrapolating a high benefit multiplier for the entire company. There is also a danger of taking for granted that successes in one part of the world can be easily translated to others. Insurers often overlook the specific conditions that make a case successful (eg, differences in the operating and regulatory environment, availability of data). On the flipside, just because a project fails in country A does not mean it won't work in B.

Analytics teams that seek to scale solutions across borders often invest heavily in workshops and communication with local teams. This is especially the case for applications that are highly dependent on country-specific variables, such as in fraud, where teams spend a lot of time calibrating scenarios and algorithms to reflect the local culture. Public attitudes to claiming compensation for minor personal injuries vary by culture. For instance, the volume of whiplash claims in the UK is very different to other countries. It is twice the average of France, Spain and the Netherlands.²⁴ That is one reason why some large insurers maintain onsite dedicated data science teams in their larger markets.

Multinational insurers also tell us that mature-market approaches to data sometimes cannot be easily replicated in emerging markets, because of missing, outdated or incorrect data (eg, provincial governments may have patchy demographic or crop yield data). Further, while many markets have embarked on the road to digitalisation, there is a considerable lag in the conversion of historical paper data to digital formats. Insurers must first assess what data is relevant and make that available. Tools only offer better understanding: they cannot make up for poor data quality. See Table 5 for differences in factors affecting analytical maturity across markets.

²⁴ "Does the UK have a problem with whiplash?", *bbc.com*, 26 November 2015.

Insurers investing in advanced analytics

Insurers in emerging markets invest in distribution before moving to more complex areas.

Different markets are at different states of maturity in application of analytics. Insurers in faster growing developing markets are more focused on analytics to support sales and distribution, and are just getting started on applying analytics in risk selection, pricing and generating efficiencies.²⁵ Insurers in more mature markets have often already invested in improving user experience and are now implementing projects to improve associated operating and underwriting efficiency. Differences within the same country can also impact how initiatives are rolled out in some areas, such as pricing. For example, in provinces in Canada, there have been opposing views on whether sensitive indicators like credit scores and criminal convictions can be used in car insurance pricing. Executives told us that they would rather start analytics projects in areas other than pricing because of such types of complexity.

Table 5
Difference in factors affecting analytical maturity by country/region

Factors	US and UK	Other developed markets in Europe and Asia	China	Other emerging markets
Quality of private and open data	Vast number of users, large databases, good quality data.	Not unified across borders due to fragmented markets and data security rules.	Vast amounts of data are leveraged. Certain kinds of data must be stored on local servers.	Missing, outdated or incorrect data, making it difficult for insurers to use data in models.
Access to expertise and talent	Deep talent pool. Insurers have established data analytics capabilities, often with proven used cases.	Often struggle to retain talent, with researchers leaving for the US in particular.	Strong skills in mathematics. Insurers have growing numbers of tech and data employees.	Low access to expertise and talent.
Focus lines of business	Workers compensation (US), commercial property, SME, marine (UK)	Motor, home, liability	Motor, agriculture, ecommerce insurance	Motor, agriculture

Source: Swiss Re Institute

Meanwhile, insurers in China are applying analytics across the value chain.

In China, insurers have begun to systematically apply analytics across the entire value chain. Ping An has collected data on around 880 million people with an average of 3 300 data fields per customer, and applications in several areas (eg, agency risk management, motor driving risk factors, auto claims risk management).²⁶ New digital insurers have moved beyond the stage of homogenous products with limited incremental innovation. They are now experimenting with ecosystem integration and greater use of analytics (dynamic needs discovery, tailored products and risk profiles based on dynamic pricing). For example, Zhong An follows a digital-only model embracing direct distribution through partnerships with digital players. With its analytical insights, it has amassed over 400 million customers, sold over 10 billion policies, and has over 2 000 products.²⁷

²⁵ J. Macgregor, K. Kong, J. Mazzini, K. Monks, *IT Spending in Insurance: A Global Perspective*, Celent, 5 April 2017.

²⁶ *From Ping An to Platform: Technology Innovation for Growth*, Ping An, 20 November 2017.

²⁷ *Thinking ecosystems is the secret behind ZhongAn*, Digital Insurance Agenda, 26 July 2018.

Analytics in property and speciality lines

Advanced analytics can benefit commercial property and SME lines of business with a wealth of new data to auto-fill information in underwriting tools, and also reduce acquisition costs by targeted marketing. In marine hull, risk drivers can be better understood by analysing situational and behavioural data about specific vessels. And in agriculture, insurers are using digitisation of land and demography to yield greater insights for use in risk assessment.









The use of advanced analytics is growing, a positive trend that varies by line of business.

Personal lines insurers have adopted more aspects of advanced analytics than their counterparts in commercial lines, given higher transaction volumes and better data quality. Commercial insurers typically face more underwriting complexities and a more heterogeneous client base. However, the use of analytics is growing in lines of business where data availability is increasing, this in turn driven by the falling cost of external data. Our interviews with experts point to large untapped potential for advanced analytics in commercial insurance, especially in underwriting and risk selection.

Most initiatives start in larger lines of business, where volumes can yield better ROI.

Most analytics initiatives in property and specialty start with underwriting and claims in larger lines of business, such as commercial property where volumes can yield high ROI. See Table 6 for a view of where we see opportunities for the application of advanced analytics in the insurance value chain. Niche specialty line insurers, while showing increasing interest, may lack volumes to justify development of analytics solutions. Also, some smaller insurers have made a conscious choice to invest in other competitive differentiators like customer service and claims management.

Table 6
Application of analytics by line of business

Line of business	Enabling growth	Engaging customers	Optimising portfolios	Improving efficiency
 Property (corporate, SME, homeowners)	 Identify preferred segments by benchmarking existing portfolios with market trends.	 Social media-led targeted marketing can help in cross and up selling.	 Enrich models with external data to generate risk profiles and monitor accumulations.	 Use of remote sensing and social media to reduce inspection and claims assessment times.
 Contingent business interruption	New products (eg, cyber business interruption (BI) and non-damage BI).	Analytics-driven services (eg, crisis simulations and business continuity plans).	Analyse customer and supplier dependencies for risk selection and portfolio steering.	Reduce underwriting costs and quote time via tangible insights into supply chains.
 Marine	Data-enabled products for new / currently uninsured / underinsured vessels.	Improve client dialogues with data driven risk insights and vessel segmentation.	Behavioural and situational data on vessels can improve accumulation monitoring.	Combining vessel and other data for faster claim payouts, subrogation for cargo risks.
 Agriculture	Remote sensing to enrich crop growth models and enable new product design.	Recommendations to state authorities about crop insurance.	Significantly improve the number of data points for pricing.	Lower loss assessment time via remote sensing data to assess payouts.

Source: Swiss Re Institute compilation of specimen pilots reported by insurers, brokers, consulting firms and technology vendors.

New data sources previously inaccessible are now available....

...which commercial property insurers can use to auto-fill forms and cut inspection costs.

Used with existing models, new data can also be used to score natural catastrophe risk.

