



Society of Actuaries in Ireland

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# Application of Data Analytics in Insurance

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24 October 2019

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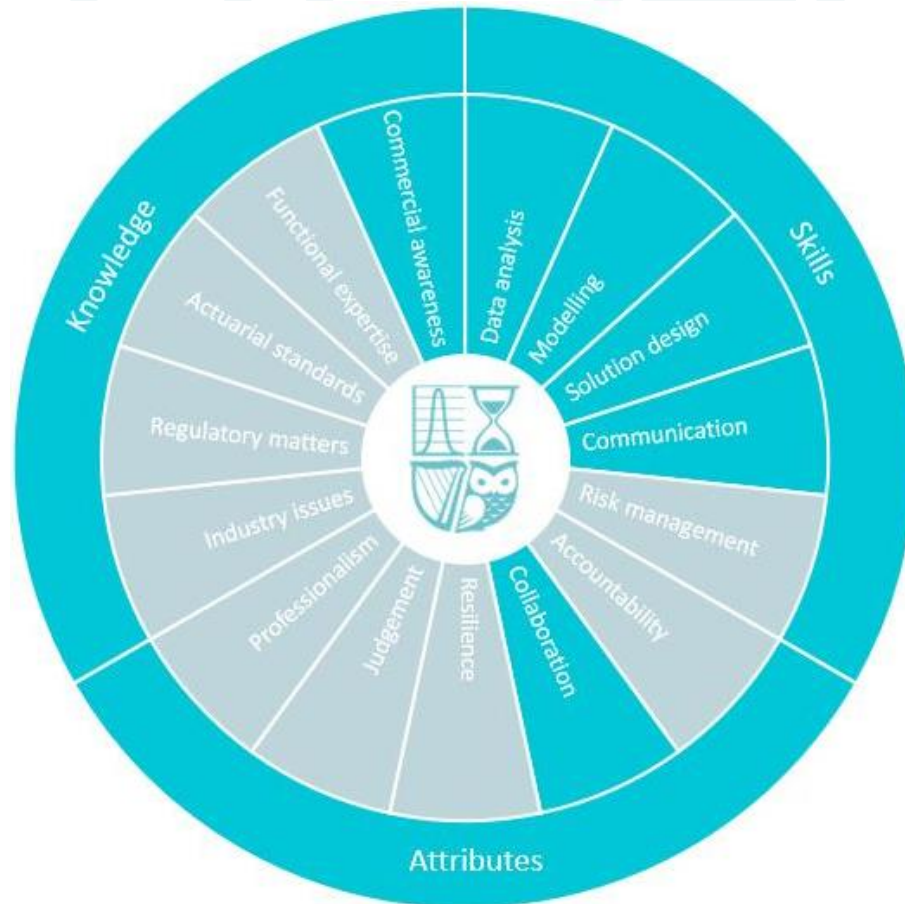
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# Disclaimer

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**The views expressed in this presentation are those of the presenter(s) and not necessarily those of the Society of Actuaries in Ireland or their employers.**

# Competency Framework





# About the speaker

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Bence Zaupper, FSAI

- Senior manager, life actuary in the Actuarial Services Group in PwC Ireland, Data Analytics Proposition Lead.
- Provides audit and actuarial services to PwC's financial services clients and supports clients in advisory projects such as risk and capital management and data analytics.
- Member of the Data Analytics Subcommittee of the Society of Actuaries in Ireland providing resources for members looking to upskill in this area.



# Agenda

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- Role of actuaries in the digital age
  - Actuaries of the future
  - Trends in the US
    - US Actuarial Modernisation Survey (PwC, 2018)
    - Top Actuarial Technologies (SOA, 2019)
  - Implications for actuaries in Ireland
- Analytics use cases in insurance
  - Behavioural analytics
  - Customer segmentation
  - Claims analytics and fraud detection
  - Other insurance use cases

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# **Role of actuaries in the digital age**

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# Actuaries of the future

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- Key messages from the leaders of the Actuarial Association of Europe (AAE) in a recent press release\* (June 2019):

*“Although traditional actuarial competence is essential, to remain a relevant partner, actuaries must extend their reach to new areas outside their comfort zone. These include sustainable finance, consumer protection, big data and modern data science and macro prudential issues.” – Esko Kivisaari (former chairperson of the AAE)*



# Actuaries of the future

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- In the same press release, Falco Valkenburg, current chairperson (former vice-chairperson) of the AAE describes actuaries of the future (or the “fifth kind of actuaries”):

*“...a data and model-driven, critical and socially responsible financial decision maker in an ever-changing world ruled by uncertainty”.*

- Previous “kinds” of actuaries in chronological order:  
1. Life 2. Non-life 3. ALM 4. ERM Actuaries





# Actuaries of the future

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- Questions:
  - What does this mean in practice?
  - Where are we now?
  - What do we need to get there?



# Actuarial Modernisation Survey

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- Actuarial Modernisation Survey\* run in the US in 2018 by PwC with 56 respondents
- Key themes:
  - The elusive goal of Full Automation
  - The challenge of Data Management
  - The Actuary today and tomorrow



# Actuarial Modernisation Survey

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## *The survey*

### **Purpose:**

Survey to understand current state of Actuarial Modernization for both P&C and Life companies

### **Scope:**

48 questions covering

- Demographics
- Modernization
- People
- Process
- Technology

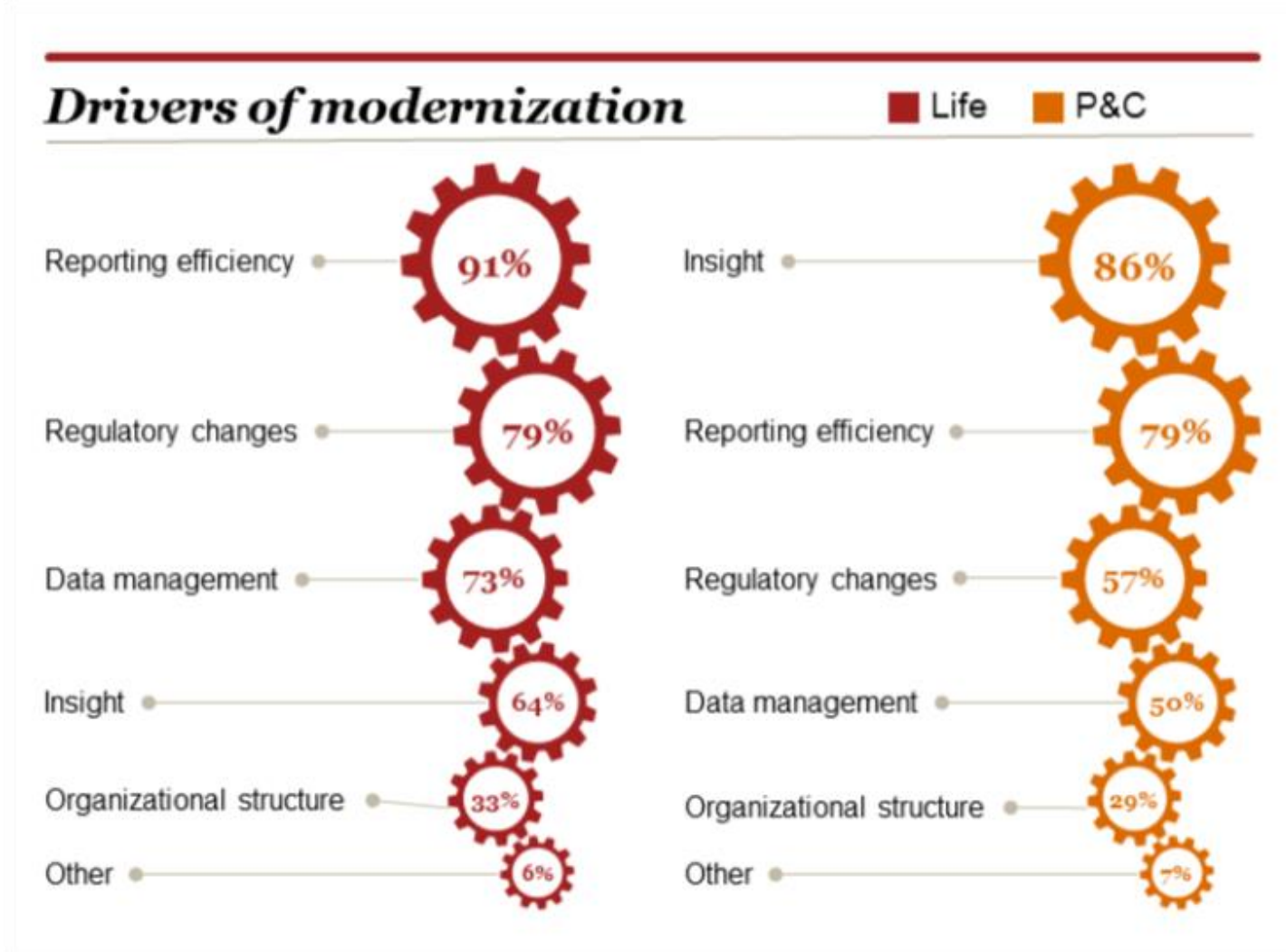
### **Responses:**

37 Life and 19 P&C companies

- 40% are US national and regional insurers, 60% are international
- Actuarial team size: 18 have less than 50 FTE (“Small”), 18 between 50 and 100 FTE (“Medium”) and 20 more than 100 FTE (“Large”)



