Actuarial Modernization and Business Intelligence:

Driving Transformation

RPM Seminar Dallas
Casualty Actuarial Society
March 2015

pwc

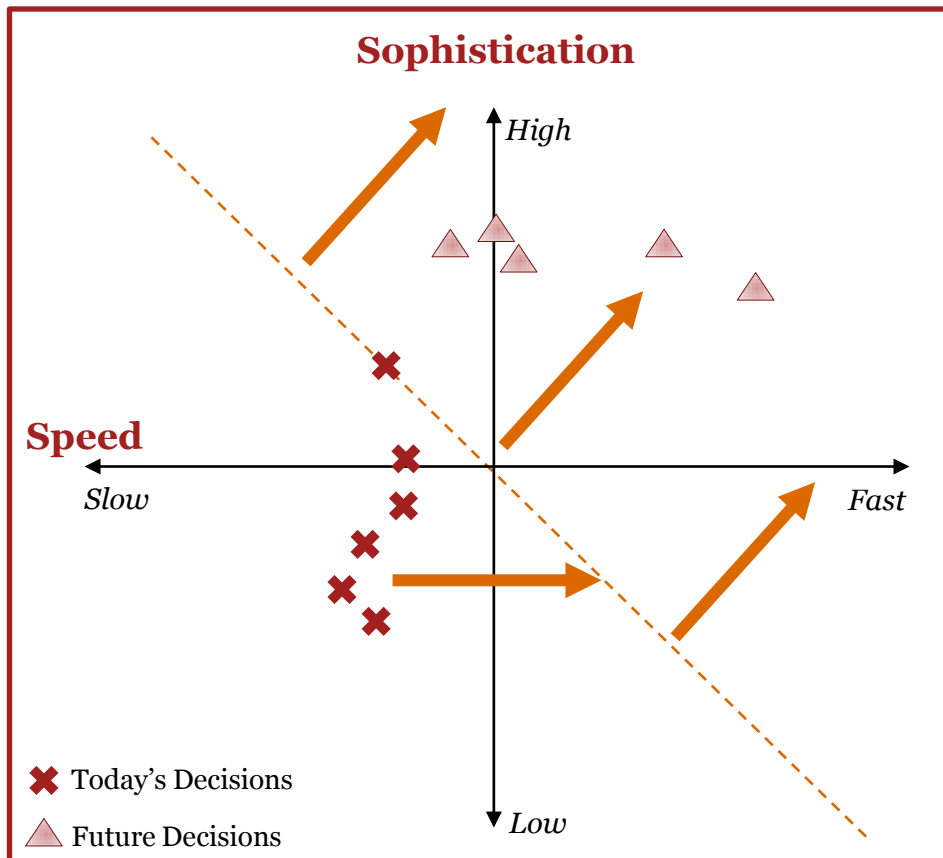# *Agenda – Modernization and Business Intelligence*

1. Introduction and Context

2. Data Structure and Technology

3. Tools and Outputs

4. Goal Alignment

5. User Application

6. In Conclusion

7. Q&A

Introduction and Context

Introduction and Context
Actuarial Modernization & Business Intelligence

Organizations seek to **accelerate decision cycles** and reduce the time to insight generation.

As innovation is enabled, organizations increase their ability to **identify new, sophisticated decisions** which are required to address market demands.

As cultures transform, **front-line managers are empowered** to make faster, consistent decisions.

Only by **embedding data and analytics** can organizations be prepared for the future.

Source: PwC's Global Data & Analytics Survey 2014. Sophistication measures the reliance on data, the inputs used in the decision, management preparedness scale etc. Speed measures how quickly a decision is/can be made and implemented in an organization.
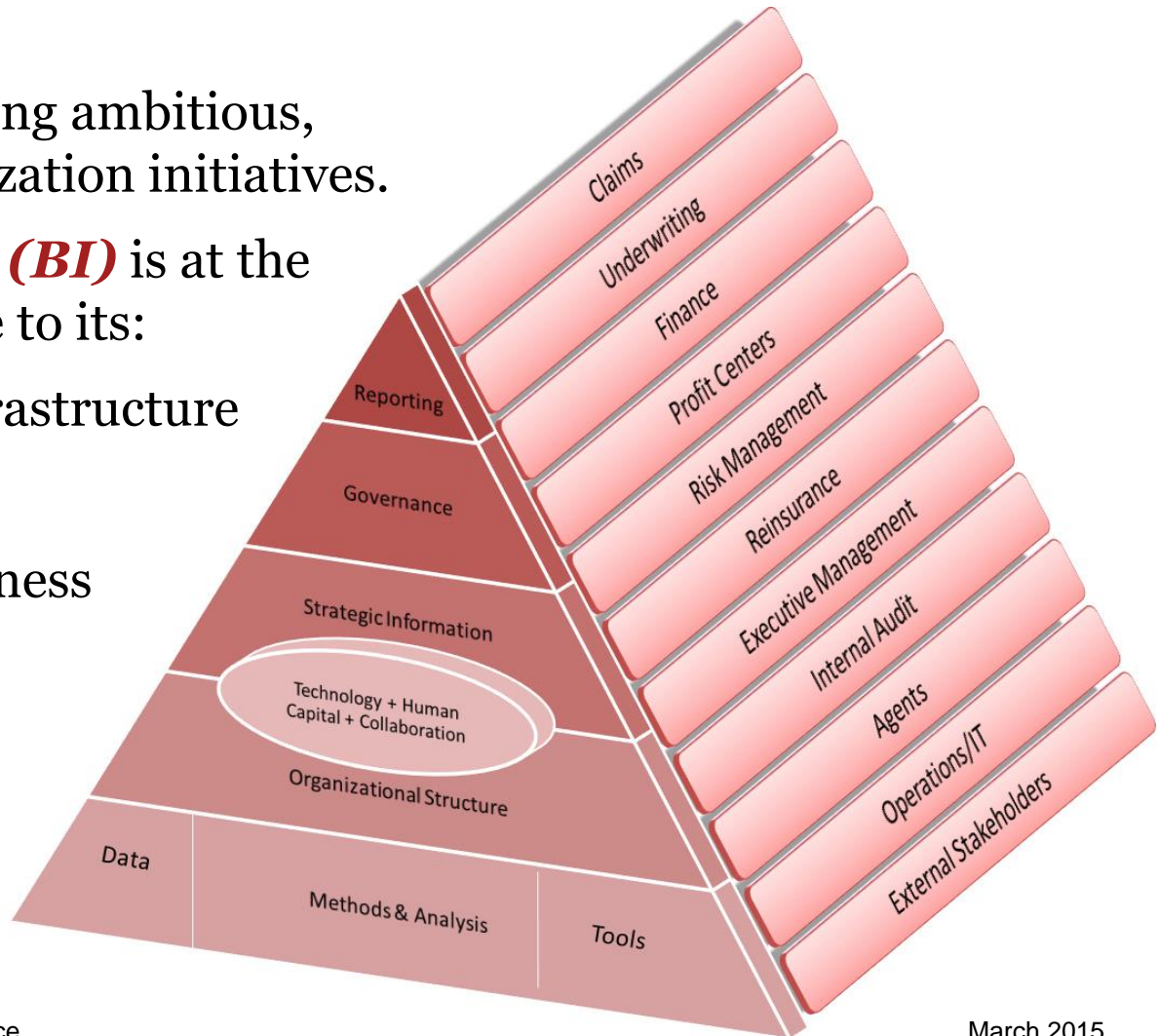
Introduction and Context
Actuarial Modernization & Business Intelligence

Insurers today are pursuing ambitious, cross functional modernization initiatives.