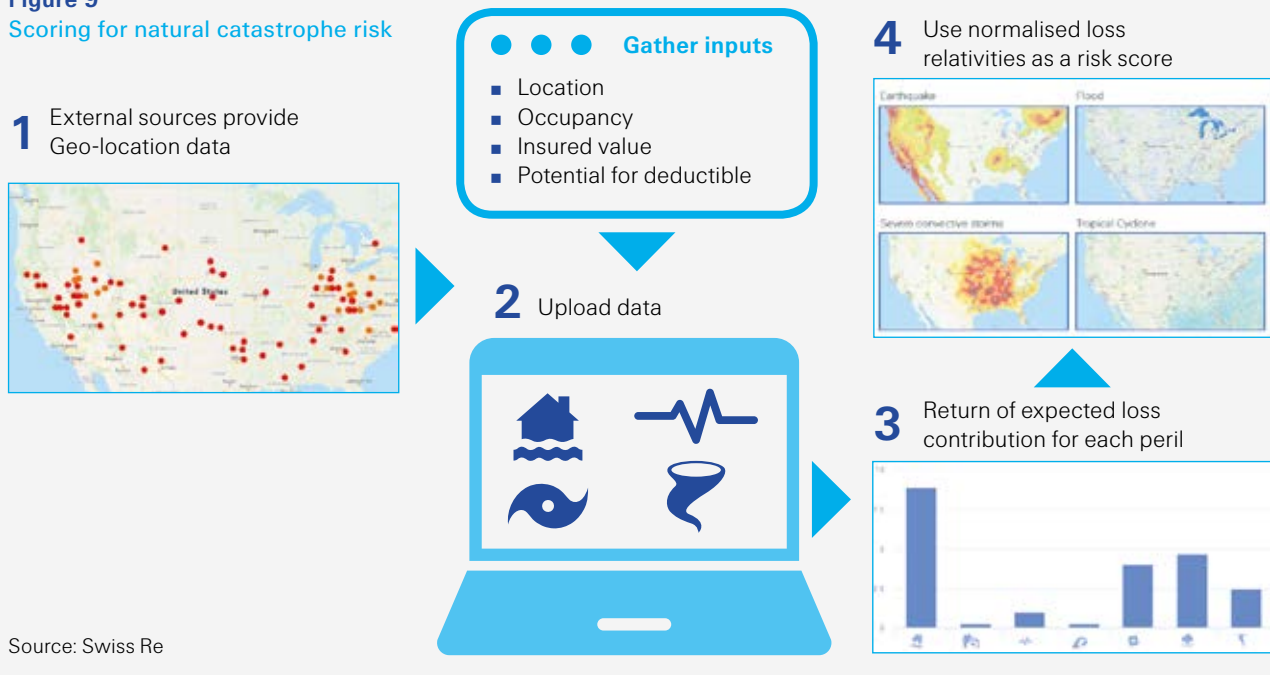
Commercial property

In recent years, lower-cost data (eg, building footprints, roof condition, occupancy and nearby hazards) has become available for analysis of property risks. Insurers can use satellite imagery combined with other publicly-available as well as internal claims data to build a risk profile of buildings, sometimes in just a few hours.²⁸ These data sets are especially useful when an insured's property assets are scattered across hundreds of locations (eg, hotel chains or retailers). Sometimes, insurers have identified the locations of these commercial risks only when they receive a request for cover. With access to the new tools, they can now quickly retrieve detailed information of the properties of a potential new customer.

Insurers are also using new data sources to auto-fill underwriting criteria for new business, and for renewal. One insurer reduced physical inspection costs by over 50% by moving to a virtual inspection platform. The process led to a reorientation of its underwriting workflow to automatically triage properties based on roof geometry and condition.²⁹ In another example, insurers found that the severity of commercial fire claims in some markets has increased despite better risk management and more stringent safety regulations. While there is no one reason behind the more severe losses, analysis revealed that a move to state-of-the-art machinery and electronics alongside refurbishment of buildings may have played a part in several large claims. The damage and associated losses can actually be greater because robots may continue to operate during a fire in a warehouse.³⁰

Property claims have shown increasing volatility due to natural catastrophes. Data on location, occupancy, total insured value per location and deductible/limit structure can be modelled to produce an expected loss contribution for each peril and derive risk scores (see Figure 9). This risk score can be integrated into existing work flows, enabling underwriters to access information outside of proposal forms, and base risk selection and price on market-wide experience at point of quote and renewal.

Figure 9
Scoring for natural catastrophe risk



²⁸ Interview: Geospatial's Dave Fox on the latest imagery technology, Airmic, 29 April 2019.

²⁹ "Cape Analytics analyses geospatial imagery with image recognition and machine learning to identify detailed physical property features," in *2018 InsurTech Impact 25*, Oxbow Partners, 2018.

³⁰ J. Thompson, *Property, no longer the risk you can depend on*, QBE, 7 May 2019.

Fire incidents overlaid on specific property locations can help in the analysis of occurrence of fires.

Analytics can also help insurers assess wildfire accumulation risk within their portfolios.

Insurers are enabling agents by proactively targeting prospects, thus reducing quote time.

Insurers can now quickly detect changes made to a property since a previous valuation...

...and also use data to assess risk and notify homeowners if that risk can be mitigated.

A similar analytical approach can be employed in fire risk analysis. The locations of fire incidents can be overlaid with specific property locations. Insurers can analyse the frequency of incidents and assess property susceptibility to a variety of incident types, such as building structure fire, cooking fire, trash/waste fire, brush and grass fires. By leveraging external data sources (eg, wildland-urban interfaces and property values) overlaid with portfolio data, insurers can derive insights on accumulation risk caused by a concentration of high-value properties.

In addition, a commercial property insurer's portfolio may include many clients with high risk of causing wildfires. For example, the utility and railroad sectors' liability exposure is increasing due to ageing infrastructure that can spark fires.³¹ Several utilities may operate in wildfire prone regions (eg, network operators, tree cutters and maintenance). Combining external data sources such as location of power lines and rail tracks, with company-specific data (size, revenue, locations) can help identify accumulation risks in a portfolio based on assets with propensity to cause a fire.

Homeowners

Carriers are aggressively fighting for market share in the homeowners sector, and InsurTech players find it an attractive line too. This is forcing more sophistication in distribution and underwriting analytics as insurers use new data sources to experiment with automated underwriting or pre-underwriting for proactive risk selection.³² For example, US insurer Plymouth Rock taps into more than 15 data sources to pre-rate properties so that customers avoid a lengthy quoting process. It targets good risks with focused advertising to bring them into the agent's office.³³ Another insurer, State Auto, has integrated aerial imagery into its workflow so that agents need to ask homeowners fewer time-consuming questions when providing a quote.³⁴

Combining computer vision with geospatial imagery is helping insurers detect if changes have been made to a property since a previous valuation. For example, has the type of roof changed (gable, hipped roof etc)? Has its condition deteriorated? Have solar panels been installed? Are there trees overhanging the building? At the same time, however, insurers and insureds alike should remain cognizant of the time-stamp on images. One insurer using data from images to underwrite a property risk refused to cover the business, because the images showed a bad roof. The insured actually had put a new roof on the concerned property, but the images were not current and the new roof did not show.