# Actuarial Modernisation Survey





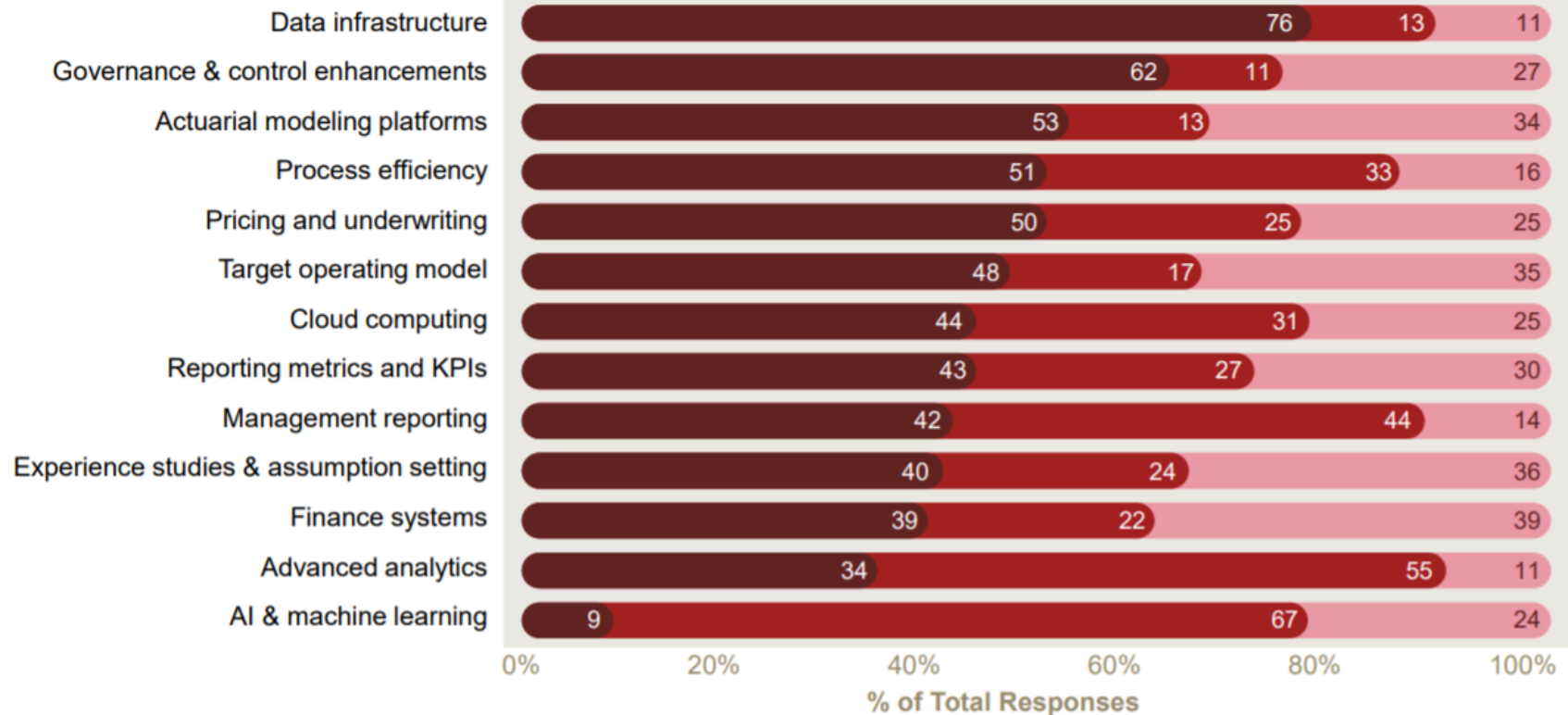
# Actuarial Modernisation Survey

## *Focus area of modernization programs*

### Modernization focus areas:

- Main focus areas are implementation of foundational capabilities, e.g. data infrastructure, governance/controls and actuarial modeling platforms
- For future focus AI/Machine learning, Advanced analytics and Management reporting are the three top categories

■ In progress ■ Future area of focus ■ Previously implemented / NA





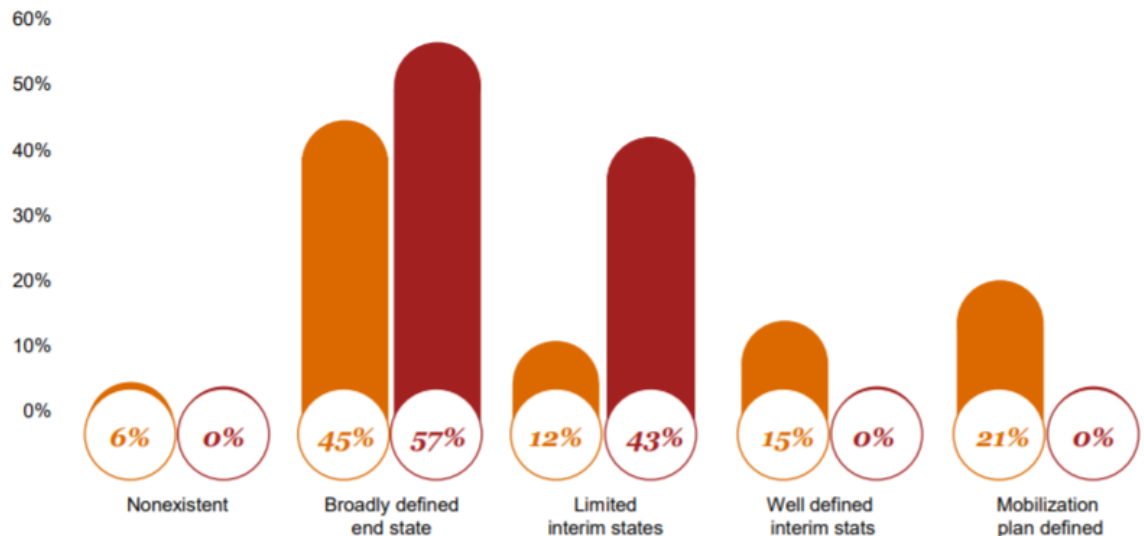
# Actuarial Modernisation Survey

## *Maturity of modernization plans*

- The majority of insurers do not have a well articulated modernization plan
- Only **25%** of insurance companies have a detailed end state with well-defined interim states (**0%** of P&C companies)

Comprehensiveness of modernization roadmap

■ Life ■ P&C

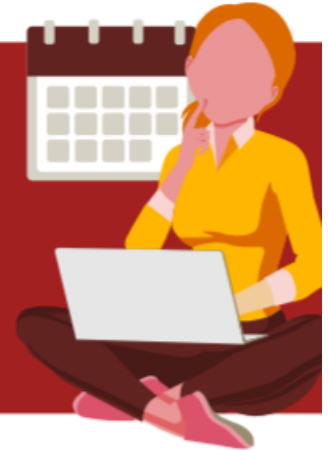




# Actuarial Modernisation Survey

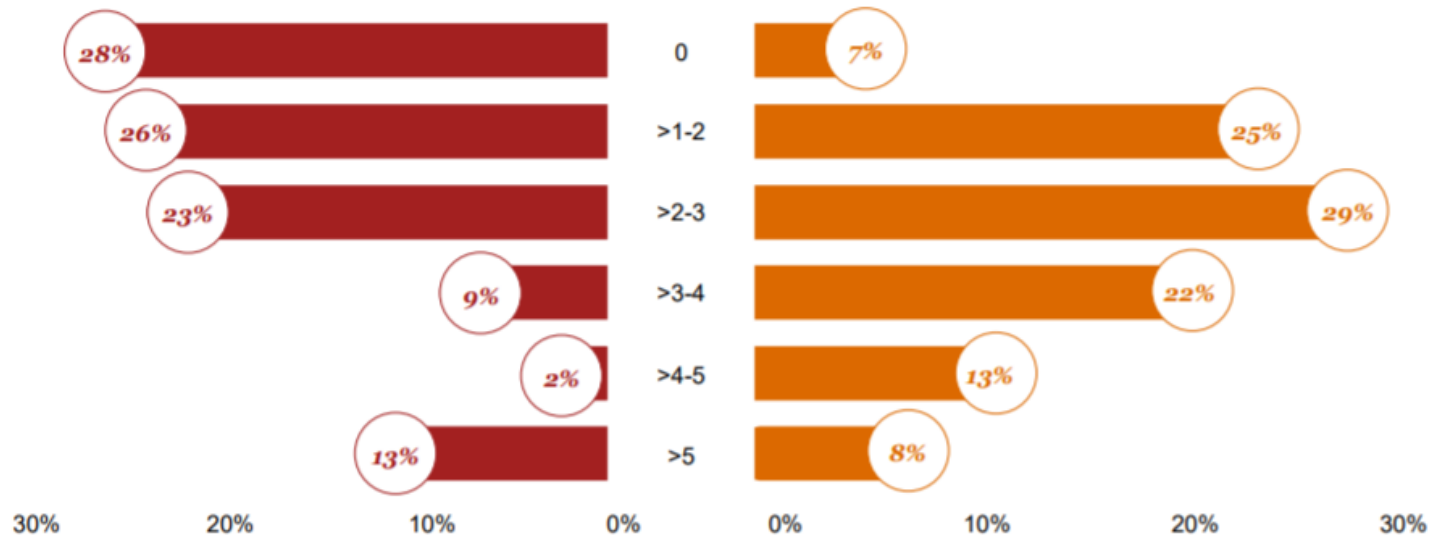
## *Duration of modernization programs*

- The majority of companies expect modernization will take in excess of 3 years
- In general, Life companies reported being somewhat further into their modernization program when compared to P&C companies



Duration of modernization programs

■ Years into program   ■ Years left to go





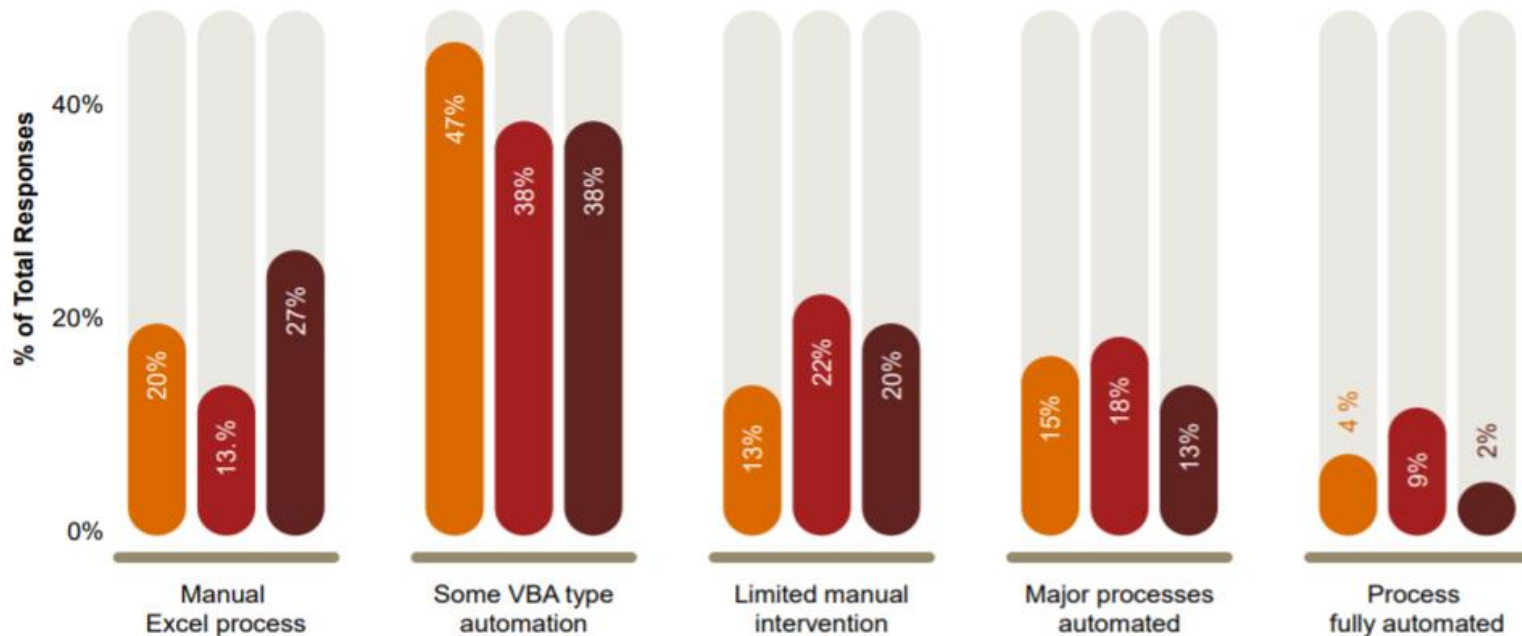
# Actuarial Modernisation Survey

**Complete process automation is very rare**

- Surprisingly, the level of automation does not vary that much by the nature of activity - Data manipulation is slightly more automated
- Not surprisingly actuaries still rely on VBA type automation
- P&C companies in general have a lower degree of automation

