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Actuarial Modernization and Business Intelligence:

Driving Transformation

CAGNY

Casualty Actuaries of Greater New York

December 2014

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. Conclusion
7. Q&A

Introduction and Context

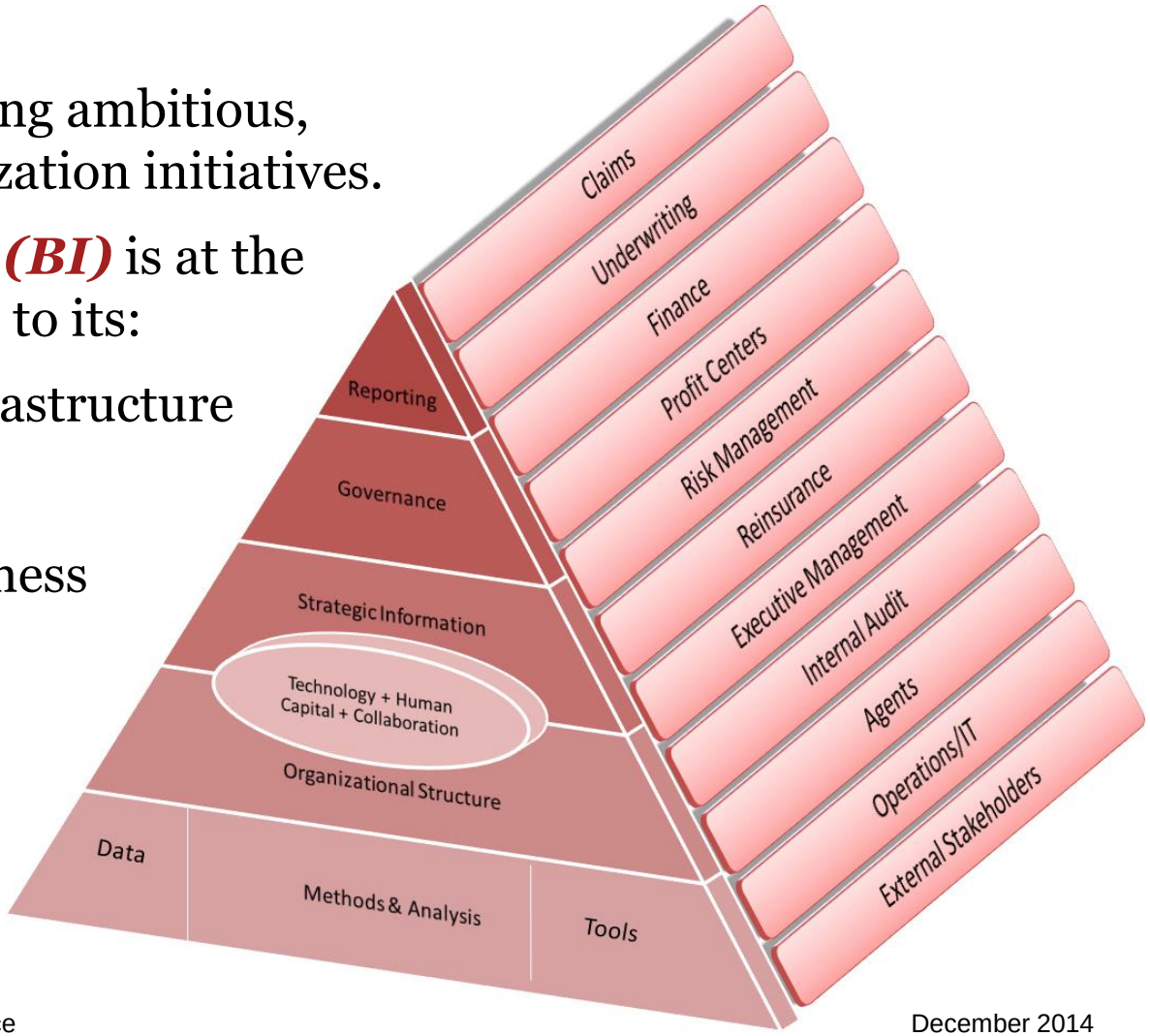
Introduction and Context

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.