Business Intelligence (BI) is at the nexus of these efforts due to its:

➢ Integration with IT infrastructure

➢ Wide stakeholder base

➢ Ability to improve business decision making

Introduction and Context
Actuarial Modernization & Business Intelligence

> ## *"What gets measured gets managed."*
> ## **-Peter Drucker**

Business intelligence rests on a simple concept:

Timely, accurate, relevant, digestible data leads to better business decision making.
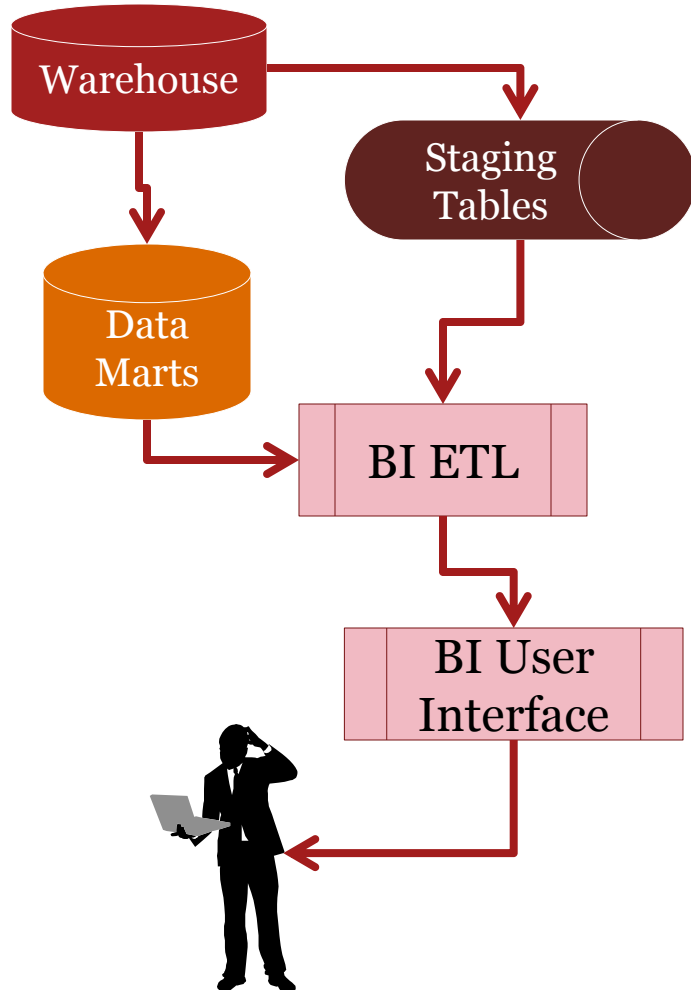
In actuarial and insurance processes, this occurs sub-optimally due to:

➢ ***Technology and data production issues***

➢ ***Opaque data presentation***

➢ ***Cultural resistance to distributing actuarial products***

The time is now to unlock BI benefits by solving these challenges. New data sources and tools address—and complicate—the task.

Introduction and Context
Challenges

BI Technology challenges

➢ Transaction Process System (TPS) datasets

➢ Irreconcilable sources

➢ Access to "unsafe" fields

➢ Extract, Transform & Load (ETL) filters/ cleansing reduce traceability

➢ Unintuitive user interfaces

➢ Lack of prospective information

➢ Limited alignment with plan or business goals

➢ Too much!

➢ Low training and user ability

Actuarial Modernization & Business Intelligence
Overview: Challenges

Despite the myriad symptoms, key challenges fall into four broad categories:

Data Structure
- Non-reconciling parallel sources
- Less is more
- Prioritize and drill down (top view requires choices)

Tools and Outputs
- Tools ≠ Solutions
- Front end enables analysis—not just production

Goal Alignment
- Collaboration across RAFT: Risk, Actuarial, Finance, Technology
- Iterative versus "Big Bang"

User Application
- Trust and training
- Leverage actuarial viewpoint—or users will form their own

Data Structure and Technology

Data Structure and Technology
Context

Time spent by senior reserving actuaries on data processing, manipulation and reconciliation:

Is there a dedicated IT resource supporting data extraction and provision to the Actuarial team?

2%
10%
29%
59%

■ below 10%   ■ 10% to 25%
■ 25% to 50%   ■ >75%
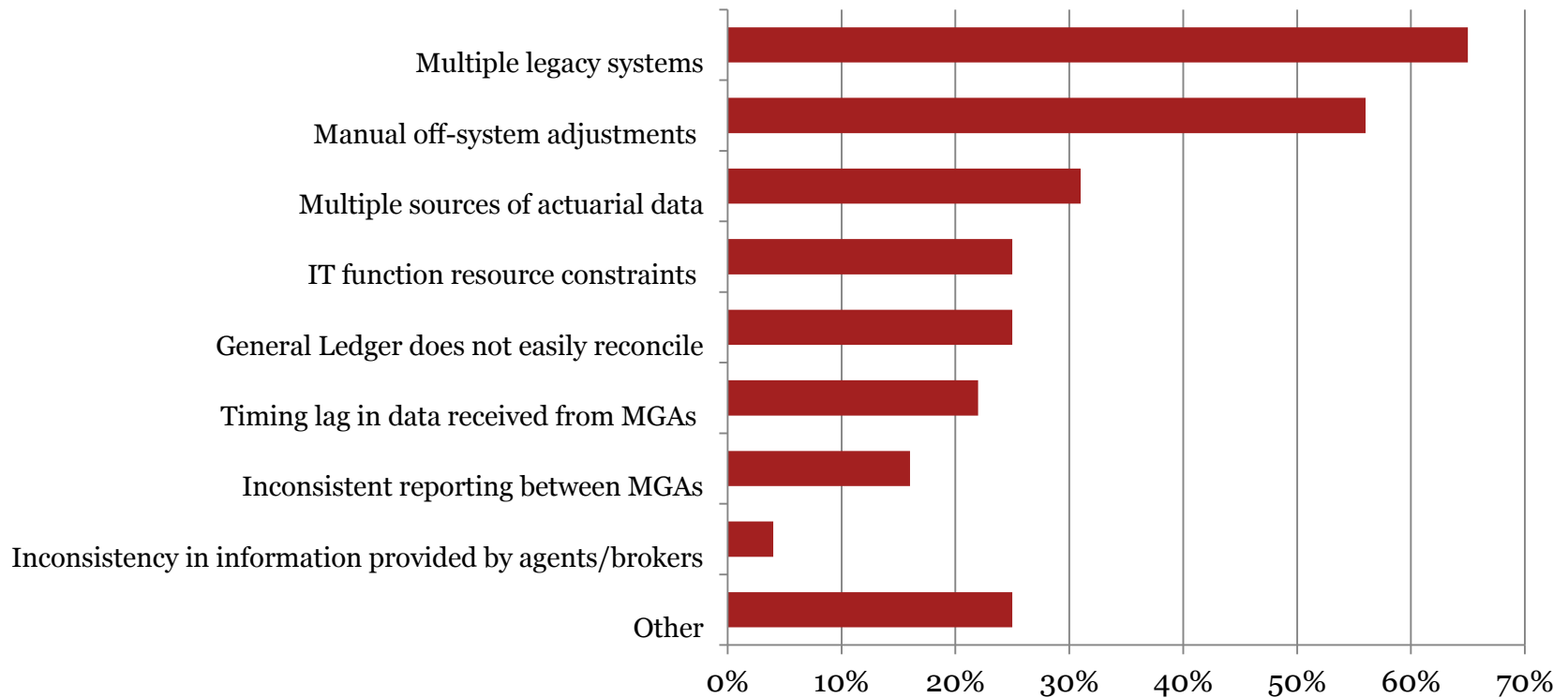
33%
67%