Reliance on manual processes

Analysis Data Manipulation Reporting



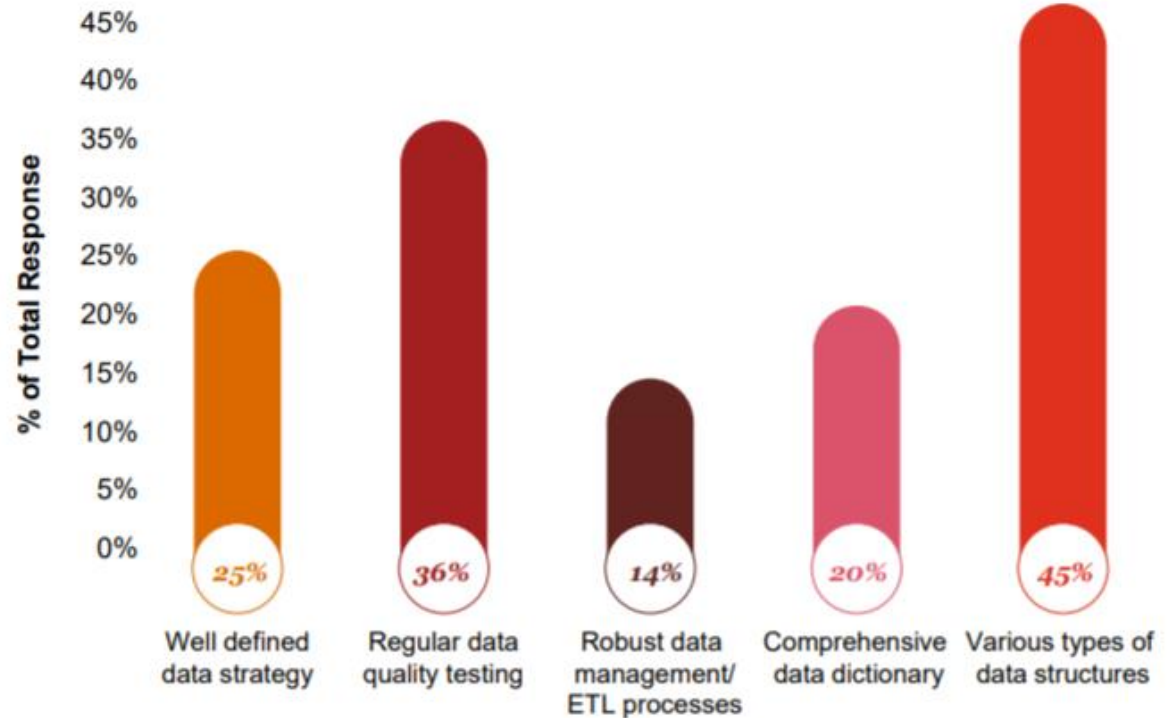




# Actuarial Modernisation Survey

- Less than half of companies have a data strategy, data dictionary or robust data management
- Few insurers can support consistent ETL processes
- Inconsistently stored data causes inefficiencies

## Actuarial data management

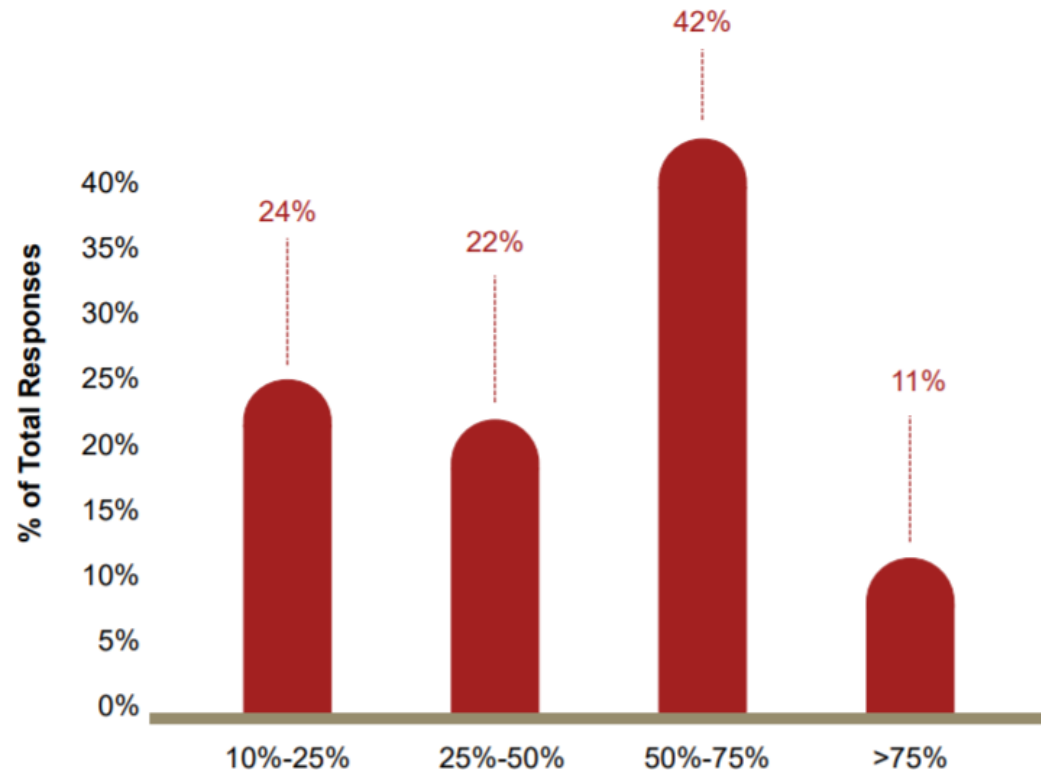




# Actuarial Modernisation Survey

- The median actuary spends more than **50%** of the time on data manipulation rather than analysis or reporting
- Actuaries spend less than **25%** of their time on data in only **25%** of insurers.
- No company polled achieves less than **10%**

Time actuaries spend on data

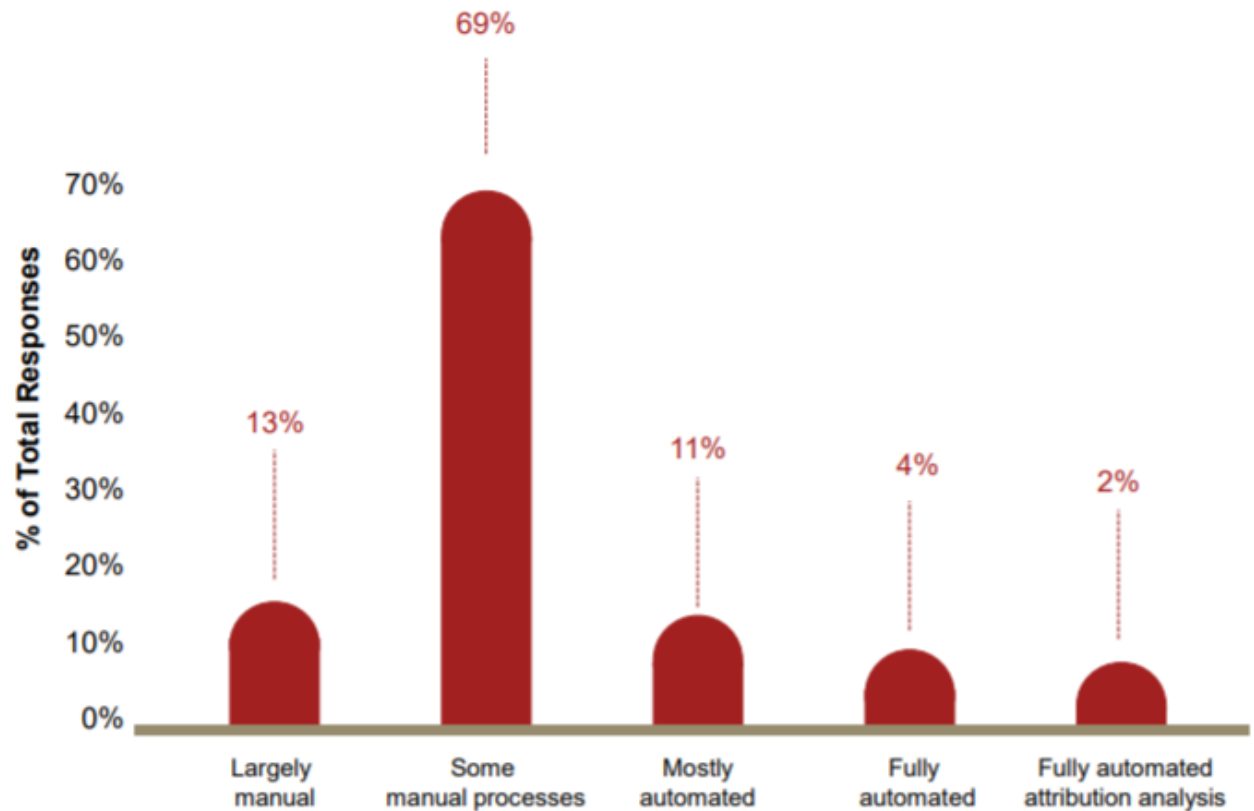




# Actuarial Modernisation Survey

- Over 90% of companies have not fully automated their modeling processes
- To achieve reduction in working day timetables this is an area that should be targeted for further automation