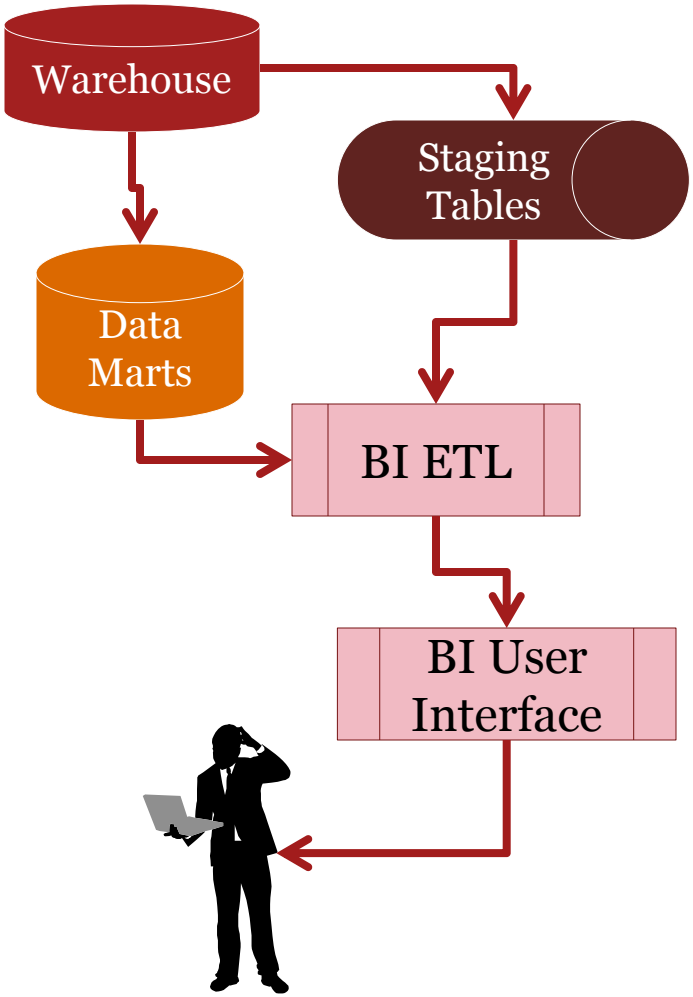
In actuarial and insurance processes, this occurs sub-optimally due to:

- ***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

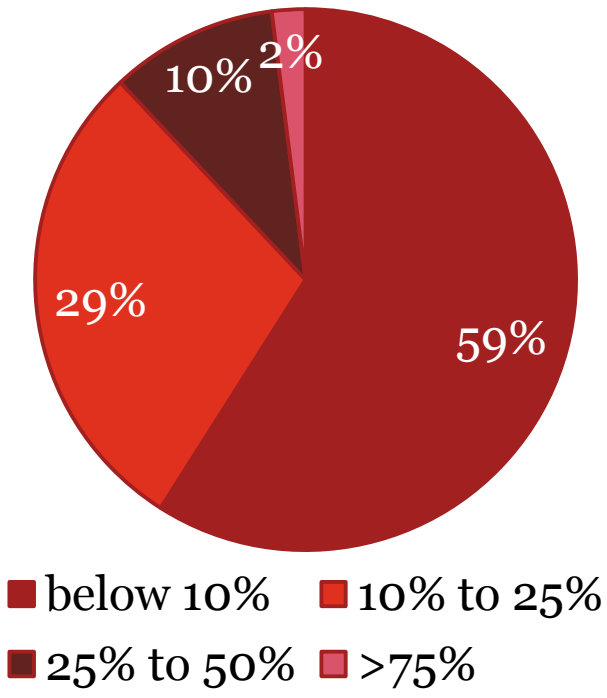
- Trust and training
- Leverage actuarial viewpoint—or users will form their own