■ Yes   ■ No
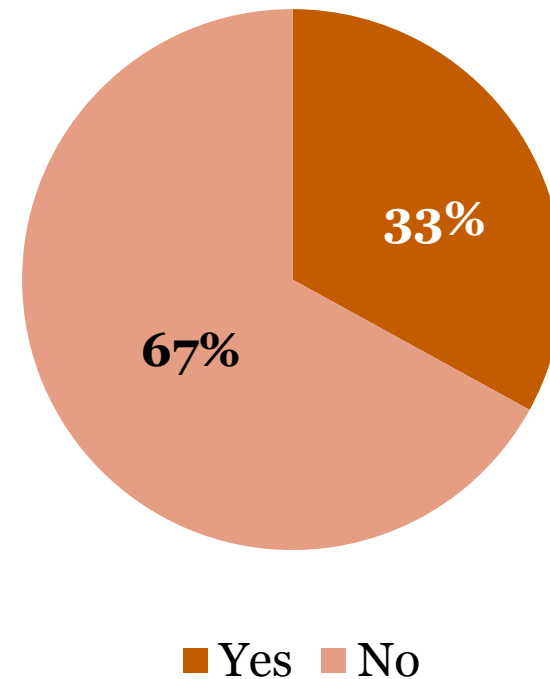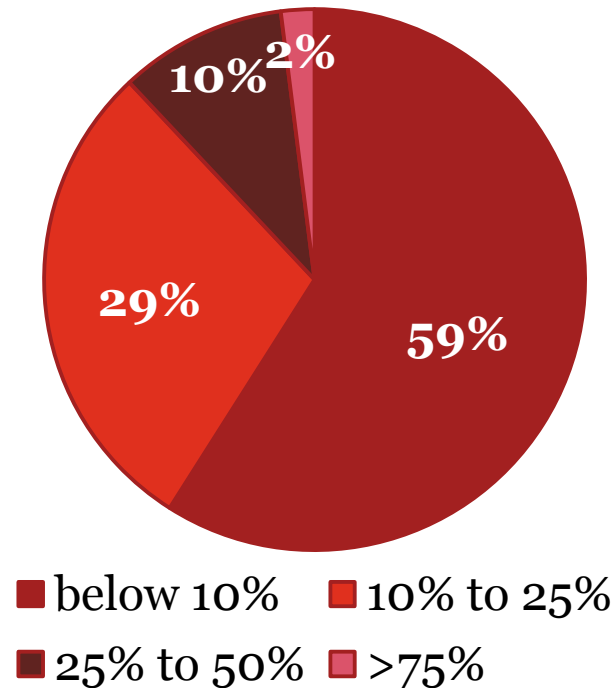
Source: PwC Actuarial Effectiveness Survey, 2013

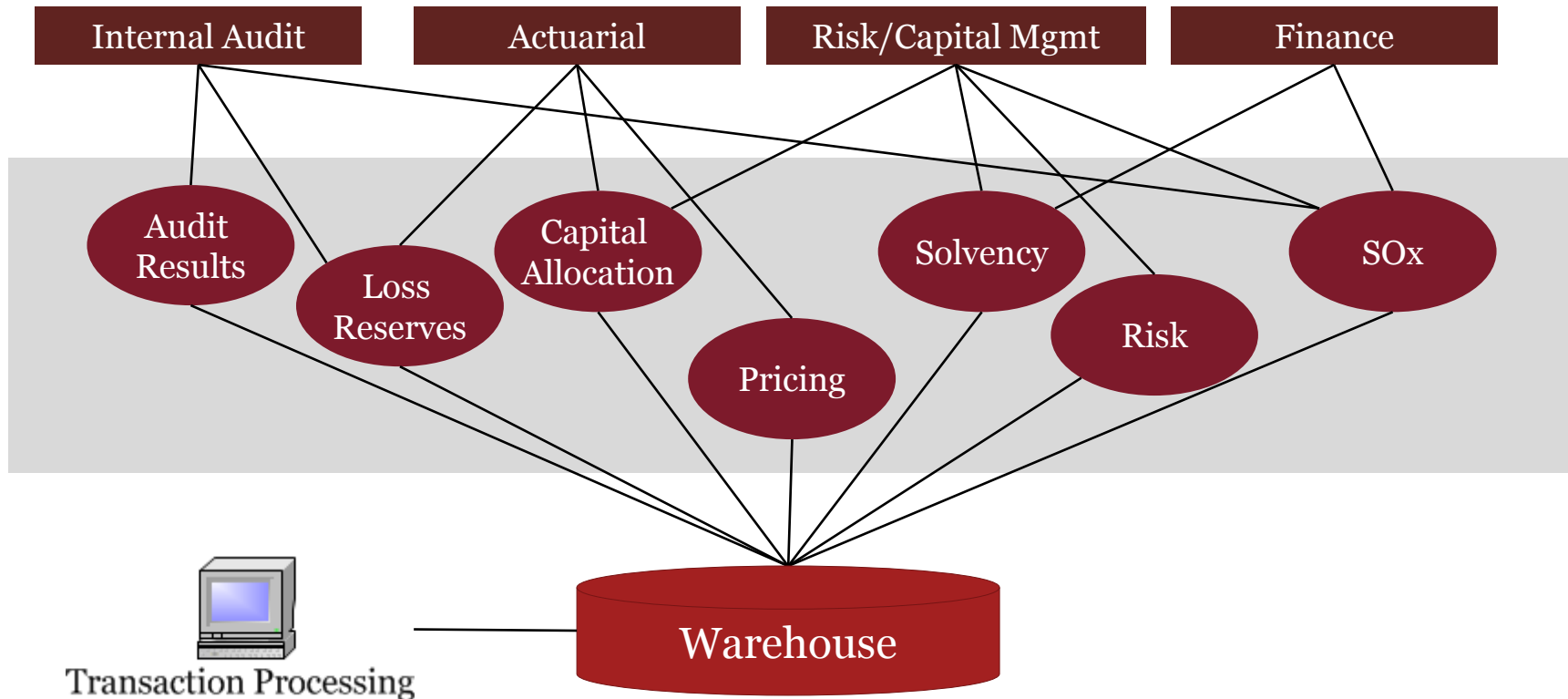# *Data Structure and Technology*
Context

What are common sources of data issues you encounter?

Source: PwC Actuarial Effectiveness Survey, 2013

Data Structure and Technology
Sources through uses

BI systems evolved to serve many disparate users.

Complexity compels architects to make choices—*less can be more.*

Data Structure and Technology
Sources through uses

"We have multiple committees—each with their own metrics. We go round the figures three times."

Multiple versions

"My guys still get pulled into ad hoc data requests twice a day."