Insurers are investigating analytical tools to mitigate major sources of homeowner claims: fire and water damage (see Figure 10). Insurers can now use imaging and data analytics to identify homes most at risk from a fast-moving wildfire by accessing data about vegetation clearance and fuel load around the home (eg, dense vegetation within 30 feet). These tools not only determine the presence of vegetation in great detail (to a resolution of 6 centimetres), but also the density of that vegetation, enabling insurers to assess whether the vegetation in a given locality is thick enough to fuel growth of a wildfire.³⁵ As a result, insurers can monitor and issue alerts for an individual home or a set of properties that are close to risky vegetation.

³¹ *Wildfire in Canada: fostering resilience through advances in modelling*, Swiss Re Institute, March 2019.

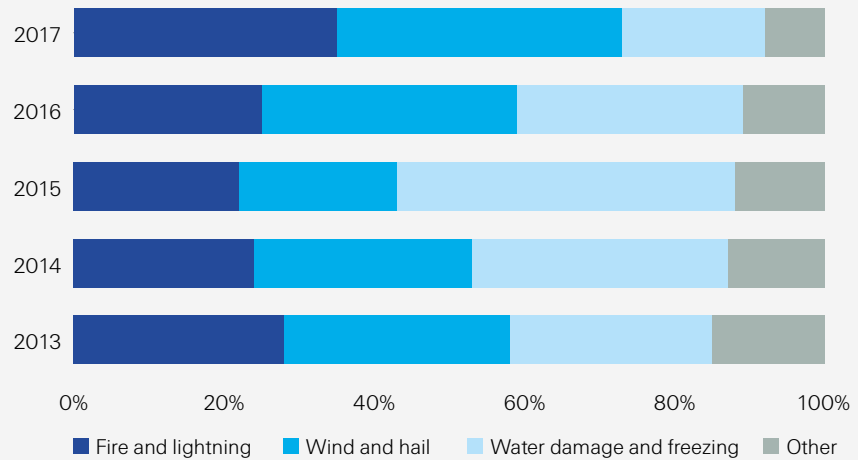
³² *Homeowners' ROE Outlook*, Aon, October 2018.

³³ *Plymouth Rock leans on big data in adding homeowners' coverage*, Digital Insurance, 17 June 2019.

³⁴ *State Auto Insurance Chooses Cape Analytics to Deliver AI-Based, Aerial Property Intelligence*, Cape Analytics, 26 March 2019.

³⁵ *This Data Startup Is Using Machine Learning And Aerial Images To Reduce Risks From Wildfires*, Forbes, 3 April 2019.

Figure 10
Sources of homeowner insurance losses, US



Source: Insurance Information Institute

Better hazard information allows insurers to ask fewer time-consuming questions.

Analytics can uncover bottlenecks in industry supply chains.

The information can inform risk selection and portfolio steering at the point of underwriting.

Swimming pools represent a significant liability hazard and usually attract a premium surcharge. However, they are often under-reported by homeowners and require validation by physical inspection. Automated pool detection using geospatial data can close this information gap by allowing insurers to automatically detect unreported pools, as well as verify the presence of reported and above ground-level (eg, roof terrace) pools, which helps determine eligibility, rates and more accurate pricing at renewals.³⁶

Contingent business interruption

Supply chain losses can be large and catastrophic, posing significant challenges to companies and their insurers. Identifying critical suppliers is key for improved risk accumulation management. An event at a small cluster of factories could have a large ripple effect regionally or globally. For example, in May 2018 several car manufacturers experienced disruption after an explosion shut down a specialised magnesium foundry in the US.³⁷ Reconciling and combining external data sources into a flexible data structure can offer tangible insights into supply chains.

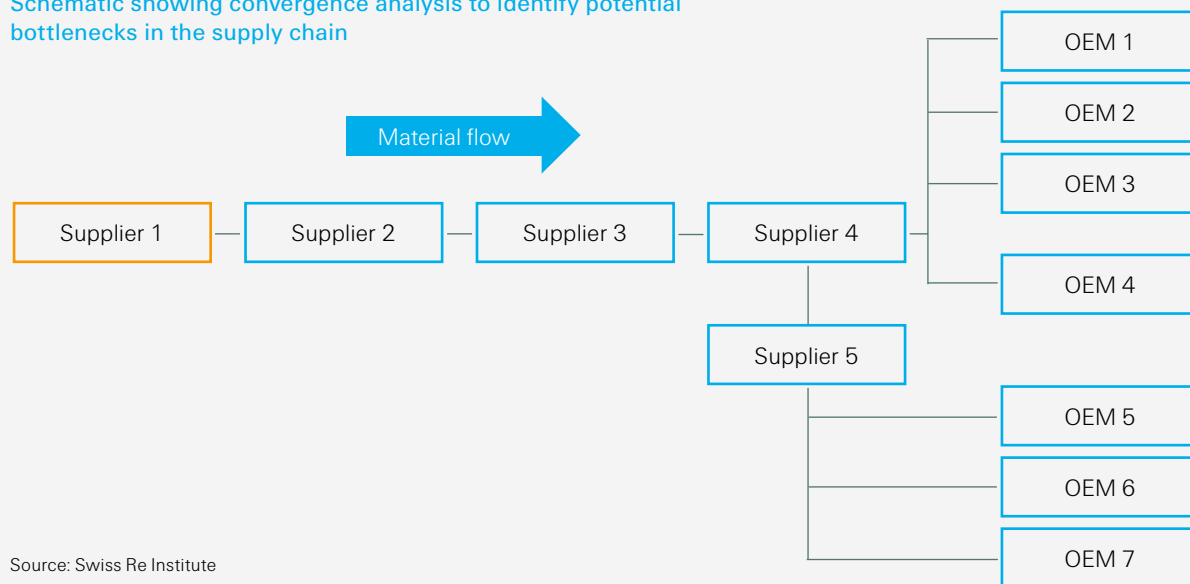
Analysis of customer-supplier relationships by product class can uncover unique dependencies. For example, many plastics suppliers in Europe recently issued alerts that certain materials used to produce car parts were in short supply. The root cause was shortage of adiponitrile, a chemical that is manufactured at only five plants in the world.³⁸ Figure 11 illustrates how several OEMs can trace their supplies to a key Supplier 1, which can become a bottle neck. Insurers can use this information to inform risk selection and portfolio steering at the point of underwriting, and leverage supply chain insights in client discussions (eg, around enterprise risk management).

³⁶ Cape Analytics introduces automated pool detection from geospatial imagery, Cape Analytics, 29 May 2019.

³⁷ A fire followed by explosions took place at the Meridian Magnesium Products of America plant in Eaton Rapids in 2018. This plant makes interior components for several major carmakers and showed how reliance on single supplier for certain parts can be risky.

³⁸ T. Larsson, S. Kamal, "The top 10 supply chain risks of 2019", *supplychainquarterly.com*, 14 June 2019.

Figure 11
Schematic showing convergence analysis to identify potential bottlenecks in the supply chain



New ways of using external data could reduce underwriting costs through triage/pre-screening...

...and help specific proposals for tailored additional covers.

Analytics can help lower acquisition costs and improve cross-selling to SMEs.