Data Structure and Technology

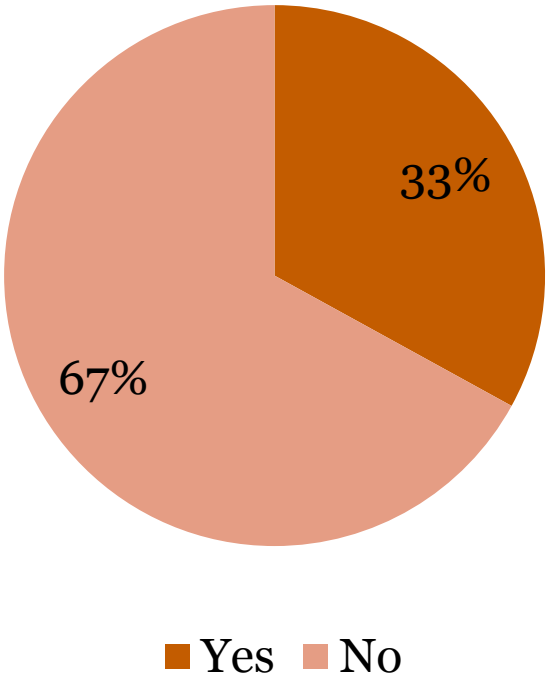
Data Structure and Technology

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?