Not intuitive

Too detailed

"Sifting through our packs could take 3 weeks—leaving no time to actually do anything."

BI tools often evolve incrementally via "add on" requests.

Excess information is produced as companies "boil the ocean."

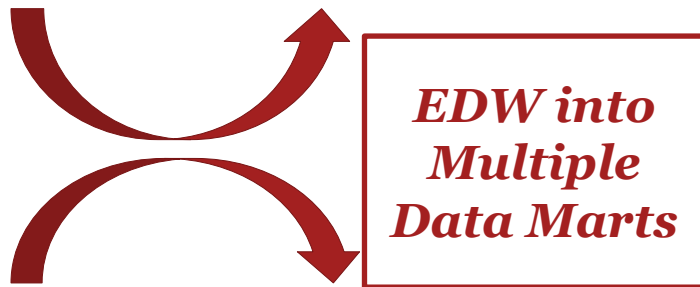More information does not necessarily lead to better decisions.

Programs lacking strategic vision can benefit from narrower scope.

Make decisions—
not reconciliations.

Data Structure and Technology
The information environment journey

Problem Focused

EDW into Multiple Data Marts

Turbulent information flows

- Generalized to problems
- Several routes to information fragments and shallows BI
- Many solutions for many individualized problems
- Reporting layers opaque

Decision Focused

Analytics Mart and Supporting Platform

Decision focused

Smooth delivery momentum

- Focused on decisions
- Single data viewing framework combats fragmented BI
- Single major decision making process platform
- Transparent and credible—ties to reporting framework

Data Structure and Technology
The information environment journey

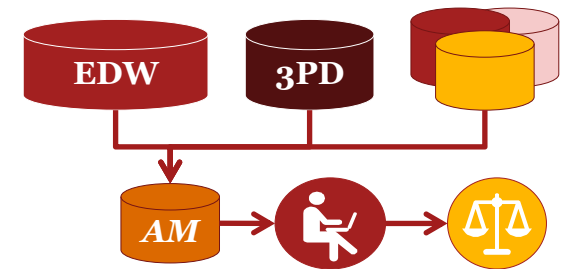| **Enterprise Data Warehouse**	**Multi-Mart Production & Reporting**	**Analytics-Oriented Decision Making**
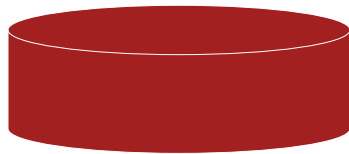
- Enterprise-wide solution with centralized storage and access, but providing a backwards-looking view
- Limited agility for rapidly changing conditions
- Typically requires large-scale IT projects, with long lead times
- ***BI: "Check what's there"***
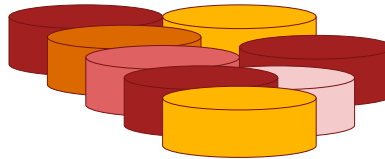
- Purpose built repositories, designed for specific task(s) or business unit(s)
- Enables run-the-business, incremental efficiencies
- Customizable, but data mart proliferation increases technology portfolio complexity
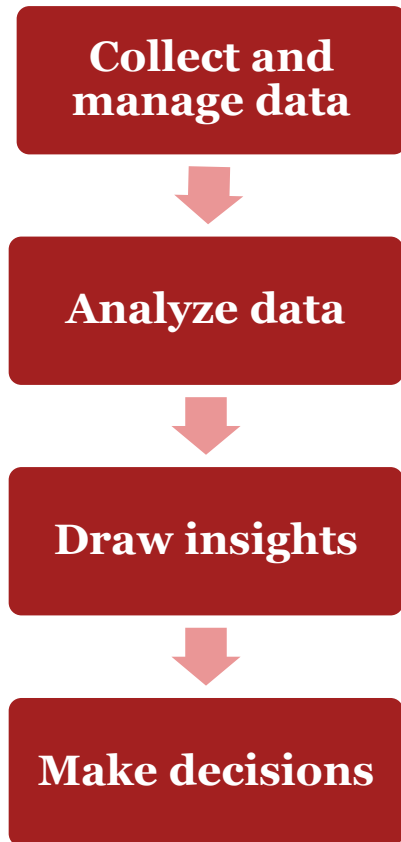- ***BI: "This is what we use"***

- Insight and decision based
- Aligns to business strategy and user adoption
- Enhances information flows and analytics tools
- Tailored to analytics models, uses, and production process
- Speeds organizational agility
- ***BI: "Use our best insights"***

Data Structure and Technology
Development approach

Left to Right

Collect and manage data

⬇

Analyze data

⬇

Draw insights

⬇

Make decisions

Right to Left

What decision is needed?

⬇

What insight will help?

⬇

What data answers this question?

⬇

Manage targeted data

Top-down strategic BI benefits:

➢ 80/20 Rule: Get the most important information right

➢ Align disparate specialists on key objectives

➢ Focus on business impact—not data issues

➢ Free resource time from reconciling differences

Data Structure and Technology
Development approach

BI users must help development teams avoid the roadblocks which typically bog down IT projects.

Less is more. Restricting BI data can improve alignment and efficiency—of both development teams and users.

Left to Right	Right to Left
• Traditional "heavy" design provides all that is possible	• "Light" development provides users only what is needed
• Includes unneeded functionality	• Needs specified by analytics
• Extra overhead increases development complexity	• Sandbox to experiment with new data or processes
• Complexity slows execution	• Lower project complexity
• Permanent solution	• Incremental solution

Data Structure and Technology
Tailor information to the audience

Level 1
Board Committees

Level 2
Committees,
Entities

Level 3
Functional
Review

Board Pack

Business Unit Metrics

Claims & Ceded Reinsurance | IT & Operations | Human Resources | Risk Management | Internal Audit & Compliance | Marketing | Underwriting & Distribution | Finance | Actuarial

Functional Area Metrics

Macro Metrics

Individual BU Metrics
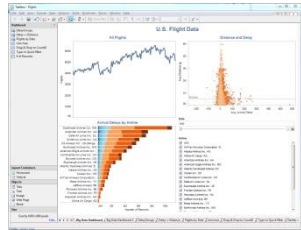
Individual Functional Area Metrics

Data Structure and Technology
Fast, Widespread Information

Better data structures benefit power users and the wider organization.
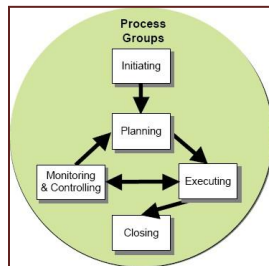
Business Intelligence

Source: Tableau

➤ Fast, reliable information source

➤ Scrubbed data aligns with operations

➤ Reduces reliance on Power Users

➤ Promotes data based decision making

Data Governance

➤ Data issues fixed at the source, rather than continually adjusted for by users

➤ Better IT understanding of business uses

➤ Tighter feedback loops when issues arise

Tools and Outputs

Tools and Outputs
Wouldn't it be great if...

Director of Investor Relations

"... I could get the information and insights I need to be able to explain our results to the market."

CEO

"...I had a clear profitability view across:
- Markets
- Channels
- Products

and could relate that back to capital."

Claims Director

"...I could understand why the claims ratio is tracking upwards faster than the market trend.

What are the drivers?"

Distribution Director

"...it was clear why I sell a significant amount of product and then get castigated for utilising capital and delivering low margins."