Small and medium enterprises (SMEs)

Unlike larger corporates, SMEs are too small and diverse for full-blown risk assessment. In our interviews, we heard that due to large volumes, underwriters can spend little time on individual SME proposals (around 7–9 minutes) and look at very few data points to analyse submissions. However, analytics tools can offer richer analysis with faster turnaround by aggregating hundreds of SME-related external data sources to answer underwriting questions, offer risk scores, and even identify more honest brokers. For example, with only a business name and address as inputs, Berkshire Hathway Guard Insurance now obtains needed information based on data available online and offline, which has reduced time from submission to quote.³⁹

Early pilots using such tools indicate significant improvement in underwriting and distribution expenses (up to 60%).⁴⁰ In terms of claims, near misses (eg, fire engine call outs) can be better identified through non-traditional data sources like local councils, fire station reports and social media, than from insurers' traditional sources. This individualised client profiling and scoring with alternative data, when combined with catastrophe models, can help insurers perform risk analysis specific to the unique nature of a business, propose additional covers, and suggest risk mitigation options.

Marketing analytics and behavioural economics using open data sources can lower acquisition costs and improve cross-selling to SMEs. Using new data sources, insurers have lowered customer acquisition costs by offering SMEs tailored insurance recommendations based only on company name and post code. For example, Hiscox is leveraging over 50 open data points to generate relevant insurance cover recommendations and reduce time spent on filling in online quote forms. This has resulted in 35% more effective cross-selling, and 40% lower customer acquisition costs, driven by targeted advertising.⁴¹

³⁹ Berkshire Hathway GUARD Insurance Companies partners with Planck to create full digital underwriting for their commercial lines, Planck, 7 March 2019.

⁴⁰ "Cytora provides risk targeting, selection and pricing advantage for commercial insurers", in 2018 Insurtech Impact 25, Oxbow Partners, 2018.

⁴¹ Digital Fineprint Case Studies – Open data and AI used to improve online customer journey and help tackle SME underinsurance, Digital Fineprint, 2018.

Analytics in property and speciality lines

Extracting behavioural insights from new vessel information may help data-driven underwriting.





Situational insights into portfolios will help insurers price more accurately...

Marine

Marine is a cyclical business where market and client segmentation are key drivers of profitability. Traditional characteristics of a ship (age, tonnage, vessel flag) offer limited information about operational behaviour and how risk-prone a vessel is. Using detailed behavioural and situational data now available from data providers for over 1 00 000 vessels, insurers can develop a range of potential applications, eg, compare vessels to identify hazardous operational behaviour (see Figure 12 for use cases). These data include variables such as speed, proximity to other vessels, number of vessels in the same port at the same time (aggregations), time spent in dangerous waters, and reports of (delayed) maintenance.

These behavioural data can be combined with other (eg, internal claims, exposure and weather data) to build models that capture the key drivers for different incident categories. In pilot environments, some marine insurers have combined five-year claims history with these new data and have found that small changes based on behavioural insights could help reduce their loss ratio by as much as 7%.⁴² For example, insurers can collect missing premiums from specific vessels that sailed into a war or piracy zone but had not reported doing so. Insurers are currently identifying which of potentially hundreds of new behavioural data points have better predictive power than traditional static factors in supporting real world decision-making.

Figure 12
Potential applications of new data in marine insurance

	Value chain	Description
	Reinventing risk management	Real-time awareness of risk exposure to minimize loss concentration (eg, analysis of ports or high-risk regions where more than one ship of a fleet are at the same time).
	Behavioural underwriting	Enhance underwriting with data-driven behavioural risk factors (eg, speed analysis, delayed maintenance, allow underwriters to form a behavioral profile of a vessel).
	More accurate pricing models	Combining traditional vessel inspection data and new risk indicators to improve the accuracy of pricing models.
	Faster claims examinations	New data can also help in claims adjudication. Comparing recent vessel activity with historical journey profiles can help determine if the vessel was moving differently.

Source: Swiss Re Institute

... and improve risk selection and monitoring of risk accumulation.

More importantly, as ports and ships grow larger, the need to monitor risk concentration becomes key in exposure management. Insurers receiving alerts for accumulation within pre-defined zones and key ports can better shape their coverage offers (eg, increase deductibles, prompt/push clients to improve preventive measures). Firms like Marsh, Lloyds syndicate Antares and Trans Re are exploring the potential of such behavioural data analytics for better risk selection.⁴³ Armed with these data points, insurers could also target currently underinsured vessels.

⁴² Quest Marine uncovers insights to improve marine loss ratio by 7%, Concirrus, 15 May 2018.

⁴³ Lloyd's syndicate Antares licenses Quest Marine for data-driven underwriting, Concirrus, 14 November 2018.

New sources of data on cargo are currently limited, but the long-term potential is significant.

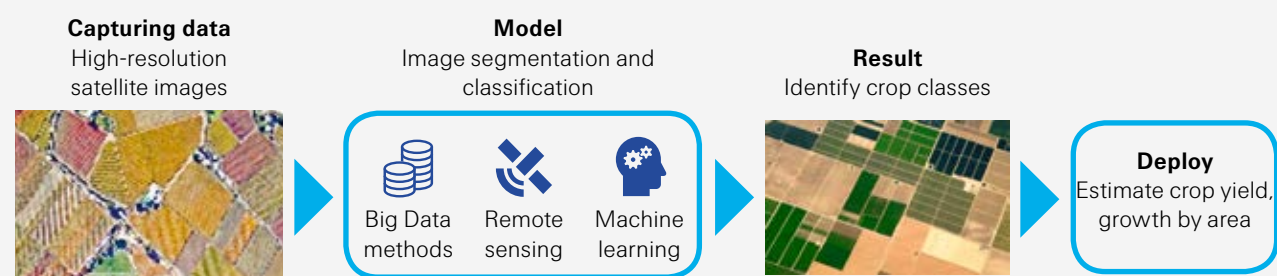
It is harder to get real time data for cargo than for vessels because of the diversity and volume of goods shipped. However, the expected growth in sea trade and efforts to digitise the supply chain using blockchain could change things.⁴⁴ Some insurers like Ascot and Beazley are already piloting tailored coverage in niche areas (eg, for sensitive cargo such as temperature-controlled foods and biological pharmaceuticals) by leveraging data feeds that combine sensor readings with external data.⁴⁵ A key objective is to track potential incidents and, if a claim occurs, to use data to determine liability based on tracked events during shipment.

In crop insurance, new data can improve the precision of crop growth models.

Agriculture

Insurers are looking to grow in the agriculture sector while efficiently managing their exposure portfolios. Increased data volume and greater mapping accuracy provide a detailed picture of risk exposure for each farm, without the costs of collecting data manually. Insurers can create a map of crop fields and crop types by capturing high-resolution satellite imagery and classifying them using image segmentation and classification techniques (see Figure 13). These techniques can identify and distinguish crop types grown (eg, soya vs barley) with high accuracy levels (almost 90%). The output is shown as segments of crop fields and classes. This information can improve the precision of crop growth models by replacing obsolete public land use information with up-to-date high-quality crop maps.⁴⁶

Figure 13
Application of satellite imagery in agriculture insurance



Source: Swiss Re

... and enable new products, improved pricing accuracy and faster claims pay-outs.

These tools can improve field assessment and risk selection by helping underwriters identify critical regions for crops and improve loss ratios through better risk selection. Underwriting results, especially for traditional indemnity products are highly dependent on good risk selection which involves knowing details such as where the crops are, and what the planting windows and soil moisture conditions are, etc. In the event of losses, insurers with deeper insight into their portfolios (exact locations, crops grown) will be able to direct loss adjustment by identifying the worst affected areas. This also allows independent checks on loss settlement to identify moral hazard, and tailored insurance products based on parametric triggers that provide a faster pay-out following a potential loss.