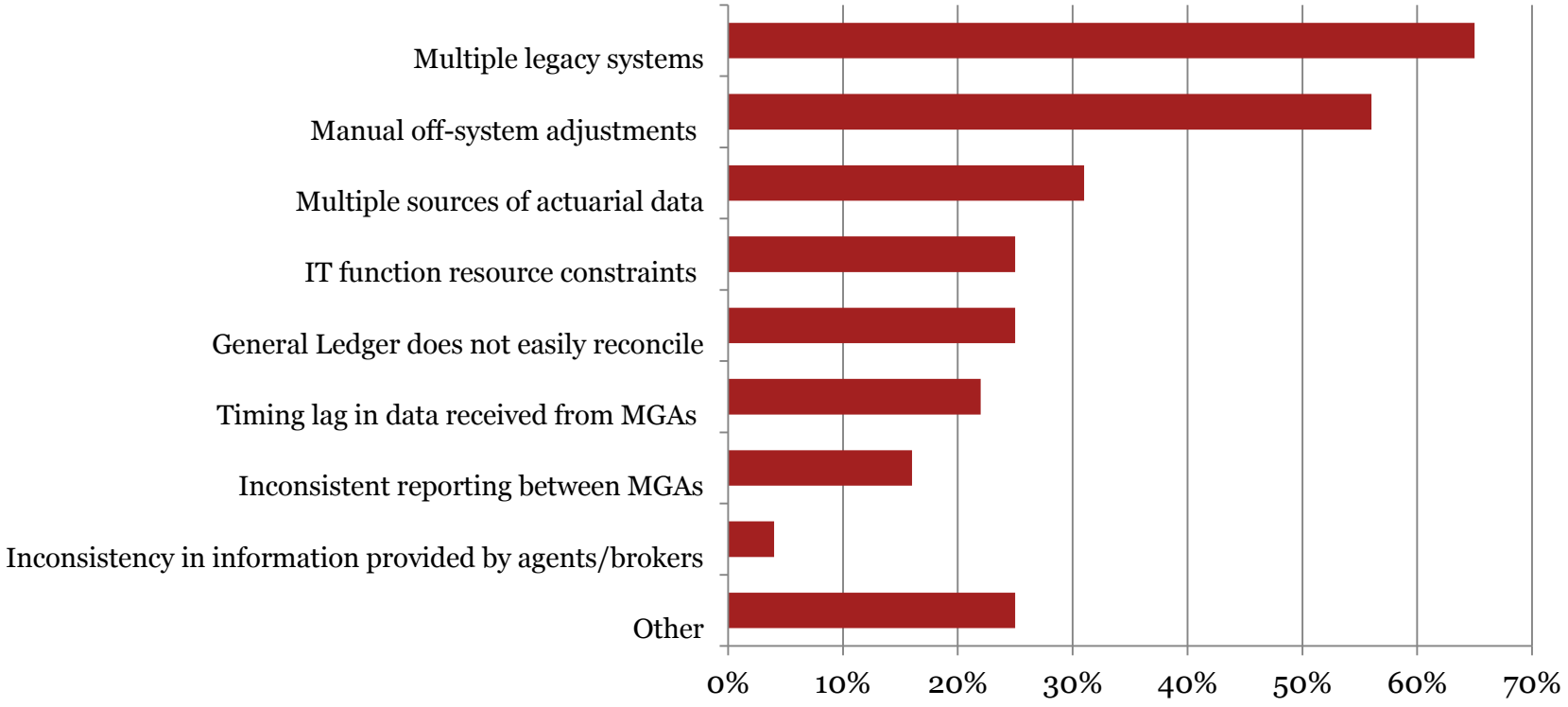


Source: PwC Actuarial Effectiveness Survey, 2013

Data Structure and Technology

Context

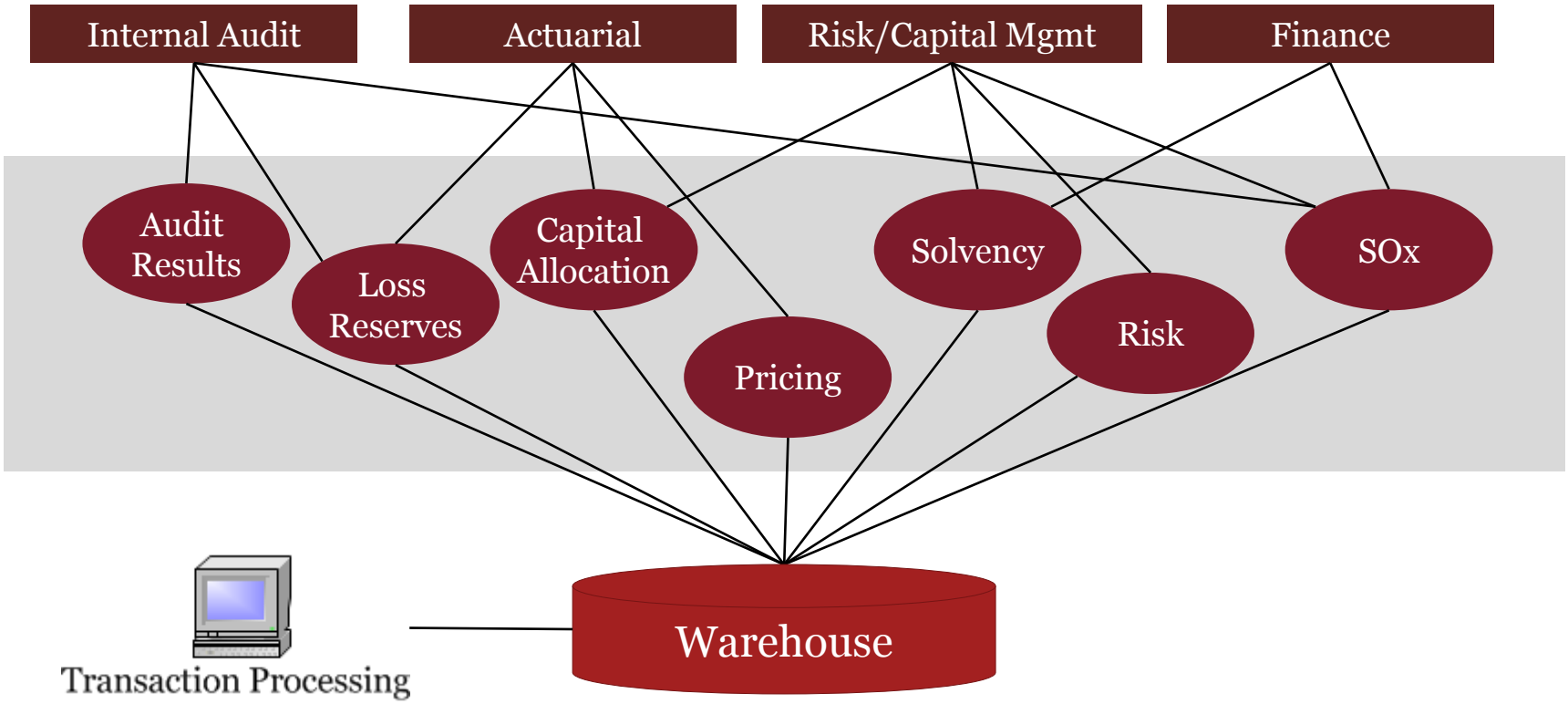
What are common sources of data issues you encounter?