CRO

"...we had a measure of risk adjusted return on capital.

We don't allocate capital effectively, and we don't have clearly articulated risk appetite metrics."

Chief Operating Officer

"...I could advise management on the cost of a new product, a claim or a customer phone call."

Tools and Outputs
State-of-the art platforms – Focus on three areas

Data	Analytics	Visualization

• **Regular and direct access to data marts:**
  • Policy and Submissions data for UW, leakage and prioritization models
  • Claims and case reserves for IELR and case management changes
• **External data:** Exploratory Sandbox versus Production Ready
	• **Enabling actionable analytics:** For decision makers to make better decisions on better data
	• **Model Validation:** Audit trail easily accessible to explore decisions
	• **Results:** Implemented after validation through MI dashboards or embedded into data marts
		• **Visualizing Analytic results:** Tuned to solving a business problem for a decision maker - not just *visuals of data*
		• **Clarity:** What the data are saying versus what it is not

Proactively:
Work with Procurement teams. Support Enterprise Data Teams to add to Production; data and model from Sandbox.

Proactively:
Power to connect analytics across enterprise and influence management and broader portfolio strategy.
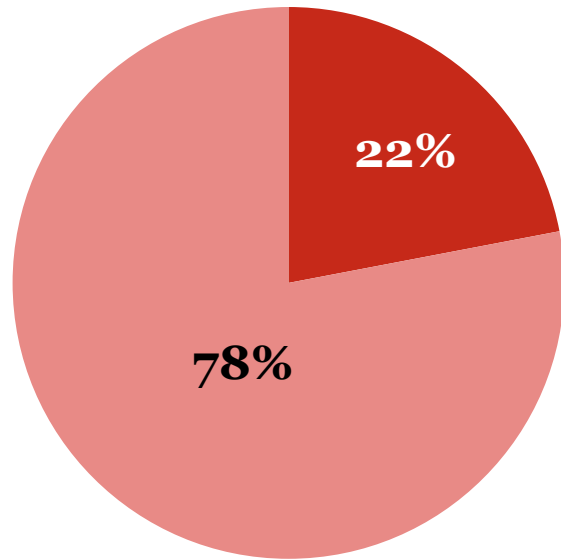
Proactively:
Visualize portfolio and change to enable key executives to make better decisions using better data.

Tools and Outputs - Reserving Survey
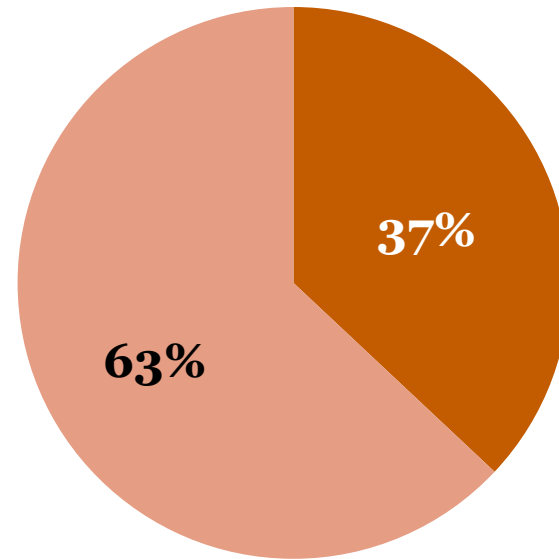## *Context*

Is an interactive dashboard currently used to present actuarial findings?

If not, their desire to build such a dashboard?

22%

78%

■ Yes ■ No

37%

63%

■ Yes ■ No

Source: PwC Actuarial Effectiveness Survey, 2013

Tools and Outputs
Emerging Data Visualization Tools

- 5 years ago, Data Visualization (DV) tools were relatively scarce

- Now, anyone with access to data can quickly produce powerful tools and exhibits in hours or days

- Open Source tends to have a longer learning curve, though exceptions exist

- ✓ The right tool for your organization for implementation speed, cost and visuals is likely available – Not necessarily a large investment

"Open source – Flexible, Free"

"Easy Build – Easy Use"

**"Full-Service – Technical"**

PwC does not express any official views on the products/tools listed

Open Source R – Chain Ladder + Lattice Plots example

R Actuarial packages include "actuar", "chainladder" and statistical "lme4" (for GLMM option).

- Example of results using Mack Method for Chain ladder estimates

- Open source options usually require more prep and knowledge, do not guarantee package accuracy but may be cutting edge

- Paid options can serve a wider, less technical group and more likely guarantee their product

➢ Fits your organization

Chain ladder developments by origin period

Mack Chain Ladder Results
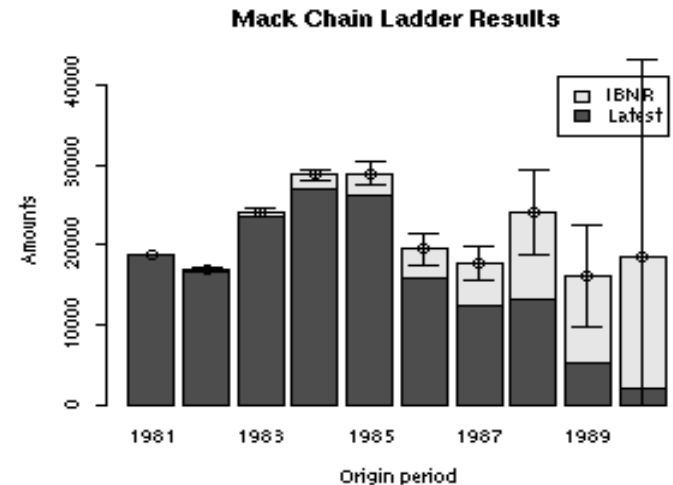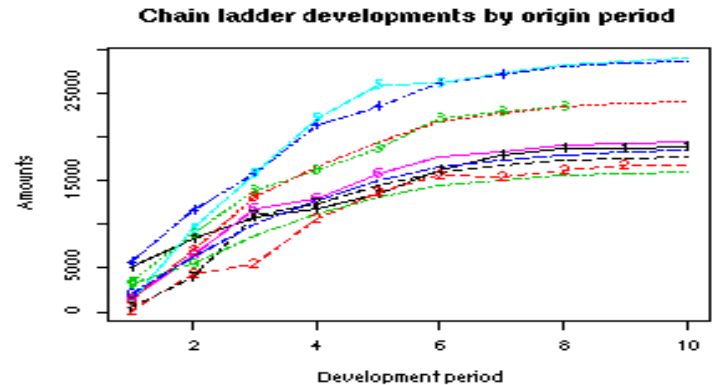
"Measuring the Variability of Chain Ladder Reserve Estimates "