## Model process automation

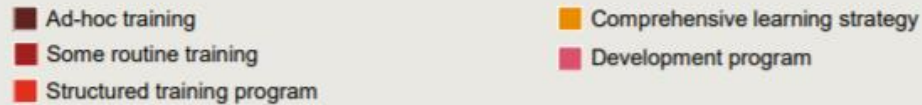




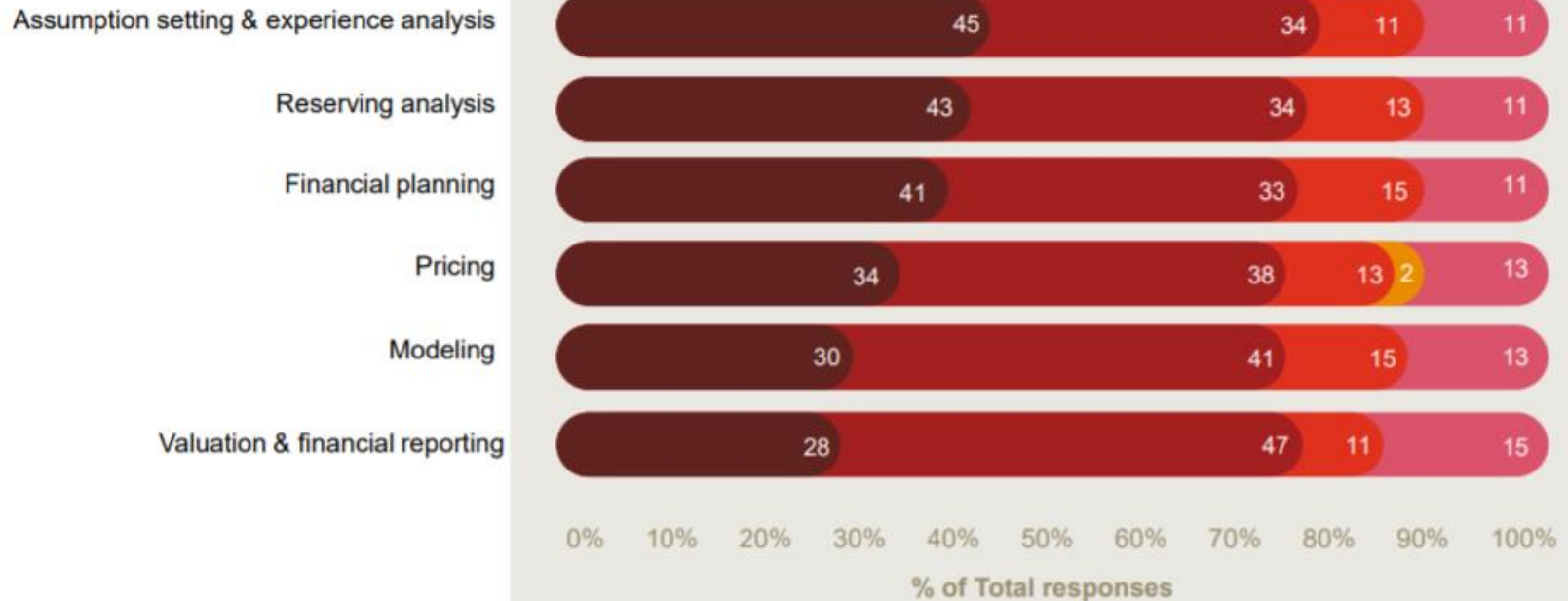
# Actuarial Modernisation Survey

## Training and development

- Only 20% of companies maintain a structured training program
- Further investment is needed to improve actuarial training and formalize current training programs



### Staff training and development

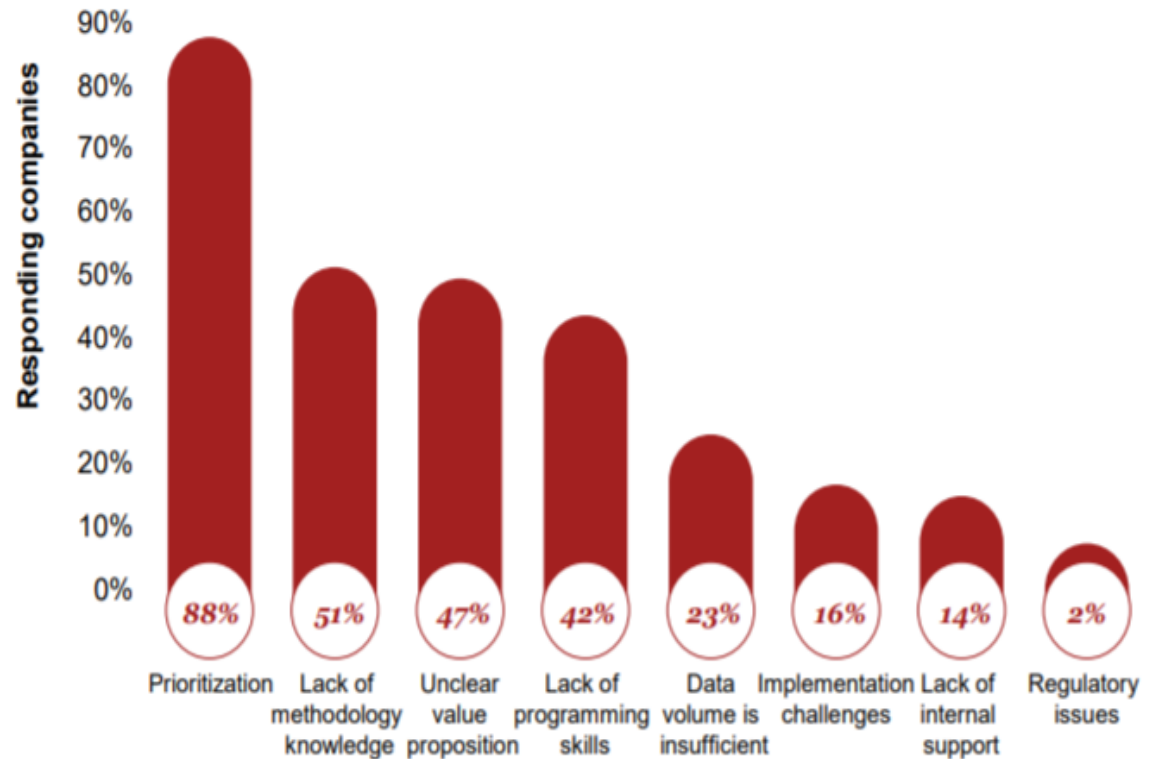




# Actuarial Modernisation Survey

- **Project Prioritization** is the most common impediment in adopting advanced analytics
- Insurers are smart to focus on data cleanup first
- Lack of methodology knowledge and programming skills are other key challenges

## Greatest Impediments to Advanced Analytics Adoption





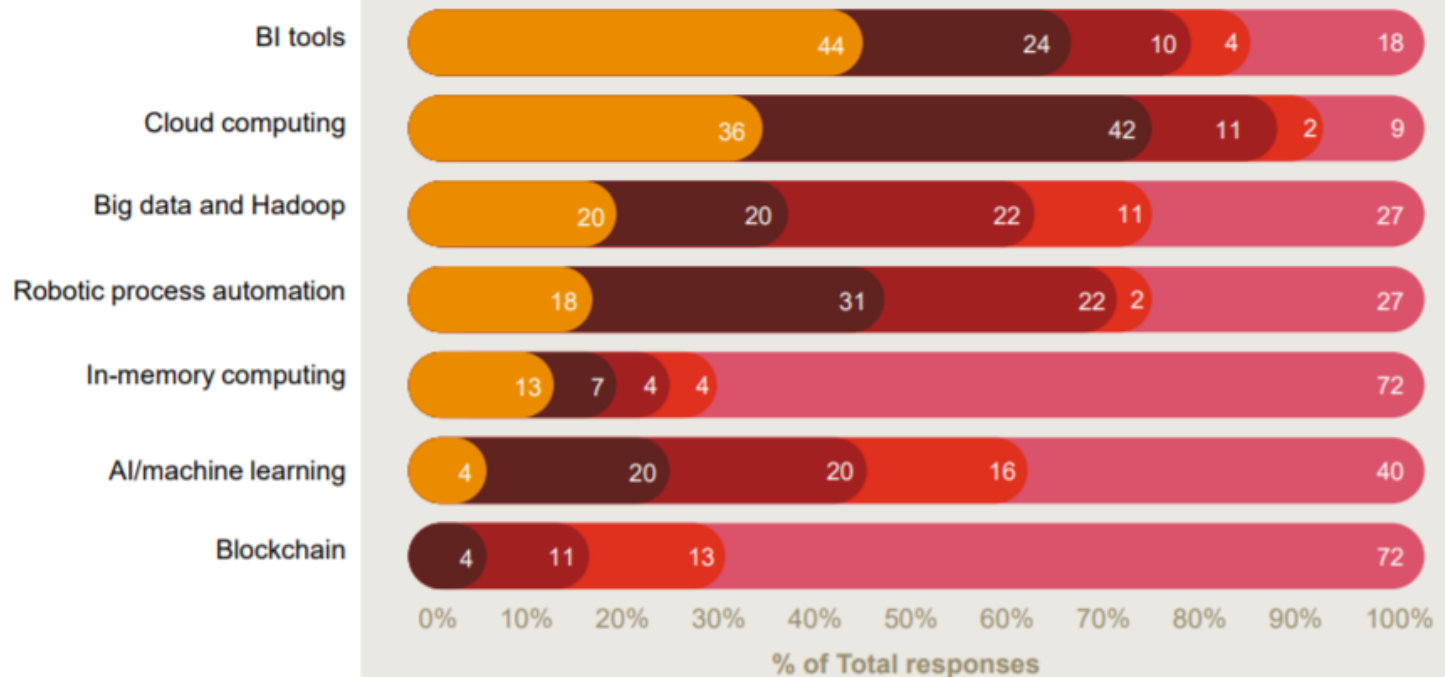
# Actuarial Modernisation Survey

## *Emergent technologies*

### Adoption of emerging technologies

- Current technology investments are focused on speed, power, and insight
- Business Intelligence and cloud computing will be a common part of the actuarial toolkit within 3 years
- Expect advanced analytics & AI adoption within 5 years
- P&C and Reinsurers are eyeing blockchain