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

Multiple versions

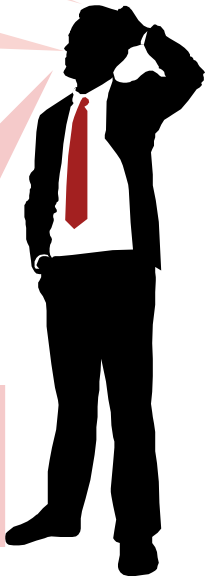
"We have multiple committees—each with their own metrics. We go round the figures three times."

"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."

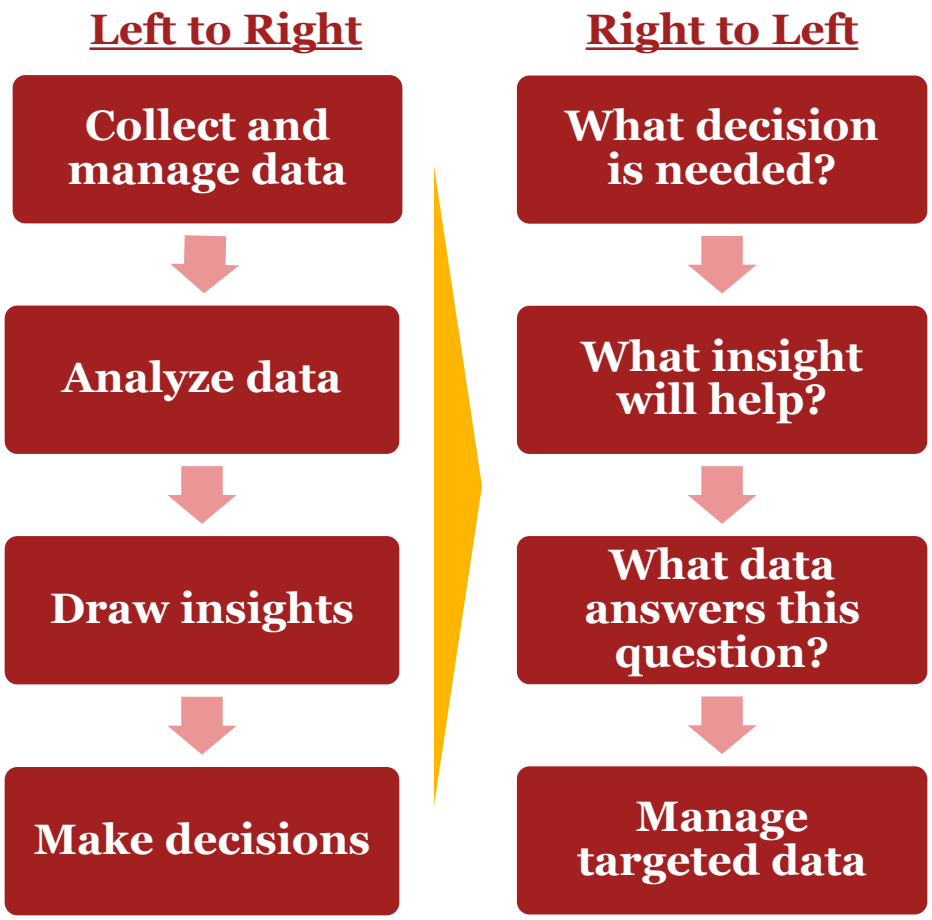
More information does not necessarily lead to better decisions.

Programs lacking strategic vision can benefit from narrower scope.

Make decisions— not reconciliations.