Thomas Mack,1993
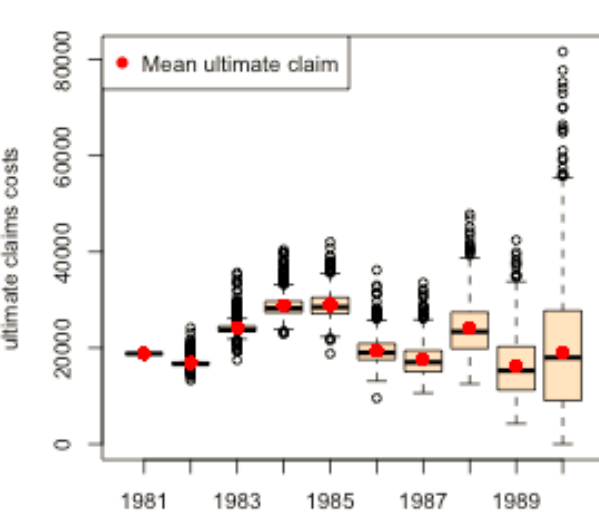
Tools and Outputs - Reserving
Example: Reserve Variation by Line of Business

| Individual Bootstrapped Estimates | Portfolio | Visualize |

Simulated ultimate claims cost

England, PD and Verrall, RJ, Stochastic Claims Reserving in General Insurance (with discussion), British Actuarial Journal 8, III. 2002
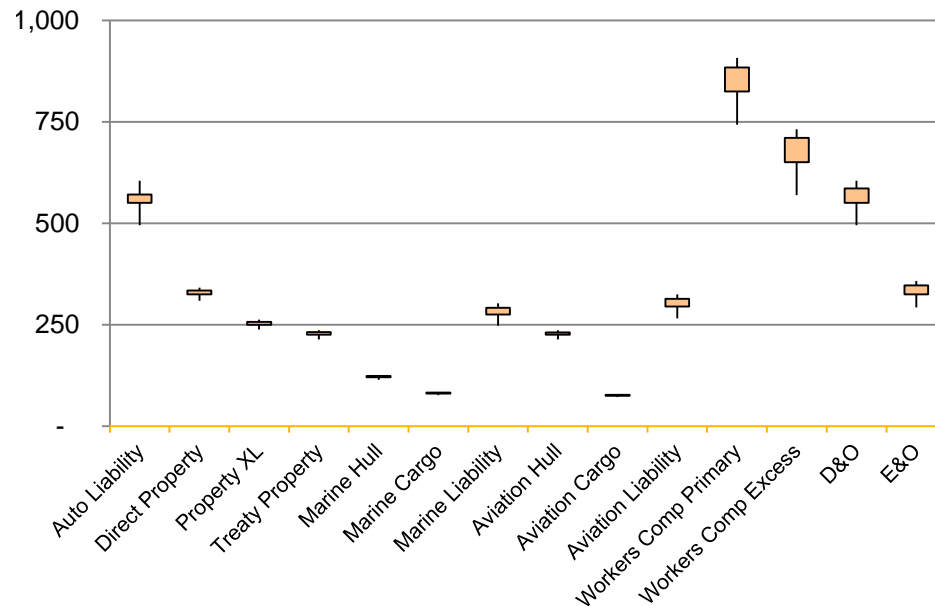
Visualize Data

Validate and incorporate to systems

Example finding: "Reserve variability is most volatile in workers' compensation primary, workers' compensation excess, D&O and E&O. Eventual outcomes are sensitive to inflationary trends, litigation outcome, economic/stock market conditions etc."

Interactive Output – Visualizing & Collaborating
Reserve Development, Duration, Run-Off

| BE Reserves | Uncertainty | Significant Run-Off |

"Transparent Reporting"

Google API:
Creates annotated charts using source data + comments

Duration and Average Variation
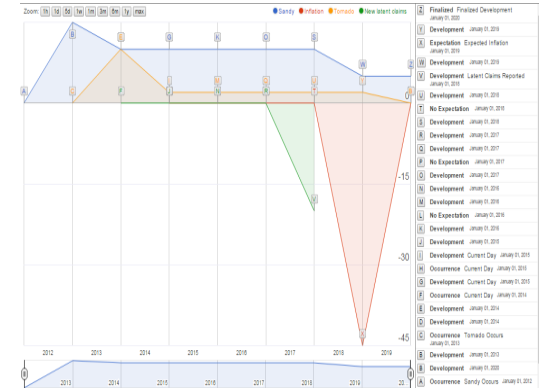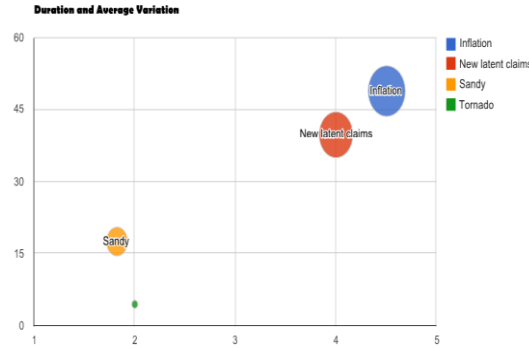
"Collaborative Reporting"

Plotly API:
*A*llows collaboration, editing and sharing through tech capability spectrum

Significant Reserves + Expectations

Average Duration and Reserve Variation

Run-Off Expectations
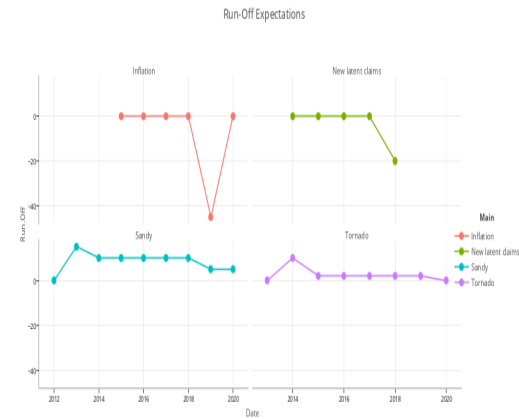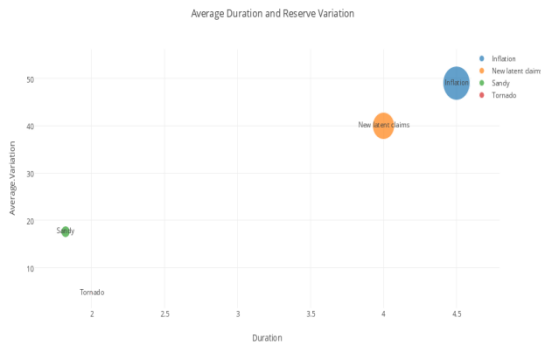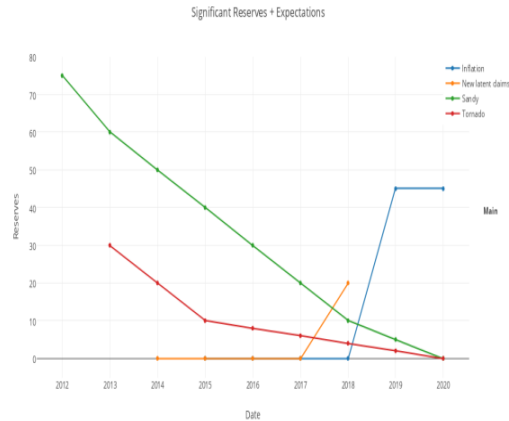
Tools and Outputs – Results and Scenario
Risk Indicators – Enterprise level