■ Current Use      ■ in 1-2 yrs      ■ in 3-5 yrs      ■ in >5yrs      ■ No plans for adoption



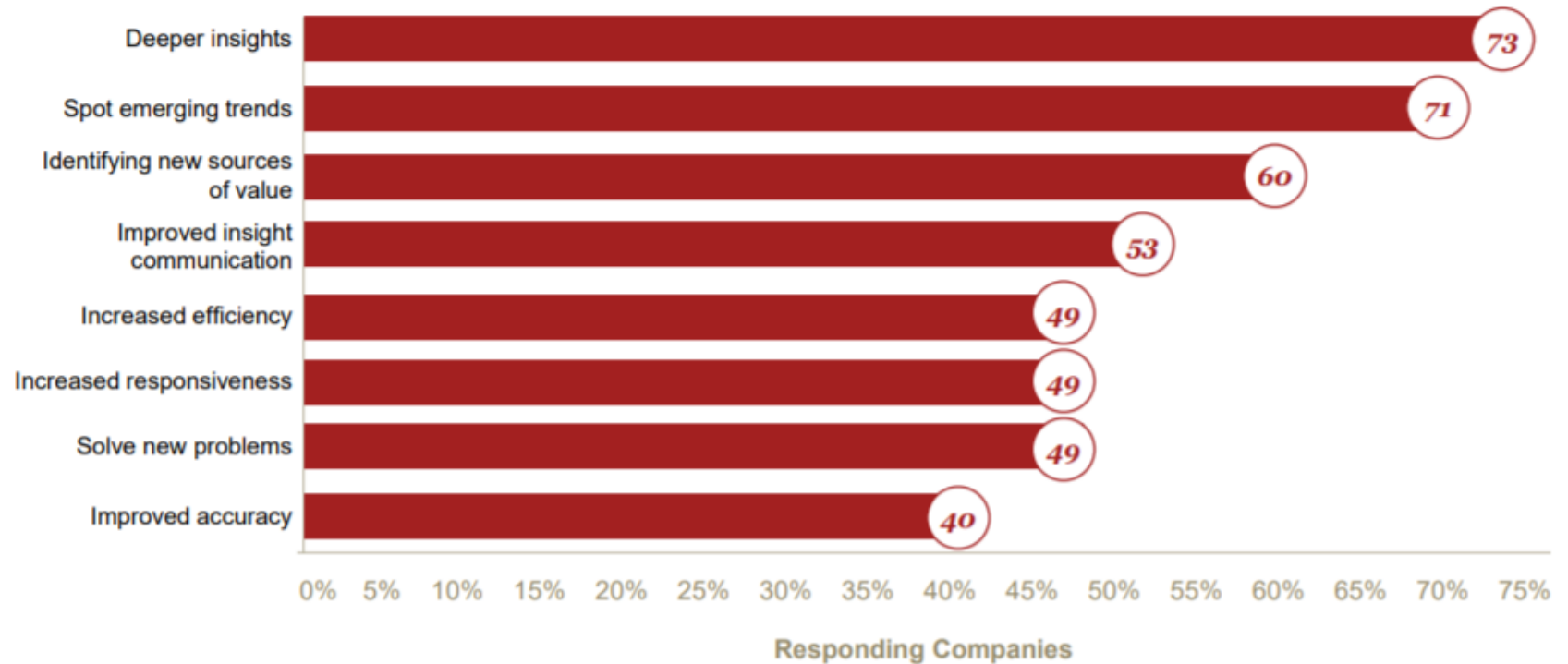


# Actuarial Modernisation Survey

## ***Advanced analytics***

- Deeper insights and emerging trends are the two top drivers of advanced analytics
- P&C insurers cited 'identifying new sources of value' as their top driver
- Coupling advanced analytics with BI results in better clarity, faster results and greater responsiveness to management requests

### Expected Value from Advanced Analytics







# Actuarial Modernisation Survey

## Key Takeaways

01

Multiple catalysts are driving companies to modernize. Successful execution depends on having comprehensive plans.

02

Significant opportunity exists to expand automation, increasing “productive time” and reducing process specialization.

03

Getting timely and accurate data is the top priority, and most companies have that today. The current state is effective, but suboptimal.

04

The changing paradigm will impact people, increasing the need for structured training and development programs, including new tools and techniques.

05

*With necessary investments in data, technology, automation, training and development, and by articulating a comprehensive modernization strategy, actuarial teams can provide greater insights and value to their business partners.*





# Actuarial Modernisation Survey

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- Survey to be re-run in 2019 with a global coverage
- Global trends by region (incl. EMEA) analysed
- Interactive dashboards (Tableau) made available for participants enabling comparison to industry peers
- Public report summarising observations by 30 November
- Deadline for completion: 31 October 2019

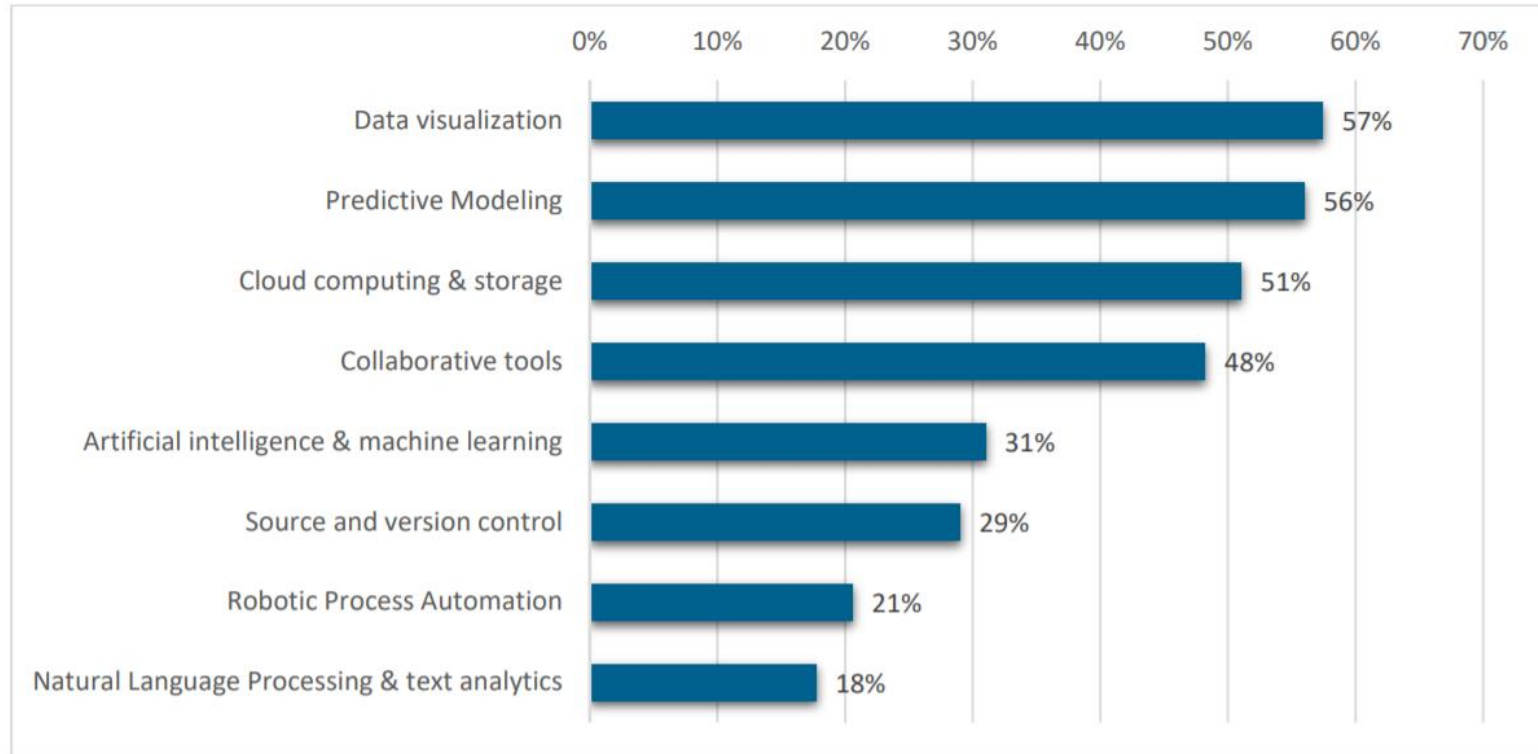
Link:

[https://pwc.qualtrics.com/jfe/form/SV\\_bQx42T4Ehm921o1](https://pwc.qualtrics.com/jfe/form/SV_bQx42T4Ehm921o1)