⁴⁴ Solution Brief Edition Two, Tradelens, May 2019.











⁴⁵ "Ascot and Beazley Launch \$50M Insurtech-Linked Cargo Consortium for SMEs", *insurancejournal.com*, 13 February 2019.

⁴⁶ Crop growth models simulate or imitate the behaviour of a real crop by predicting the growth of its components, such as leaves, roots, stems and grains.

Analytics in casualty lines

Data analytics usage is well established in workers compensation business for detecting fraud and identifying claims that could grow in severity. Niche casualty lines (eg, product liability and D&O) can leverage text analytics to understand litigation drivers and the supply chain for early warning signals. Emerging business lines like environmental liability and cyber are leveraging data analytics to construct risk profiles in the absence of reliable historical data.

Table 7
Application of analytics by line of business

Line of business	Enabling growth	Engaging customers	Optimising portfolios	Improving efficiency
 Workers compensation	 Data-driven insights when quoting new and renewal business.	 Draw tangible insights on specific actions to improve worker safety.	 Identify sooner claims that could grow in severity.	 Identify frauds faster by leveraging online information.
 Product liability	Refining strategy via early warning signals by analysing scientific and court records.	Analytics enabled risk consulting services (eg, product safety and reliability analytics).	Insights about recalls by combining unstructured (recall/shipping data) and structured data.	Reduce claim severity and litigation costs by data-driven insights into supply chains.
 Directors and officers liability	Identify protection gaps and firms that are underinsured.	Risk consulting by analysing issues like M&A, regulatory changes.	Anticipate litigation trends and increase awareness of potential sources of claims.	Access to more data on litigation exposure improves underwriting.
 Environmental liability	Grow in new risk pools, especially in emerging markets.	Advise authorities and clients about environmental risks.	Better underwriting by analysing external data (eg., facility monitoring systems).	Reduce cost of risk assessment with better understanding of liability exposures.
 Cyber risk	Real-time data offer risk insights; historical data is of lower value.	Risk consulting based on outside-in, third-party data analysis.	Test accumulation scenarios and models by combining external data with risk judgement.	Reduce cost of risk assessment and quote time by using third party data.
 Motor (commercial and personal)	Refine segmentation via data driven insight, (eg, in a tariffed market).	Mould driving behavior by collecting/analysing real-time driving data.	Identify premium and exposure mismatch by leveraging data analytics.	Reduce claims handling costs by data-driven triaging.

Source: Swiss Re Institute compilation of specimen pilots reported by insurers, brokers, consulting firms and technology vendors.

Insurers have figured out how to successfully implement analytics in workers compensation cases.

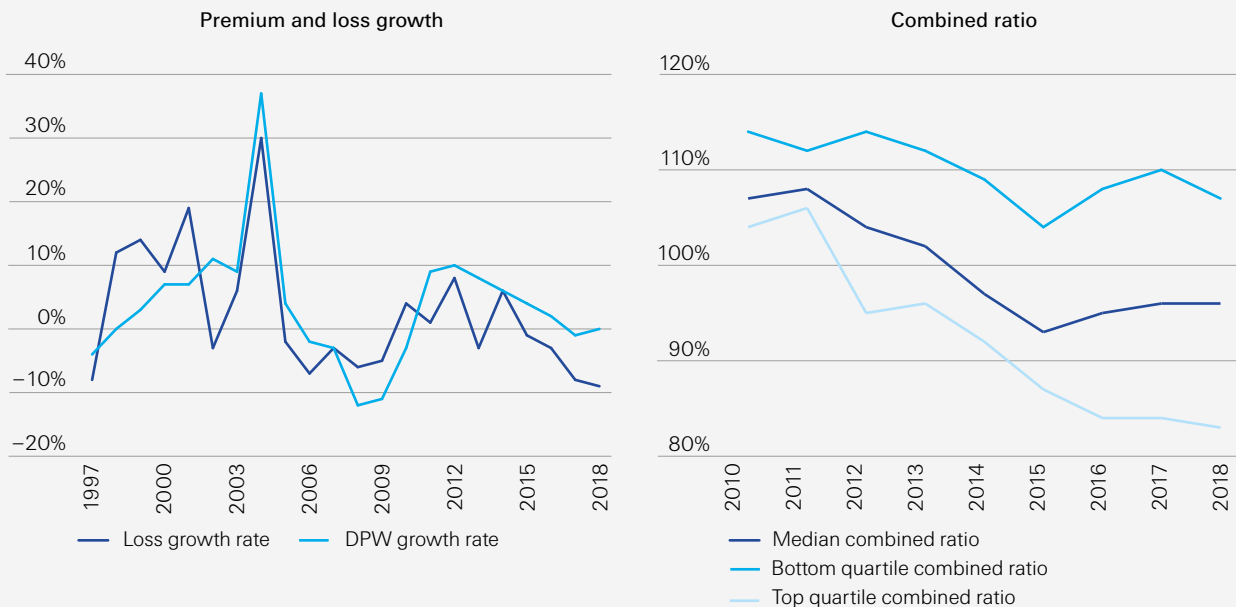
Workers compensation

Workers compensation was among the first lines of business to implement analytics because of the sheer volume of data, potential to detect fraud and the need to identify claims that could grow in severity over time, either due to litigation or other reasons. Premium growth has outpaced growth in losses (see left panel of Figure 14), one reason being the adoption of advanced analytics in risk selection and underwriting.⁴⁷ Combined ratios in workers compensation in the US have improved to their lowest level in decades. However, there is a significant and growing gap between the combined ratios for the top and bottom quartiles of insurers (right panel): according to AM Best, analysts believe the differential is partly due to more intelligent use of data analytics among insurers with better combined ratios.⁴⁸

⁴⁷ See *Predictive Analytics Aids Performance, Balances Underwriting Cycles for Commercial Lines Insurers*, AM Best, 2 April 2018.

⁴⁸ Ibid.

Figure 14
Underwriting performance indicators in workers compensation, US



Note: DPW = direct premiums written. The right panel is based on the top 60 companies, representing around 90% of US net premiums written.
Source: AM Best, SNL, Swiss Re Institute

Insurers have also been successful in identifying fraudulent claims.

Fraud for workers compensation is estimated at USD 7.2 billion annually and is the fastest growing segment of insurance fraud in the US.⁴⁹ Many insurers use social media analytics to detect fraudulent individual claims. Such as Allstate, which is leveraging online information to identify fraud faster (eg, claimants who claim to be too injured to work, but engage in strenuous activity like horseback riding).⁵⁰ However, large-scale crime rings often cost employers an average of USD 10 million in paid-out losses for each case; much more than individual claimant fraud (average loss is USD 30 000).⁵¹ Analytics can help uncover such large frauds by flagging certain suspicious events (eg, when smaller medical clinics originate large volumes of claims). While individual insurers may lack sufficient data to detect mass frauds, law enforcement agencies do co-ordinate with carriers with analytics know-how to uncover patterns (eg, search for comparable bills coming from the same players).

Analytics teams predict how claims might develop very early in the claim trajectory...