<u>Q32012 Review Dashboard</u>

2012 GAAP result distribution

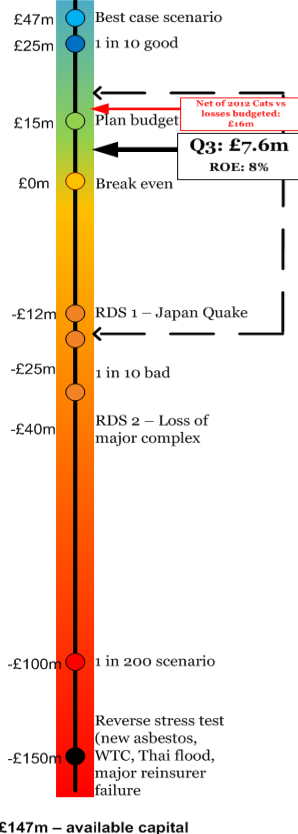|	
£47m	Best case scenario
£25m	1 in 10 good
£15m	Plan budget
£0m	Break even
-£12m	RDS 1 – Japan Quake
-£25m	1 in 10 bad
-£40m	RDS 2 – Loss of major complex
-£100m	1 in 200 scenario
-£150m	Reverse stress test (new asbestos, WTC, Thai flood, major reinsurer failure)

Net of 2012 Cats vs losses budgeted: £16m

Q3: £7.6m
ROE: 8%

£147m – available capital

Performance Commentary

Expected 2012 profit is £7.6m (below budget of £15m). Driven by catastrophe result being £8.4m below expectations and the underwriting result (excluding cats) being £4.4m below expectations. This was partially offset by a favourable movement of £6.2m in reserves.
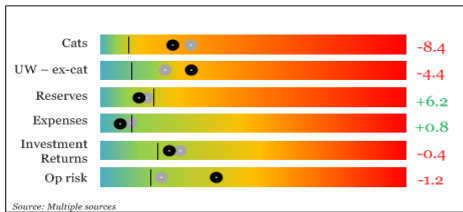
<u>Reforecast of likely outcome</u> indicates result of £17m to (£18m).

Underwriting result (excluding cats) has deteriorated by £4.4m. This is driven by a deterioration in financial lines of £9.2m partially offset by improvement in other lines. On financial lines rates have been 15% less than expected and volumes 12% more than expected.

<u>Proposed actions</u>

Decide whether to change underwriting strategy for financial lines.

Investigate estimated catastrophe load given cat activity over this year.

Cats	-8.4
UW – ex-cat	-4.4
Reserves	+6.2
Expenses	+0.8
Investment Returns	-0.4
Op risk	-1.2

Source: Multiple sources

Risk Commentary

<u>Overexposed to US quake risks</u> because we have been unable to <u>place the second cat layer reinsurance on acceptable terms</u>. Similar issue to <u>non-peak Oceania risks</u> where unable to place <u>catastrophe reinsurance cover</u>.
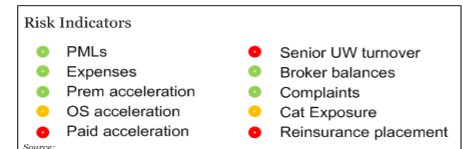
Senior underwriter turnover is higher than expected with loss of 2 key property underwriters.
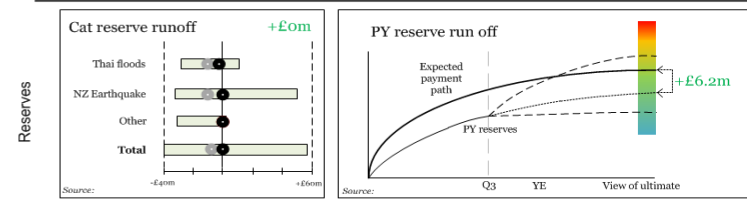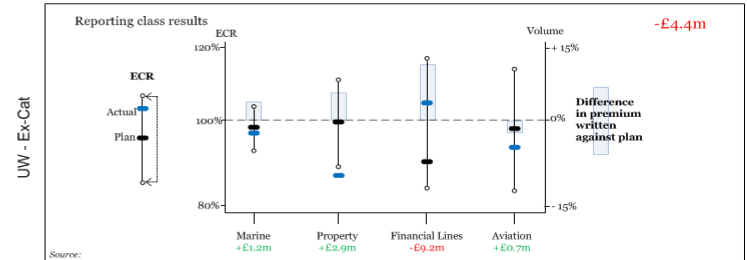
<u>Proposed actions</u>
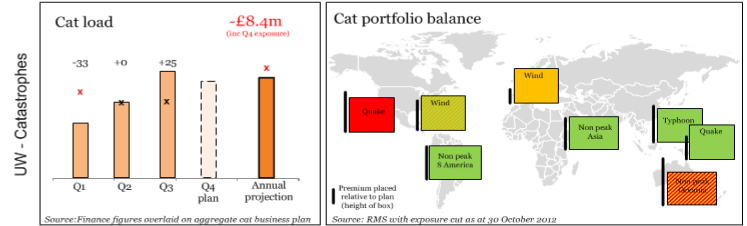If we cannot place appropriate reinsurance on acceptable terms in Q4 we should <u>reduce primary exposure</u> (or revise risk appetite).

Review property business plan given loss of 2 key underwriters.

Understand what is driving acceleration in paid claims.

Risk Indicators

● PMLs	● Senior UW turnover
● Expenses	● Broker balances
● Prem acceleration	● Complaints
● OS acceleration	● Cat Exposure
● Paid acceleration	● Reinsurance placement

Source:

Key:
- Q3 position ●
- Q2 position ●
- All ranges are 10th/90th %ile
- All figures in millions
- Positive versus budget
- Negative versus budget
- Help ?

Cat load -£8.4m (inc Q4 exposure)

	-33	+0	+25		
	Q1	Q2	Q3	Q4 plan	Annual projection

Source: Finance figures overlaid on aggregate cat business plan

Cat portfolio balance

Quake, Wind, Typhoon, Quake, Non peak Asia, Non peak S America, Non peak Oceania

Premium placed relative to plan (height of box)

Source: RMS with exposure cut as at 30 October 2012

UW – Catastrophes

Reporting class results -£4.4m

ECR, Volume, +15%, Actual, Plan, 120%, 100%, 80%, -15%, 0%

Difference in premium written against plan

Marine	Property	Financial Lines	Aviation
+£1.2m	+£2.9m	-£9.2m	+£0.7m

Source:

UW - Ex-Cat

Cat reserve runoff +£0m

Thai floods	
NZ Earthquake	
Other	
Total	

-£40m ... +£60m

Source:

PY reserve run off

Expected payment path, PY reserves, +£6.2m

Q3, YE, View of ultimate

Source:

Reserves

Rates achieved vs volume business written
+15%, Aviation, Marine, Rates, Property, Financial Lines, Volume, -15%, +15%

Financial impact included in reporting class results.

Source:

Goal Alignment

Goal Alignment
Decision enablers have to "think more about thinking"

R

A

F

T

In most insurance processes, insights are:

➢ Discovered within ***Risk, Actuarial,*** and ***Finance***

➢ Enabled by up and down-stream ***Technology***

Actioned by decision makers outside RAFT roles

➢ Most Decision Makers regularly use *System 1** thinking, so base judgments on small samples and heuristics ➜ cognitive biases

- e.g.: Underwriters in controlled environments with same information calculate varying prices for same risk in experiments

Question: How can Decision Enablers better help Decision Makers?