# Top Actuarial Technologies of 2019\*\* (SOA)

Technology Areas Expected to Grow Fastest in Use in 2019\*



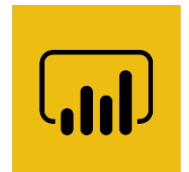
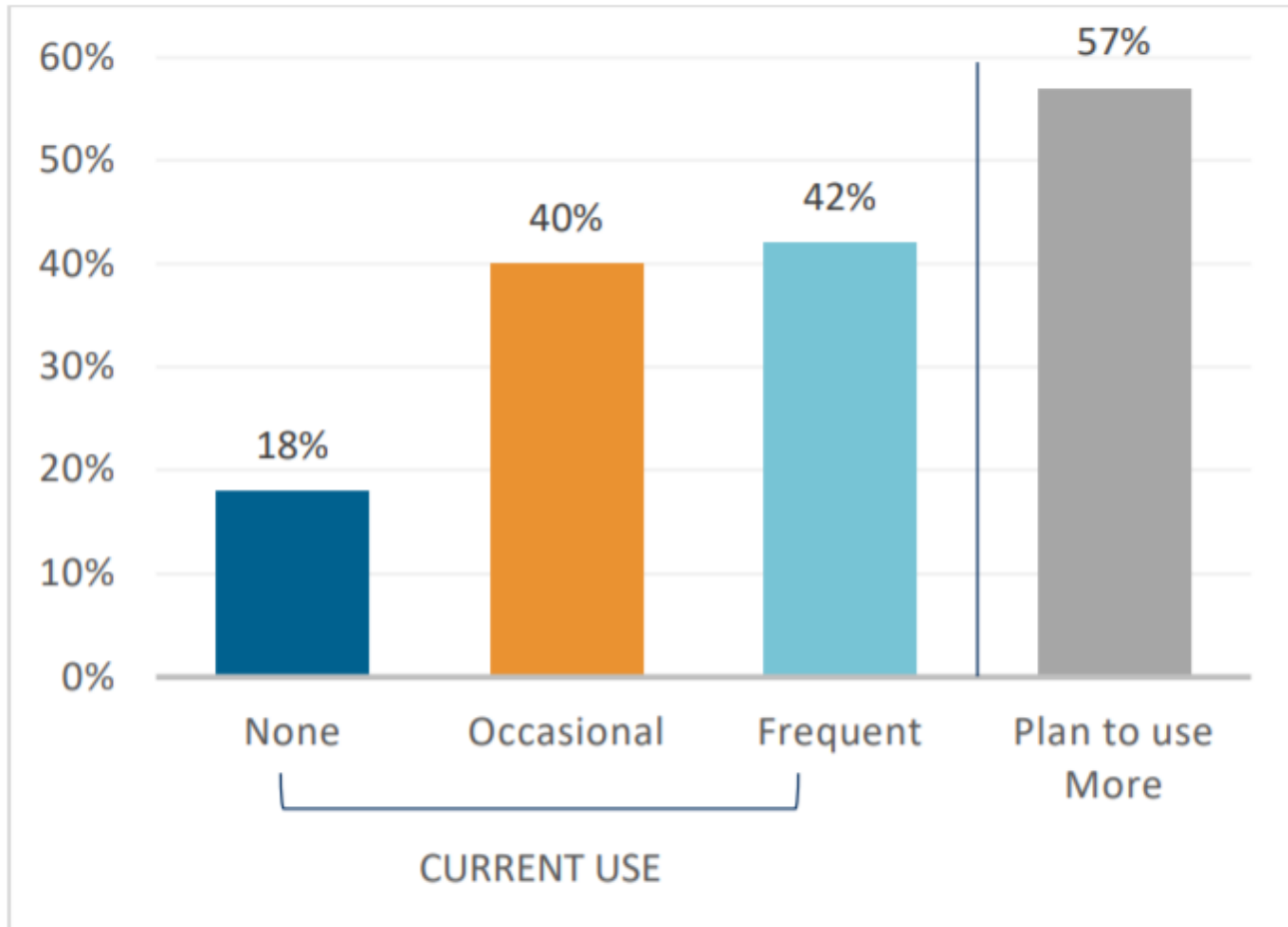
\*Percentages represent the percent of actuaries surveyed who believe their usage will increase between March 2019 and March 2020.

\*\*Source: Society of Actuaries (US), link included in the Appendix



# Top Actuarial Technologies of 2019 (SOA)

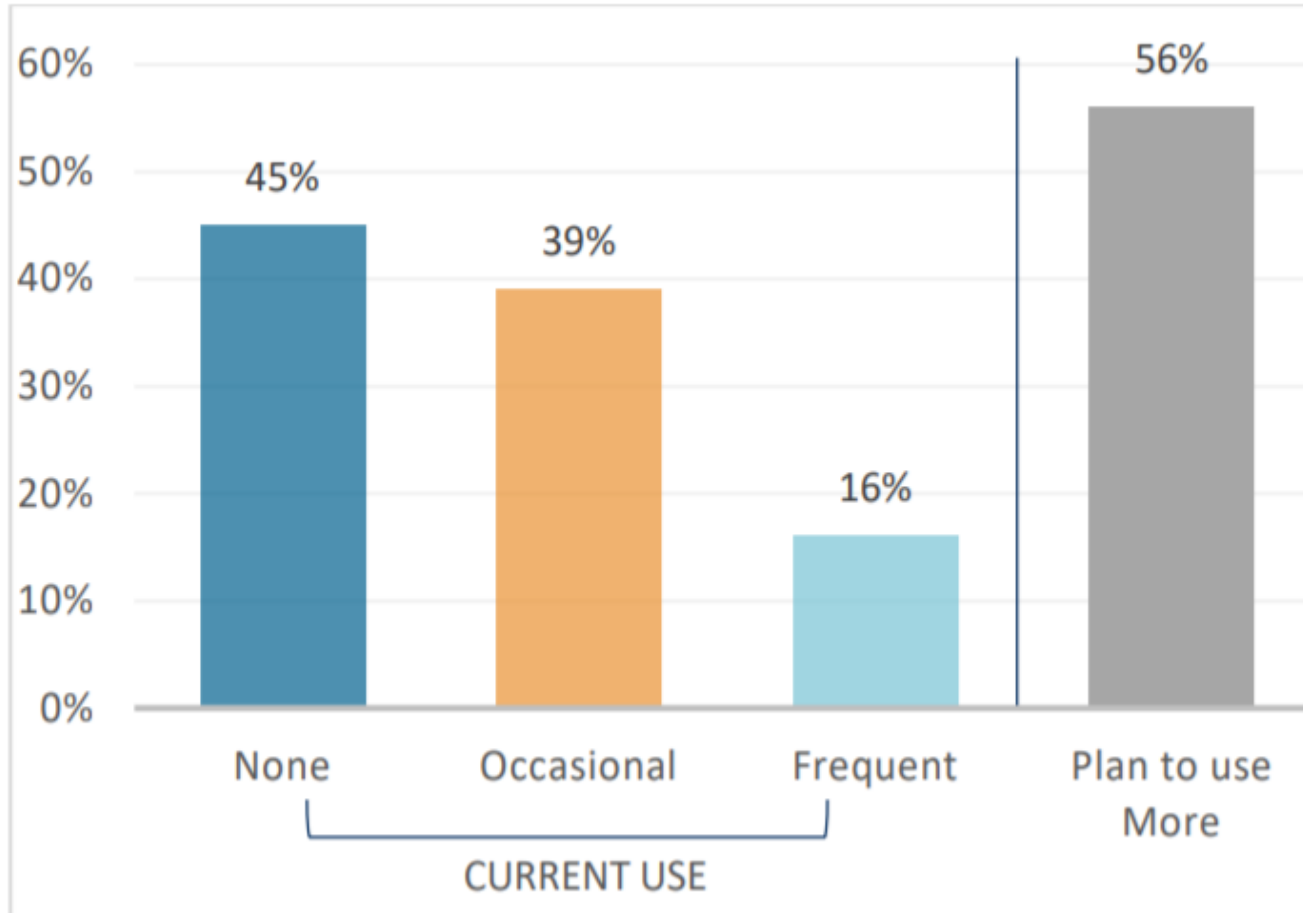
Use of Data Visualization Among Actuaries





# Top Actuarial Technologies of 2019 (SOA)

Use of Predictive Analytics Among Actuaries





# Implications for actuaries in Ireland

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- Focus areas of digital initiatives
  - Short term: process automation and visualisation
  - Long term: predictive analytics and machine learning
- Training and upskilling
  - Actuarial skillset good basis
  - Still significant gap to be filled
  - Need to link training to solve practical problems
- Different mindset required
  - Collaboration
  - Business acumen



# Implications for actuaries in Ireland

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- Regulatory changes
  - IFRS 17 implementation and US GAAP changes (Long Term Contracts) over the next few years
  - Solvency II – Shorter timelines for submissions and regulatory push to run ORSA quicker (e.g. ad-hoc ORSA), plus Boards looking for more insights / scenarios
- Data and modelling platforms
  - Data strategies and revamping of modelling platforms (modernisation plan) driven by regulatory changes and analytics
  - Actuaries should contribute in a proactive way – aiming to maximise benefits for business (vs. minimising data requirements for valuation)

# Examples of what we do – Firm wide

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- Global technology training initiative
- Digital Fitness App, Digital Academies, Digital Labs
- Innovation challenges and Hackathons
- Think beyond campaign – just launched in national press, radio and Dublin airport

Financial Accounting News



PwC Global Chairman Robert Moritz, shown during an economic forum in Russia in June, said the Big Four firm will spend \$3 billion on technology training.  
Photographer: Andrey Rudakov/Bloomberg via Getty Images

## **PwC Pledges \$3 Billion Technology, Training Investment Worldwide**

*\*Source of article:  
Bloomberg, link  
included in the  
Appendix*

# Examples of what we do - Actuarial

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- Online coding programme for all actuaries (team of 25 learning 2+ tools each)
- One week course on data transformation and automation tool (Alteryx) for 2 people solving real life problems (process inefficiencies)
- Working on around non-life audit and SCR process automation, interactive dashboards
- Collaborating with other teams (e.g. data analytics and technology)
- Linked in global insurance data analytics network promoting pricing automation and fraud detection using machine learning





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# Analytics use cases

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# Analytics use cases

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- Behavioural analytics
- Customer segmentation
- Claims analytics – fraud detection
- Other insurance use cases



# Behaviour Analytics

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- Traditional actuarial techniques
  - Experience studies (lapse, option take up rates etc.)
  - Dynamic policyholder behaviour (as a function of economic indicators)
- Behaviour analytics
  - Churn analysis – predictive modelling applied to identify segments of policyholders most likely to churn (=lapse)
  - Connect with policyholder lifetime value (CLV)
  - Retention programmes for high value customers



# Behaviour Analytics – example

## Behavioral intervention model for a Fortune-100 global insurance company

PwC used proprietary market research with agent-based modeling to understand consumer retention behaviors under varying economic and strategic scenarios

Created shortlist of specific retention interventions and developed suggested implementation roadmap

A

Experiments	Description	Retention Driver	Overall Appeal*	Suggested Action
1. Customized Best Offer Communication	Communicate rate change request customer communication for different risk class	Proactive Intervention	High	Do Now
2. Competitive Benefits Comparison	Communicate opportunities to receive packages, "SM" offer/health benefits, while other insurance offers, to our customers	Deflect Competition	High	Do Now
3. Renewal Coverage Review	Agree up to reduce coverage 90 days before renewal coverage renewal	Proactive Intervention	High	Do Now
4. Deductible Incentive	Incentive deductibles credits that go with each renewal, and increase "factoring" cost	Covered Self Service	High	Start Soon (After Development)
5. Partner Service Outreach Offer	Partner with external vendor (e.g., the replacement, to rate reduction) and that enhance other value and offer best of	Covered Self Service	High	Start Soon
6. "SHARE" Offer to High Risk Customers	Target high value or at-risk customers by triggering a call with an offer of converting them to better overall "SHARE"	Proactive Intervention	High	Start Soon (After Marketing)
7. Deductible Claims Pay	Deductible Claims are assigned to customers to help them understand through their claims process	Proactive Intervention	High	Start Soon
8. "SHARE" Offer to Long-Term Renewed Customers	Offer "SHARE" rates to attracting renewed "loyal" customers through our share of an additional line	Temporarily Manage Price	High	Start Soon (High or Moderate Impact, and/or Regulatory Impact)
9. Premium Waiver Offer	1 year premium waiver offer for high renewal customers with experience at renewal cycle	Covered Self Service	High	Start Soon
10. New Insurance Cap Offer	Declare increase of 5% for groups of customers with renewal cycle	Temporarily Manage Price	High	Start Soon