Data Structure and Technology

Development approach



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

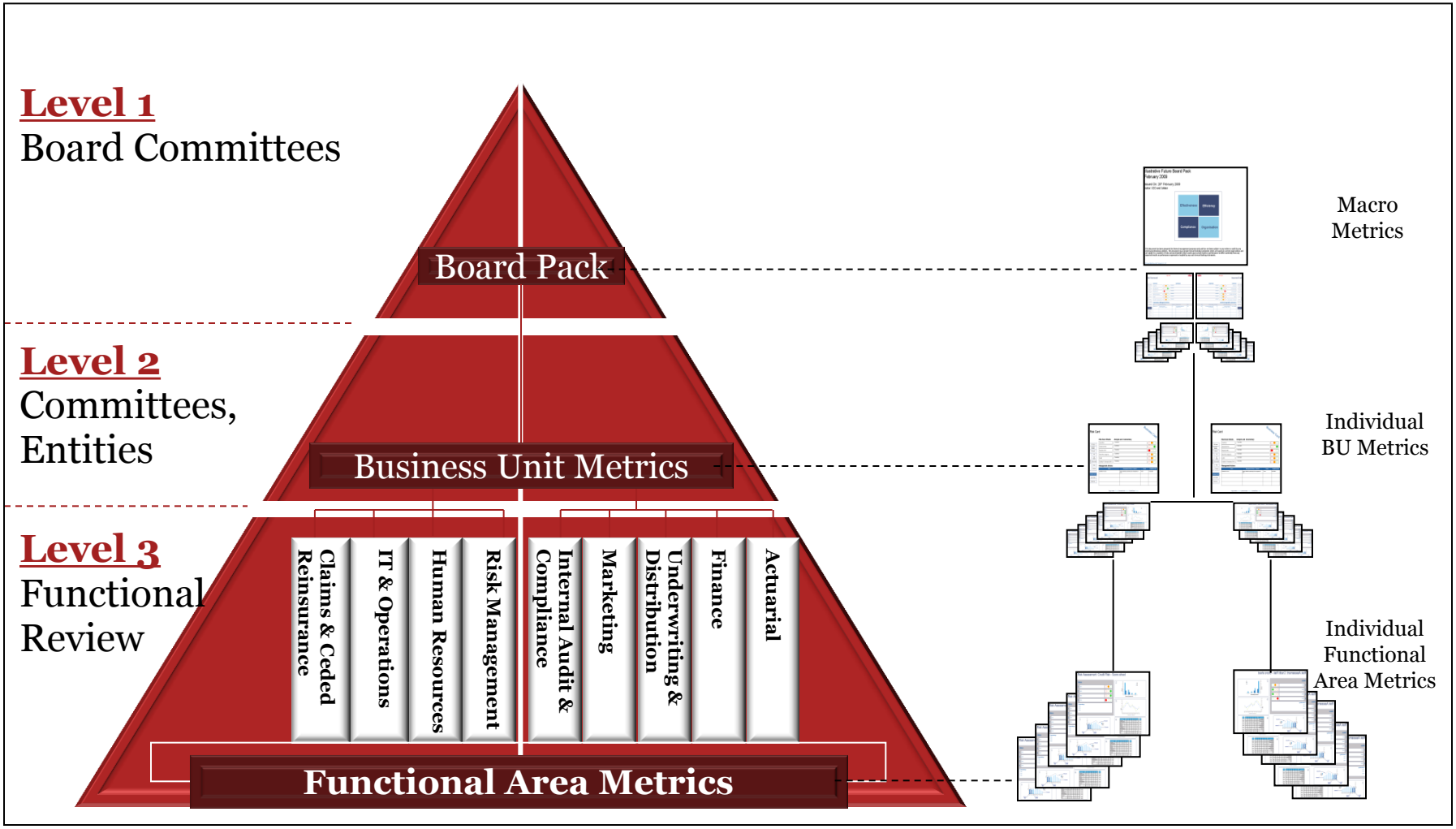
- Traditional "heavy" design provides all that is possible
- Includes unneeded functionality
- Extra overhead increases development complexity
- Complexity slows execution
- Permanent solution

Right to Left

- "Light" development provides users only what is needed
- Needs specified by analytics
- Sandbox to experiment with new data or processes
- Lower project complexity
- Incremental solution

Data Structure and Technology

Tailor information to the audience

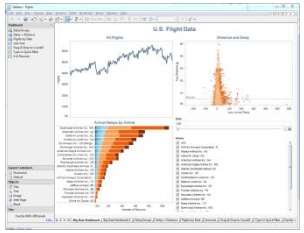


Data Structure and Technology

Fast, Widespread Information

Better data structures benefit power users and the wider organization.