Answer: Understand decision making process and incorporate frameworks into analysis and technology to reduce cognitive bias:

➢ ***RA***FT: Underwriting and Claims Adjusters receive better and/or more resonant information to process new accounts (e.g. benchmarks)

➢ RA***FT***: Underwriters receive psychometric style questionnaires to check information grasp and feedback loop impact before assigning prices

Goal Alignment
Enabling decision makers see your data driven world

Decision Makers incorporate their prior beliefs

➢ Biased to the individual

Decision Enablers can help by:

➢ Communicating the limits of data analysis

➢ Advising on the boundaries of decisions from the data

■ Toy Example: *"The data shows that the variation of WC losses for construction companies (10% CI) is larger than for clerical staff (2%CI) – taking all other known variables into account."*
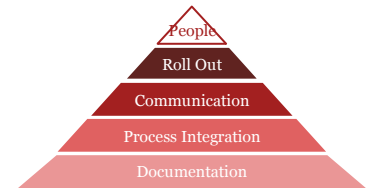

Goal: Inform human decisions in ways that:

➢ *Reduce unbeneficial variation when using the same information*

➢ *Increase information usage*

Note: This still may not incorporate all economic, relationship and other variables pertinent to the specific decision.

Goal Alignment
Decision making enablers

Success Factor	Leading Practice
People	• Management promotes full "buy in" • Tool champions build data self sufficiency
Roll Out	• Training/ change programs prepare users • Speak across RAFT silos
Communication	• Tailored to specific stakeholders • Bottom up feedback guides iterations
Process Integration	• BI mirrors business process • BI tied to key metrics (e.g. versus plan/ industry)
Documentation	• Robust data dictionaries and metadata • People are aware of documentation—and access it

User Application

User Application
Distributing Actuarial Insights

Actuarial insights can be difficult to understand. This has not prevented incorporation in downstream business processes, such as pricing and straight through processing.

BI should be no different.

Current State	Future State
➢ BI limited to transactional data	➢ Granular IBNR included in BI
➢ Untrended, Undeveloped	➢ Trend and Inflation Tables
➢ No credibility measures	➢ Auto-generate credibility routine

Actuarially enabled BI helps decision makers robustly consider information.

User Application
Distributing Actuarial Insights

Group

State; Payment Type; ZIP; Industry

Fact

Loss_Paid; Loss_OS; Loss_Developed; Z_Score

Where

State in (CT, MA); Policy_Symbol = 2

LDF, GLM, or IBNR Allocation Routines

Call Out Credibility Issues

Credibility

Claim Count

User Application
Distributing Actuarial Insights

Restrict Distribution
- Reduce misuse risk
- No training need
- Low credibility

- No development
- Users form own view

Distribute
- Share insights
- Improve decisions
- Easy to design

- Misuse risk
- Training need
- Volatility

In Conclusion

In Conclusion
Actuarial Modernization and Business Intelligence

Modernize Business Intelligence by:

1) "Right to left" data selection

2) Dashboards facilitate understanding—pick the right tool for you

3) Communicate and train to improve decision making

4) Fill information vacuums; caveat if needed

Business Intelligence tools and data sources should:

- Tie to metrics

- Enable drill down capability

- Be internally consistent

Focusing on widely applicable metrics builds alignment.

Questions?
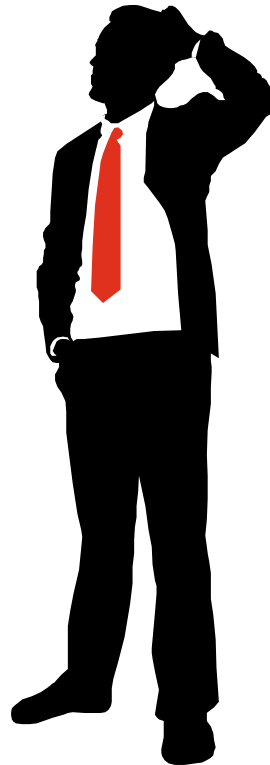
P&C Insurance Modernization
Tony Beirne, Director

Professional background

- Tony is a Director in PwC's predictive analytics practice with over a decade's experience in the financial services industry. Tony advises clients on technical modeling, predictive analytics, operational, technology, and data quality engagements.

- Tony has led numerous engagements quantifying, pricing, and managing financial cash flows. He has assisted insurers, banks, and other organizations with pricing, underwriting, subcontractor evaluation, customer management, costing the burden of disease, and predicting borrower default rates and costs, and testing complex algorithms on systems integration projects.

- Since joining PwC in 2005, Tony has split his time between the Philadelphia and Sydney, Australia offices. Prior to joining PwC, Tony was an actuary and underwriter with Liberty Mutual Group in Boston where he held various insurance reserving, pricing and underwriting responsibilities.

- Tony is a Fellow of both the Casualty Actuarial Society, and is a Member of the American Academy of Actuaries. He is pursuing his MBA from NYU's Stern Business School. He graduated cum laude with a BA in Mathematics and Economics from Boston College, along with a minor in continental Philosophy.

Project experience highlights

- Spearheaded the actuarial testing of a major Australian bank's new SAP-based core banking system. To ensure that interest and fee calculations worked "first time, every time," Tony's team investigated which peculiar banking activities would stress the system, and designed test bank accounts with these unusual characteristics and reviewed system generated output. Numerous high priority defects were identified and remediated.

- Led Analytics Data Mart premium requirements gathering for the workers' compensation business leveraging questionnaires, interviews, working sessions, and code reviews on current analytics uses, future state ADM use, and source data flows. User needs were distilled for system analysis and design teams, to ensure compatibility with existing business processes.

- A workers' compensation insurer fundamentally changed underwriting industry classifications. Tony led data mapping, re-rating, and transition management efforts for the client. The team better aligned rate with risk, and developed multiple implementation rules to minimized extreme increases and revenue losses.

- Evaluated Third Party Administrators claims handlers performance over claim lifecycles using Markov Chain methods. The model was tailored to the particular attributes of each TPA's settlement process. Results were used to distinguish remuneration for good versus poor performance, and to redistributing market share.

P&C Insurance Modernization
Prashant De, Manager

Professional background

- Prashant is a manager in PwC Advisory practice using better data and models to drive better decisions making. His focus is on combining Data Science, Insurance Strategy and Technology to support intelligent business decisions.

- Prashant has led analytical projects and teams focused on using predictive analytics, machine learning and external data to improve commercial books of business in pricing and fraud detection.

- Prashant has also led Insurance strategy projects aimed at identifying better Management Decision-Making through Modern MI and Data, Improved Reserving and Reporting and advising Large Insurance Carriers on reserve estimates.

- Prashant joins PwC's Insurance Advisory practice in 2014, previously he worked for large American and European carriers in the Actuarial, Reporting and Data Science/Predictive Analytics departments.

- Prashant holds an MBA from the University of Oxford – Said and an Undergraduate degree in Mathematics from the University of Texas at Austin

Project experience highlights

- Led analytics projects pricing commercial lines of business using external data and machine learning algorithms to better predict over incumbent models. Businesses needed better pricing to reflect current risks and new insights around the use of external data in pricing.

- Led project to introduce unsupervised fraud detection methodology combining expert judgment and statistical methods to provide robust fraud suspicion scores. Streamlined referral process and quantified total fraud model impact using actuarial methodology.

- Conducted a worldwide benchmarking strategy project focused on best practice corporate decision making during key organizational change to customer focus. Presented actionable results to board and implemented model in foreign operating entity.

- Led Insurance Market entry project for mid-tier US based Insurance Broker looking to enter Commercial P&C. Advised CEO on Product, Legal and Market dimensions.

- Led M&A Project to quantify fair value for several large insurance company acquisitions.

Thank you!

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