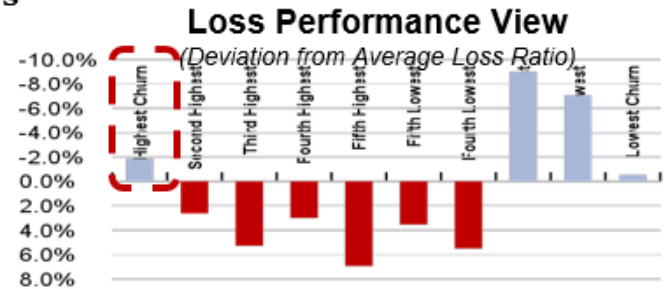
\*Overall Appeal is defined as a probability measure to drive Motivation and thereby reduce underwriting

Legend: ● Very High ● High ● Medium ● Low



... Developed new customer segmentation based on churn indicators

B



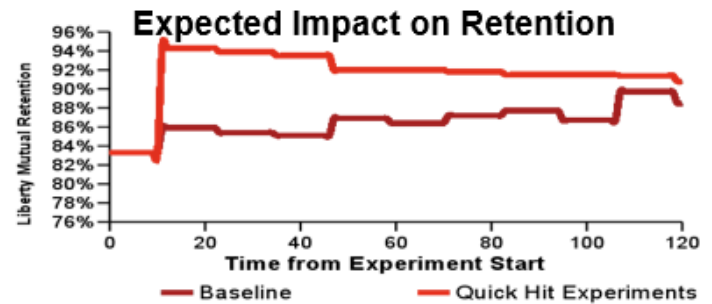
Helped the client stand up a 'Test and Learn' environment to test predictions before roll-out

D



Simulated impact of select retention experiments on both shopping as well as switching behaviors

C

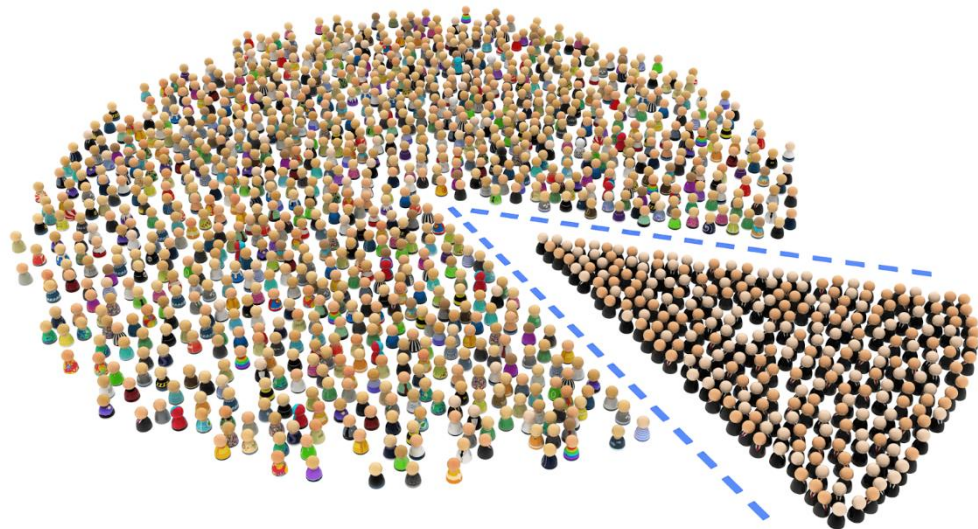




# Customer segmentation

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- Key element of business strategy
  - Which customer segments should the company target?
  - Determine characteristics of most attractive segments
  - Tailor products and distribution strategies to satisfy the needs of these segments
  - Further enhance strategy to create personalised products





# Customer segmentation - example

## Customer Segmentation

*PwC performed quantitative surveys, gathered data, performed key driver analysis and developed customer segments to finally design the various distinct customer personas*

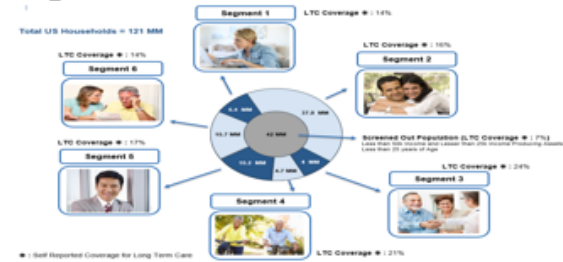
**PwC consumed and validated client survey data for selecting drivers for market segmentation...**

**A**



**...developed market segments and built personas based on constructed segments...**

**B**



**...constructed visuals to prioritize zip codes and areas to target**

**D**



**...developed a predictive model to compute opportunity size across US geographies and identified priority of zips...**

**C**

Zip_Code	MSA	State	Population (P 100)	Current LTC Density (P 100)	Zip Tier	Real Targetable Opportunity (P 100)	Real Targetable Opportunity (P 100)	Real Targetable Opportunity Density (P 100/sq mi)	Proportionality Score (100 Year and % Real Targetable Opportunity)	Priority/Key Priority (Age and % Real Targetable Opportunity)
34421	Orlando, FL	FL	145	17	3rd	13	13	0.24	1	1
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32985	Orlando, FL	FL	134	21	3rd	13	13	0.26	1	1
32987	Orlando, FL	FL	134	21	3rd	13	13	0.26	1	1
32989	Orlando, FL	FL	134	21	3rd	13	13	0.26	1	1
32991	Orlando, FL	FL	134	21	3rd	13	13	0.26	1	1
32993	Orlando, FL	FL	134	21	3rd	13	13	0.26	1	1
32995	Orlando, FL	FL	134	21	3rd	13	13	0.26	1	1
32997	Orlando, FL	FL	134	21	3rd	13	13	0.26	1	1
32999	Orlando, FL	FL	134	21	3rd	13	13	0.26	1	1



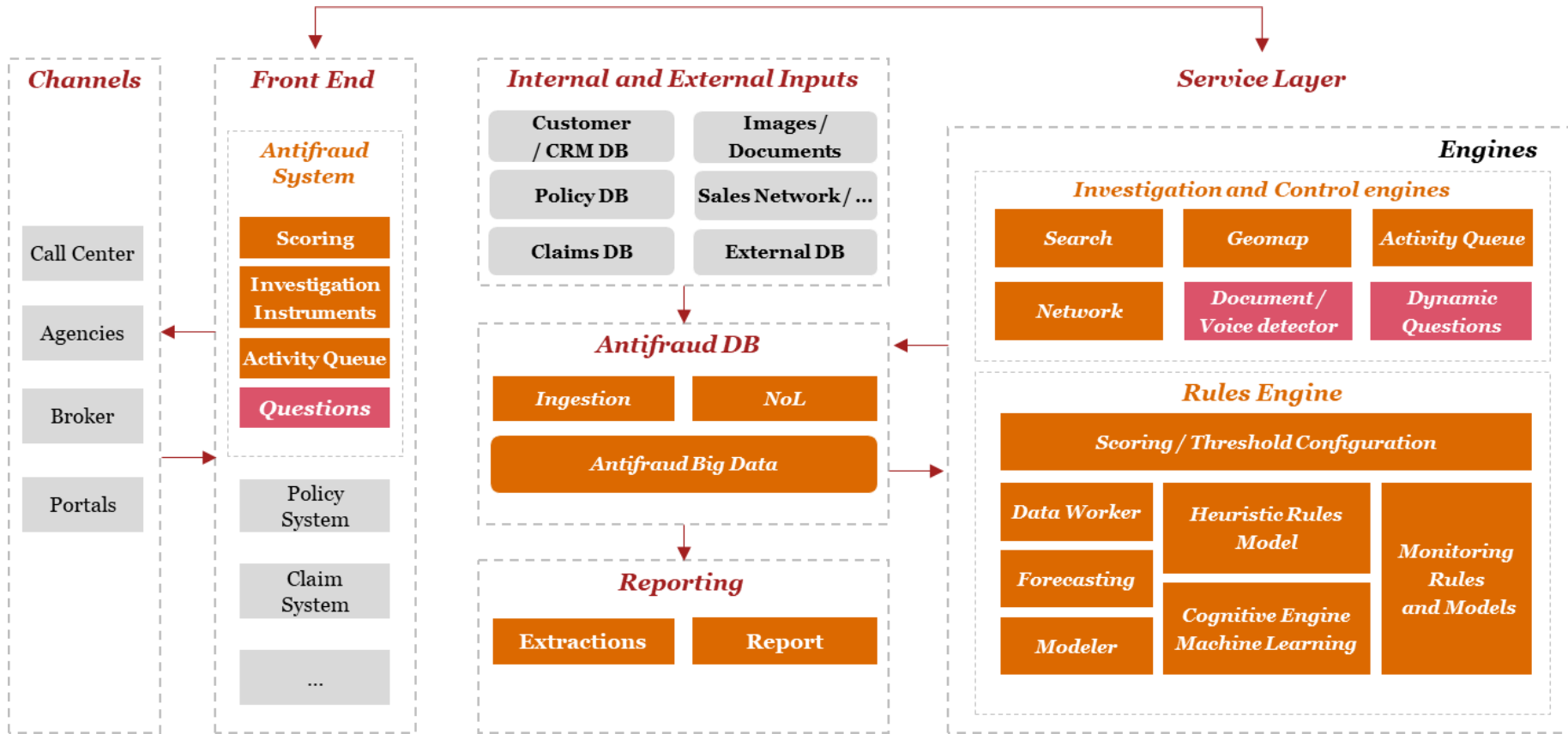
# Fraud detection

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- Fraudulent claims represent upwards of 5-10% of non-life claims in Europe
- Innovative solution supported by approach developed by PwC in cooperation with technology firm GFT
- Focus on prevention, ability to learn, specialisation and transparency
- Aim is to detect all types of fraud real time using an anti-fraud database
- Scores produced by rule engine



# Fraud detection







# Fraud detection – Data collection

- We collect real time claims data from the customer. All these data and documents are analysed real time against all data in the antifraud database.