Claims staff at leading insurers collaborate with analytics teams to build models that interact with a claim from the moment it is filed until it is closed. At Zurich Insurance, models constantly run in the background of claim files, and staff are sent notifications every time a file is updated.⁵² An example of an early warning is extended opioid use by a worker. In another example, AIG's advanced injury analytics uses over 100 time-sensitive formulas to continuously review claims, refreshing every 30 days to reveal insights into the most complex cases. By applying more than 30 factors that can predict complexity, they identify the most severe claims as early as possible.⁵³

⁴⁹ Claims Fraud Analytics: *Overview And Prominent Providers*, Novarica, May 2019.

⁵⁰ "Allstate Finds Fraud Faster with Innovative Data Company", *www.prnewswire.com*, 28 November 2017.

⁵¹ *Why Physician Fraud Rings Are a Major Workers' Comp Issue And What You Can Do About Them*, Risk and Insurance, 18 September 2018.

⁵² *Predictive Analytics delivers on workers' compensation claims*, Zurich Insurance, 14 June 2018.

⁵³ *Workers' Compensation Advanced Injury Analytics*, AIG. See <https://www.aig.com/content/dam/aig/america-canada/us/documents/claims/wc-advanced-injury-analytics.pdf>

Analytics in casualty lines

In doing so they can mitigate claims severity by resolving cases quicker...

Sharing data with insurers can benefit insureds through prevention and safety insights.

In product liability, fragmented data and complex supply chains make it hard to generate insights.

However, data from individual loss and recall documents can help fine-tune risk assessment...

Analytics can also identify cases that can be resolved quicker. Longer duration claims significantly drive up costs. As an example, analytics has shown that a nurse referral within 90 days of the first report has a positive impact on total costs and closing rates of claims, but nursing staff are a limited resource and cannot be allocated to all claims.⁵⁴ Zurich Insurance uses analytics to decide on cases where it can assign a nurse within this time period. This has saved it from USD 6 000 to USD 26 000 per eligible claim – with almost 50% reduction in overall costs.⁵⁵

Insurers emphasise that the focus for employers should be to use data and analytics to draw tangible insights and take specific actions to improve safety. With access to detailed information about job characteristics of injured workers, insurers can help employers identify underlying causes of claims. Data can also be used to inform worker training and education. Marsh discussed a beverage manufacturer whose workforce had constant back pain. Analysis of historical injury and illness data identified shoulder injuries as a risk for employees handling beverage cases and pallets, and job-specific training was created on how to lift such objects.⁵⁶ In another example, Caterpillar cut the number of high-risk lifts done by workers by 80%, by making use of wearables data. The number of injuries fell by half, reducing claims.⁵⁷

Product liability

The majority (around 60%) of liability claims are caused by defective products and faulty workmanship.⁵⁸ The extended global supply chain that manufacturers rely on is complex and difficult to understand. Often original equipment manufacturers (OEM) mitigate their own risk by passing the liability for recalls down the supply chain to component manufacturers responsible for defects in finished products. Structured data offers only limited insights into this complex and ever-changing web of relationships between manufacturers and suppliers.

Deeper insights can be uncovered by incorporating unstructured data, such as information in recall reports and shipping records. For example, although auto recalls in the US have been increasing (see Figure 15), structured recall databases typically contain only basic information about recalls (like auto OEMs, car make and model, vehicle part(s) recalled). However, more detailed information is available in PDF documents on a recall-by-recall basis. Using text mining tools, this information can be extracted, digitised and used to visualise customer-supplier relationships, including product information, for the companies involved in recalls.

⁵⁴ E. Siegel, "Wise Practitioner – Predictive Analytics Interview Series: Dr. Gary Anderberg at Gallagher Bassett", *Predictive Analytics Times*, 4 March 2019.

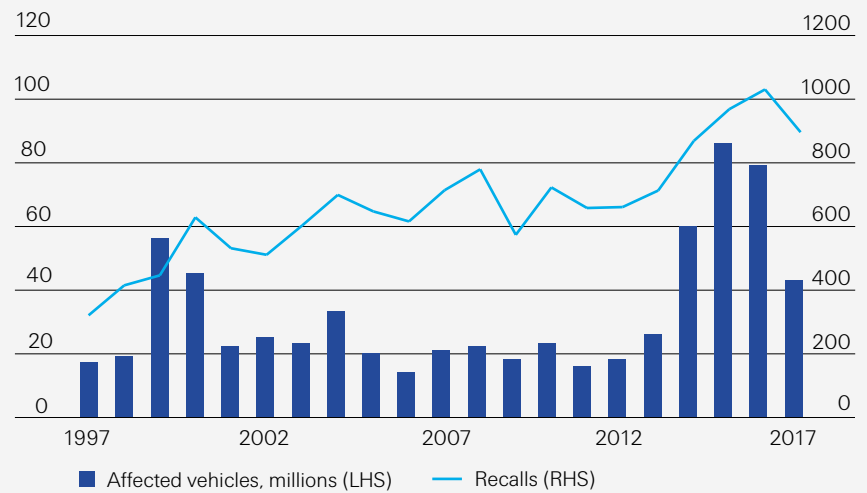
⁵⁵ *Predictive analytics + medical knowledge = improved outcomes for injured workers*, Zurich Insurance, 24 July 2018.

⁵⁶ *Creating Safer Workplaces And Reducing Costs Through Predictive Analytics And Technology*, Marsh, 2015.

⁵⁷ "The Promise of IoT in Commercial Insurance", *CFO.com*, 3 April 2017.

⁵⁸ *Global Claims Review*, AGCS, December 2018.

Figure 15
Number of recalled vehicles,
and number of recalls, US



Source: National Highway Traffic Safety Administration

... and underpin value added services like crisis simulations and recall planning.

Early warnings of litigation can be obtained by mining scientific journals at scale.

With the benefit of such detailed information, some insurers have started offering pre-incident consulting services, which helps them form long-term partnerships with commercial clients. For example, AXA XL offers bespoke services such as product safety and reliability analytics to help manufacturers through crisis simulations, recall planning and supplier approval processes.⁵⁹

Leveraging new tools that mine data from scientific journals, insurers can also estimate the likelihood of scientists reaching consensus that exposure to a substance or product causes a particular form of injury. Companies need to employ dozens of scientists to keep track of such information, and the process is usually very manual. Using these tools, companies can cover a wider set of information and better assess whether lawsuits over substance exposures are likely to be awarded to the plaintiff(s). This information can then be overlaid on an insurer's portfolio to identify potential accumulations of liability risk.⁶⁰ Allianz Global Corporate & Specialty, for example, is partnering with an analytics firm to provide these analytical resources to policyholders and mitigate product safety risks for liability insurance clients.⁶¹

⁵⁹ Automotive Components Product Recall, AXA XL. See <https://axaxl.com/insurance/insurance-coverage/professional-insurance/automotive-product-recall-excess>

⁶⁰ *Emerging liability risks*, Lloyd's *Emerging Risk Report*, Lloyds, December 2015.

⁶¹ "AGCS extends partnership with Praedicat to mitigate product safety risks for Liability insurance clients". AGCS, 27 November 2018.

D&O insurers can leverage analytics on court filings to track market and legal trends.

Analysis of multiple data sources could allow early indications of performance issues.

By integrating analytics with sensor data, insurers can begin to cover hitherto excluded risks.

In some areas, analytics can help insurers in emerging markets tap into environmental risk pools.

Directors and Officers Liability (D&O)

According to a recent survey, 58% of insureds said the most important change made to D&O insurance programmes in 2018 was that they had obtained more favourable terms in their policies.⁶² In this accommodative environment, deeper insights regarding market and claims trends can allow for better business steering. Many insurers have underperforming D&O professional liability portfolios and struggle to accurately identify loss drivers. Chubb recently noted that almost one out of every 11 companies is being sued.⁶³ Insurers can analyse D&O court filings and group cases by industry to understand trends in lawsuits, which can help quantify loss frequency and severity across lawsuits. Overlaying portfolio data with these industry loss trends can help insurers better understand and optimise their professional liability portfolios.

Speciality liability underwriters are beginning to use exposure management tools that aggregate multiple data sources to generate insights on liability exposure. This risk selection approach feeds external data into predictive models in order to compliment underwriting intuition about questions like predictability of lawsuits, eg, what is the probability that the company will face a securities class-action over the next 12 months. For example, angry social media posts and other online expressions of generalised public anger are strongly correlated to greater losses from reputational issues.⁶⁴ These early warnings help D&O underwriters move beyond experience metrics like claims and near misses, to forward-looking modelling of adverse events (eg, complaints reported for a particular drug, or device).⁶⁵

Environmental liability

Although environmental liability insurers compete on price and coverage expansion, their appetite is limited in some areas such as densely-inhabited risks like hotels and hospitals, due to an increase in claims related to indoor air quality, mould and outbreaks of Legionella.⁶⁶ For example, insurers typically exclude Legionella outbreaks because monitoring the condition of water systems on a regular basis using human resources is cumbersome and expensive. By integrating advanced analytics with technology that monitors water systems, Tokio Marine Kiln recently began offering preferential terms for Legionella cover.⁶⁷ Underwriters can see how an insured's risk profile changes through monthly reports and real-time dashboards.

Further, insurers in emerging markets can leverage analytical approaches from more mature markets when tapping into environmental risk pools. For example, regulators in emerging markets such as Latin America are launching tougher environmental protection laws. Insurers in these markets often lack experience in the nuances of environmental liability risk assessment (eg, in China they are less familiar with policies that include protection for gradually occurring pollution events). To address this information gap, insurers can consider generating risk scores from Big Data, and combine these with results from both quantitative and qualitative surveys on pollution-exposed companies to form a view on the environmental risks.

⁶² 2018 Willis Towers Watson Management Liability (Directors and Officers) US Survey, Willis Towers Watson, 18 July 2018.

⁶³ "D&O rates skyrocket in hardening market", *businessinsurance.com*, 25 June 2019.

⁶⁴ *Directors and Officers Now Face Personal Risk*, Risk and insurance, 16 December 2016.

⁶⁵ Start-up Pharm3r – a healthcare analytics business – provides risk insights into medical device and pharmaceutical manufacturer liability risk.

⁶⁶ *Construction Marketplace Realities 2019 – Environmental Liability*, Willis Towers Watson, 29 March 2019.

⁶⁷ Risk analytics firm Shepherd, broker Lockton and speciality insurer Tokio Marine Kiln have produced a product for managers who have a legionella compliance responsibility. See *Sentinel Shepherd for Legionella compliance*, Shepherd, 2019.

Most corporations do not use, nor have, detailed quantitative cyber risk models.

The risk is usually quantified through deterministic scenario analyses.

However, some researchers have recently launched probabilistic models to quantify cyber risks.

Some insurers partner with cyber analytics firms to augment traditional actuarial analysis.

Commercial auto carriers are yet to use data, to improve results to the extent that other lines have.

Cyber risk

The lack of historical cyber claims data makes extrapolating information about future losses (both frequency – including unsuccessful attacks – and severity) challenging. For this reason, insurers have tended to take a relatively rudimentary approach to quantitative modelling. Although the actual history of losses can be large enough to infer realistic possibilities of some routine events like data breaches, to rely on historical information for rare and severe events may be misleading. Insurers have addressed this by developing threat scenarios, similar to scenarios employed in natural catastrophe business, to identify, model and quantify cyber risk accumulation.

With this approach, an insured's potential exposure is assessed under a number of hypothetical scenarios (eg, prolonged power grid outage, theft of financial information due to a vulnerability in a software system or at a cloud service provider).⁶⁸ Analytical models take a deterministic view to derive estimates of the size of possible losses if the scenario were to happen (a "what-if" estimate of the impact). However, a shortcoming of pure deterministic scenario analysis is difficulty in establishing the likelihood of such events. It is difficult to know how much weight to put on the resulting estimated losses.

Responding to this limitation, analysts are developing probabilistic models to assess potential losses. For example, after releasing 17 deterministic scenarios since 2017, risk modelling firm AIR recently introduced its probabilistic model for cyber risk. This model is calibrated with claims data from around 77 000 incidents and the cybersecurity profiles of over 100 000 firms.⁶⁹ Compared with deterministic tools, these models look to quantify the full probability distribution of future losses rather than provide a single best estimate. All told, however, the rarity of extreme cyber losses means that modellers still have to rely on qualitative information to generate estimates of aggregate loss distributions.

Anecdotal accounts suggest that 20–50% of historical cyber incident data becomes obsolete annually. As a result, insurers are using analytics to obtain "outside-in" data to create a multi-dimensional risk profile of select companies. Insurers working with specialist firms that scan and crawl the web can get thousands of data points to assess risks from the outside-in (non-intrusive, truly third-party data). For example, how often does security information, like stolen passwords, appear in dark web forums? Insurers are still trying to assess the predictive power of such data. Such analysis will not replace underwriting expertise and risk-based judgement but can be a complementary set of risk assessment tools.

Commercial motor

Analytics driven insights in commercial motor insurance have not improved underwriting performance to the extent they have with other lines. Commercial fleets use telematics for safety, location management and supply chain optimisation, but not necessarily for insurance. Insurers have begun using some telematics data for rating and claims resolution but have not changed how they underwrite risk. Instead, they rely on traditional methods using historical data on the business and the individual.⁷⁰ The expectation is that increasing use of telematics will reduce frequency and severity of accidents by moulding driving behaviour, but the severity of awards may increase if data is used in the courts to prove driver's negligence.⁷¹

⁶⁸ *Cloud Down Impacts on the US economy*, Lloyds, February 2018.

⁶⁹ *Introducing Our Probabilistic Model for Cyber Risk in ARC*, AIR, 31 October 2018.

⁷⁰ "Data Enrichment to Drive Commercial Motor Insurance Sector", *lexisnexis.com*, March 2019.

⁷¹ In the US, a Federal mandate to use Electronic Logging Devices (ELDs) is being used by some insurers to provide discounts to eligible truckers that share this data. See "Still an Uphill Climb for Commercial Auto Market", *insurancejournal.com*, 5 February 2018.

Analytics in casualty lines

Underwriters are trying to fetch more exposure information via reporting from insureds.

Faster and more accurate fraud detection reduces pressure on frontline claims handlers...

.. and generate significant time and cost savings.