**INSURED PERSON**

ID: \*

JUFUQ91FSS/276T

Surname: GROCE      Name: GIOVANNI      Address: VIA GARIBALDI, 78, BUSCEMI, Siracusa, 96010

Policy ID: \* 3264340896      Affected Guarantees: Casco      Agency: 1131

Regularity: Administratively Regular

**+ Claim Details**

Date: \* 01/12/2016      Registration Date: \* 15/12/2016

Time: \* 2:57      Address: Via Sammarina, 54 Castel Maggiore BO 24100

Number of Vehicles: no      Damage Type: To persons      Responsibility Percentage: 90%

Is there a CAI form with a joint signatures?      Is there any third party responsibility?

Attached Images

foto1.jpg  
foto10.jpg  
Scegli file foto10.jpg

Calcolate

- Real time check of notified claims data
- Real time check of uploaded documents
- Usually the antifraud tool is integrated in the company's IT landscape (claims systems and underwriting systems) through our service layer



# Fraud detection - Scoring

- We calculate the antifraud score real time and we give the users a first set of information to manage the claims properly: antifraud score, type of fraud, possible amount of fraud, next best action

The screenshot displays a 'SCORING RESULT' window with the following details:

- Location: Via Sarmerino, ...
- Time: 2:57
- Authority presence: No
- Date: 01/12/2016
- Policy ID: 3264340896
- Collision: Yes
- Reporting Date: 15/12/2016
- Counterpart: FORLI PAOLO
- Involved: 2

Key indicators and actions:

- 76 POSSIBLE FRAUD ORGANIZED** (Red circle)
- 360€ POTENTIAL AMOUNT OF FRAUD** (Red circle)
- Assign to SIU** (Red circle)
- REPROCESS** (Button)

**SUGGESTED QUESTIONS!**

- Is it possible to check the damage?
- Why has the report been submitted 2 months after the event?
- Has some repair been done yet? Is it possible to check the documentation?

- Real time antifraud score that sums heuristic rules, predictive models and investigation checks
- Real time alerting whenever the score is updated
- Dynamic questions to discourage potential fraudulent clients and collect more information
- Detailed information for the adjuster to manage the claim properly such as possible amount of fraud and type of fraud and next best action

Heuristic model result <span>🔴</span>	40
There is a connection in the relationship network.	<span>🔴</span>
SITA black box, Authority not present, The vehicle has been radiated	<span>🔴</span>
There is a risk of the accident relating to the province, There is a risk related to the province	<span>🔴</span>
No witness, The vehicle has been radiated	<span>🔴</span>
Predictive model result	36
<b>The claim is classified as fraud from predictive model</b>	<span>🔴</span>
Strength: Low	
Images forgery detection result	—
No images attached to this claim	



# Fraud detection - Investigation

- Set of investigation tools in a unique solution. These are the best of the breed in the market and leverage on a unstructured database that is able to collect and search on structured and unstructured data

The screenshot displays a web application interface for investigation. The browser address bar shows 'localhost:8080/GFT-Demo-Ft/tools.jsp'. The main interface is divided into several sections:

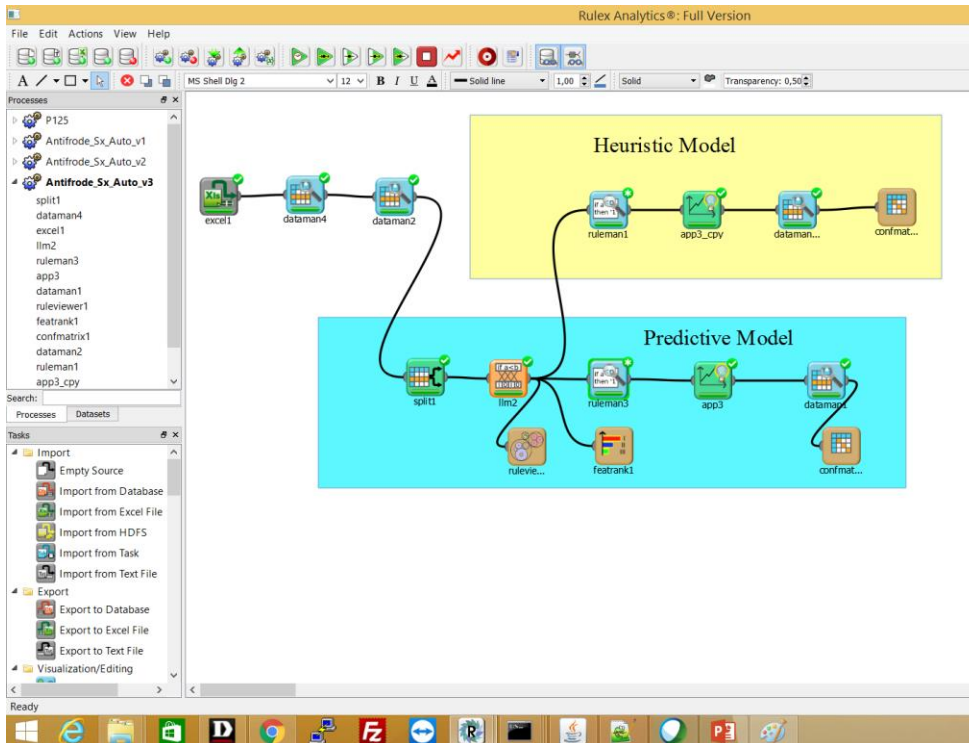
- Search:** A search bar containing 'CLURDEINI FABRIZIO'. Below it are search options including 'Scope', 'Criteria', and 'Fields'.
- Search Results:** A section titled 'Search Results' showing three results for 'CLURDEINI FABRIZIO' with details like 'Scope: Anagrafica' and 'Nome: FABRIZIO'.
- Real analysis Network:** A network graph showing connections between nodes.
- Geolocation:** A map of Europe with a location marker over Italy.
- Information Viewer:** A detailed view for 'CLURDEINI FABRIZIO' with fields: Tax code (P04UC09P44834U), Surname (CLURDEINI), Name (FABRIZIO), Gender (Maschio), Registry type (P), and Public Administration (No).
- Anomalies found:** A section titled 'Anomalies found (0)'.
- Related entities:** A list of related entities including 'SOLARTE MILIC', 'SOLA LA FERRIGIA', 'GEBERTI', 'PIRELLI', 'SODDI LUIGI ADELFO', 'GEBERTI', 'WIPERTINASTAZIO TABELLA SS', and 'REMI ANPERTINASTAZIO SS'.

- Document search engine (Elasticsearch)
- Real time network analysis
- Geo mapping powered by Google
- Out of the box reporting and case manager
- Real time creation of documents with indication of anomalies found, connections and recurrences



# Fraud detection – Machine learning

- Cognitive machine learning technology embedded. This technology enables running parallel heuristic models and different predictive models for each scenario.



- Cognitive machine learning to test heuristic models and to elaborate predictive models
- Different predictive models can be run in parallel
- White box with predictive models that can explain to customers how data are used and by whom
- Predictive models include both rules that explain why it is a potential fraud and why it isn't



# Customer Insight Platform



## DATA PREPARATION

*Clean and import data* from in-house and external sources.



## ADVANCED ANALYTICS

*Use advanced analytics* to discover patterns and make predictions to plan and forecast.



## DATA-DRIVEN BUSINESS

*Adopt artificial intelligence, machine learning* to become a data-driven enterprise.

Data Science Tools - Potentiate your Analytics team with collaborative tools

Modularised Analytics Applications - Ready-made applications

Enriched Datasets - Specific data models for insurance and data to enrich analysis

PwC's Insights Platform - In-house or Cloud hosted



# Other insurance use cases

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## Pricing automation

*Automation of the non-life pricing process using machine learning and challenger models*



## Telematics

*Smart motor insurance products using telematics to achieve competitive pricing and to help people become better drivers*



## Distribution channel management

*Optimise agent and broker performance and incentives*



## Customer lifetime value (CLV)

*Reliable indicator produced for CLV across the business and used in customer loyalty programs*



# Practical hints

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- Encourage and reward innovation
- Help people upskill & link training to solving real life problems
- Start with small projects close to actuarial skillset – sandbox / pilot approach
- Measure success, clear KPIs
- Start with projects that pay off immediately and use them to upskill your team



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# Appendix

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# References

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- AAE press release “Actuary 2020 - A profession on the move” on actuaries of the future (June 2019):  
<https://actuary.eu/wp-content/uploads/2019/06/AAE-PR-ECA2019-FINAL.pdf>
- PwC Actuarial Modernisation Survey report 2018 (US Only):  
<https://www.pwc.com/us/en/industries/insurance/assets/pwc-actuarial-modernization-survey-2018.pdf>
- Actuarial Modernisation Survey 2019 (Global) – deadline for completion 31 October 2019:  
[https://pwc.qualtrics.com/jfe/form/SV\\_bQx42T4Ehm921o1](https://pwc.qualtrics.com/jfe/form/SV_bQx42T4Ehm921o1)
- Top Actuarial Technologies of 2019 (SOA):  
<https://www.soa.org/globalassets/assets/files/resources/research-report/2019/actuarial-innovation-technology.pdf>
- PwC Pledges \$3 Billion Technology, Training Investment Worldwide (Bloomberg Tax, October 2019):  
<https://news.bloombergtax.com/financial-accounting/pwc-pledges-3-billion-technology-training-investment-worldwide>

*Links are clickable in Slide Show mode only, otherwise please right-click and select “Open Hyperlink”.  
You can change mode on the Task Bar in the bottom-right corner of the PowerPoint window.*



# Contact

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One Spencer Dock, North Wall Quay  
Dublin 1, Ireland

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# Upcoming events

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# Upcoming Events

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OCT

Wed  
30  
14:00

## Professionalism Training

Venue: The Davenport Hotel, 8-10 Merrion Street Lower, Dublin  
Speakers: Sally Calder, Education Actuary at the IFoA

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OCT

Wed  
30  
18:00

## M&A from a Practitioners Perspective

Venue: The Richmond Education and Event Centre, 1 Brunswick Street North, Smithfield, Dublin 7  
Speakers: Waheeda Narker, Director at Willis Towers & Fergal O'Shea, Senior Director at Willis Towers

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NOV

Fri  
01  
19:00

## SAI Inaugural Student & Recent Qualifiers' Ball

Venue: Radisson Blu Royal Hotel, 8 Golden Lane, Dublin 8



# Upcoming Events

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- **Students & Recent Qualifiers Ball**
  - Hosted on Friday, 1st November 2019. In the Radisson Blu, Golden Lane.
  - Ticket price of €65 includes:
    - Drinks Reception
    - 3 Course Meal
    - Live Band
  - Limited Tickets still available for sale on SAI website.