Analytics can help turn around poorly performing motor books, but this can take a few years.

Portfolio quality assessment is a difficult task for the commercial motor segment. It is not always clear which of two factors are responsible for rising claims: 1) poor risk selection; or 2) increase in exposure due to higher vehicle usage. In the former, an insurer can tighten underwriting standards, but the latter could reflect a mismatch between exposure and price. Underwriters are trying to access more exposure information via reporting from insureds, and portfolio auditing. This data will allow insurers to identify microsegments where premiums are out of line with exposure.

Personal motor

Personal line motor insurers use analytics across the value chain, especially in claims assessment, to detect fraud and reduce loss ratios. Analytics can reduce the pressure on claims handlers by routing suspect claims to special investigation units. For example, personal lines insurers use analytics to identify induced crash-for-cash cases and ensure that such claims are identified, triaged and handled appropriately.⁷² In one case, insurer Esure set out to reduce the time taken to detect and identify fraud. The project had a positive financial net ROI within 12 months and generated a 12% increase in crash-for-cash fraud cases retained for investigation, and a 54% reduction in time taken to assign cases requiring investigation.⁷³

Looking at relationships in the data and combining information from disparate systems can help insurers detect fraud from organised crime rings. In nine months of implementing fraud analytics, SBM, an insurance information and monitoring centre in Turkey, uncovered USD 86 million in potential fraud.⁷⁴ In another case, an insurer (Anadolu Sigorta) employed a 50-member fraud detection team to manually check 25 000 to 30 000 claim files for fraud every month. Fraud analytics helped shorten the fraud detection process from 15 days to almost real time, saving millions of dollars in fraudulent claims and fraud detection costs.⁷⁵

In many countries, neighbouring areas have totally different risk levels of car theft and collision. Analytics help in risk discrimination and understanding a book's exposure to region-specific accident risk, allowing insurers to integrate pricing intelligence across risk profiles and helping them turn around poorly performing books. Some insurers operate in markets where compulsory lines are completely tariffed. While they may not be able to improve rates, they can improve the risks they write for those rates. Industry experts indicate that it takes at least three years to see significant benefits from corrective action, as insurers need to adjust their operations and sales effort to bring people on board.

⁷² In induced accidents, criminals defraud innocent motorists to claim whiplash compensation. These can amount to almost half of all organised motor fraud. See *Fraudulently induced accidents*, Aviva. See <https://broker.aviva.co.uk/news/article/334/fraudulently-induced-accidents/>

⁷³ *Celent Model Insurer 2019: Data, Analytics, and Artificial Intelligence*, Celent, 12 April 2019.

⁷⁴ *Cracking down on insurance claims fraud, SBM sees fraud-detection rates improve fivefold*, SAS. See https://www.sas.com/en_us/customers/sbm-tr.html

⁷⁵ *Customer story, Anadolu Sigorta*, FRISS. See <https://www.friss.com/customer-story/anadolu-sigorta/>

Figure 16
Benefits of analytics in auto claims

Commercial lines		Personal lines	
Cost savings/benefits for insurers	Saving/benefit	Cost savings/benefits for insurers	Saving/benefit
Annual average claims savings for fleet operations, based on 1 000 vehicles	USD 370 000	Loss ratio saving based on a survey of 10 000 policies for younger drivers. 220 claims per month, and an average premium of USD 1 440	7.7%
Insurer savings on pre-litigation and supported litigation cases using telematics data, per case	USD 6 000 to USD 437 000		
Personal injury savings for fleet operations	USD 143 000	Reduced costs of getting accident data directly from the impact management system rather than from a third party	60%
Vehicle not at alleged collision location	USD 99 300		

Source: Intellimec, <https://www.intellimec.com/zurich-claims-telematics-case-study>

Insurers are reducing claims costs, and optimising processes to improve claims efficiency.

In recent years, telematics data has played a key role in re-creating the exact circumstances of an accident. Figure 16 shows the claims cost reductions that have been experienced in some cases, eg, loss ratios for younger drivers can show significant improvement. Claims processes are being automated too (eg, automated validation of car glass repair bills). Insurers have also begun accessing tools which read and check workshop invoices, and create a detailed assessment for each claim, avoiding human error.⁷⁶ In certain pilot conditions, insurers have seen processing costs fall by up to 50% and indemnity spend by 5–10%.⁷⁷

⁷⁶ SV Versicherung uses Cognotekt AI, Cognotekt, 7 December 2017.

⁷⁷ Bitesize Impact 25: Cognotekt, Oxbow Partners, 13 July 2018.

Conclusion

The P&C insurance value chain can benefit extensively from new data and analytics.

There is still work to do. Being able to explain results is key to building trust and adoption.

Mind-set change is a difficult but crucial element for success of any analytics initiative.

Insurers will need to adapt to regulatory changes with respect to the use of new sources of data.

The insurance industry has been slow to adopt new technologies. This is changing, with varying degrees across different lines of business. Key components of the P&C value chain are set for changes brought about by technological advancements and new data analytics techniques. Initial use cases have been launched in portfolio optimisation and efficiency gains, and we expect to see much expanded usage to facilitate understanding of new risk pools. Analytics capabilities will become an essential ingredient of competitive advantage for insurers. However, the true potential will only be realised with development of industry-specific enabling infrastructure, resources and knowledge.

There are challenges too. Analytical tools are often designed to generate simplistic outputs (eg, a single risk score, probability of fraud or attorney's winnability). Many analytics teams default to dumbing down the output or score, with limited transparency into the underlying driving factors. Users, especially underwriters, require clear explanation of results to build trust: they need transparency so that the results are more interpretable. Insurers would do well to engage underwriters and other users early in the process.

Insurers often underestimate the extent of cultural change needed. To overcome institutional barriers, analytics projects should be clearly aligned with business objectives. By definition, analytics projects have uncertain outcomes and to maximise probability of success, management should prioritise initiatives that lie in the intersection of desirability, feasibility and viability. Multiple departments should be involved early on with clear accountabilities and realistic expectations. This will help ensure the results become part of the work process, rather than output that is difficult to comprehend and consequently under-utilised.

New tools and approaches, however, also raise new questions. Regulators are growing more familiar with advanced analytics and some have approved "pilot" programmes in different regions. However, more sophisticated products involving machine learning raise questions, particularly around the impact on consumers and the use of consumer data. Looking ahead, analytical models will require adjustments to incorporate new data from evolving technologies, making data quality and governance frameworks key to harnessing the benefits of digitalisation.

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Swiss Re Management Ltd
Swiss Re Institute
Mythenquai 50/60
P.O. Box
8022 Zurich
Switzerland

Telephone +41 43 285 2551
Email institute@swissre.com

Swiss Re Institute has a global presence with offices in New York, London, Bangalore, Beijing, Hong Kong and Singapore

Authors
Jonathan Anchen
Ashish Dave

The authors thank Binay Biswal and Aakash Kiran Raverkar for their contributions to this report.

sigma editor
Paul Ronke

Managing editors
Dan Ryan
Head Insurance Risk Research

Dr Jerome Jean Haegeli
Swiss Re Group Chief Economist

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Swiss Re Management Ltd.
Swiss Re Institute
Mythenquai 50/60
P.O. Box
8022 Zurich
Switzerland

Telephone + 41 43 285 2551
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