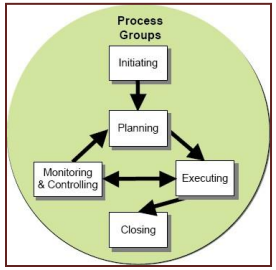
Business Intelligence



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

- **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

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

Analytics

- **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

Proactively:
Power to connect analytics across enterprise and influence management and broader portfolio strategy

Visualization

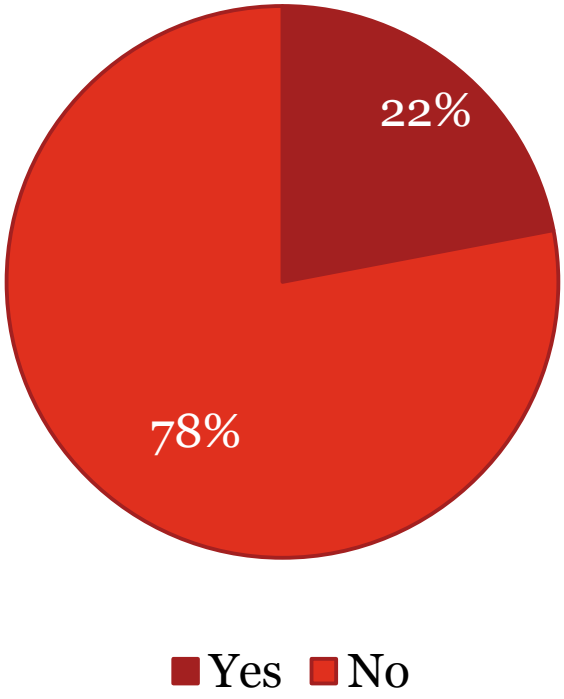
- **Visualizing Analytic results:** Tuned to solving a business problem for a decision maker - not just *visuals of data*
- **Clarity:** What the data are saying versus what it is not

Proactively:
Visualize portfolio and change to enable key executives to make better decisions using better data

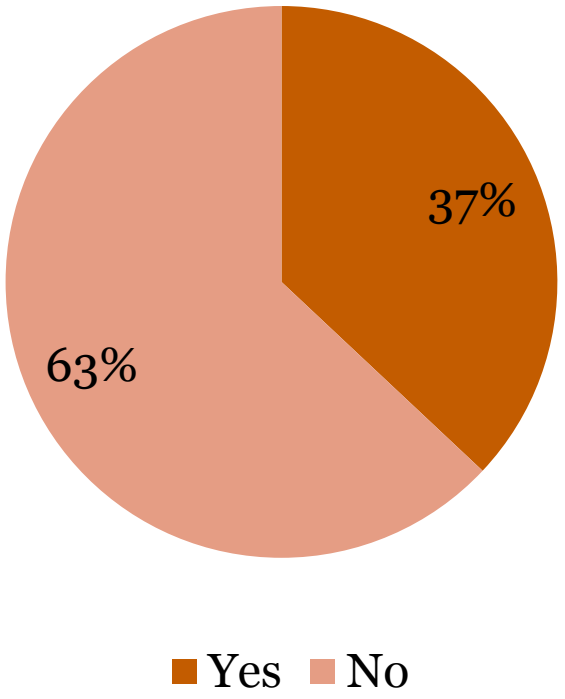
Tools and Outputs - Reserving Survey

Context

Is an interactive dashboard currently utilized to present actuarial findings?



If not, their desire to build such a dashboard?



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"

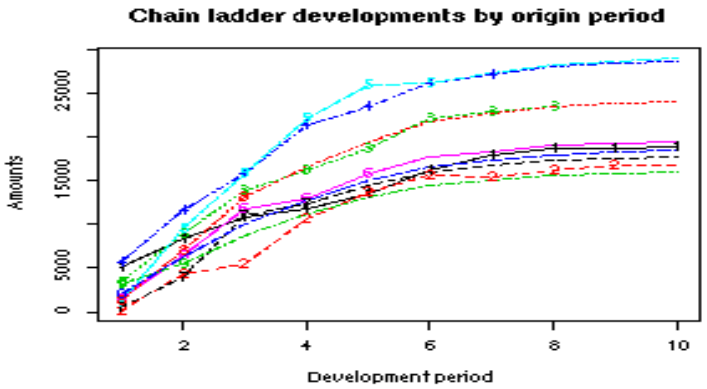
PwC does not express any official views on the products/tools listed

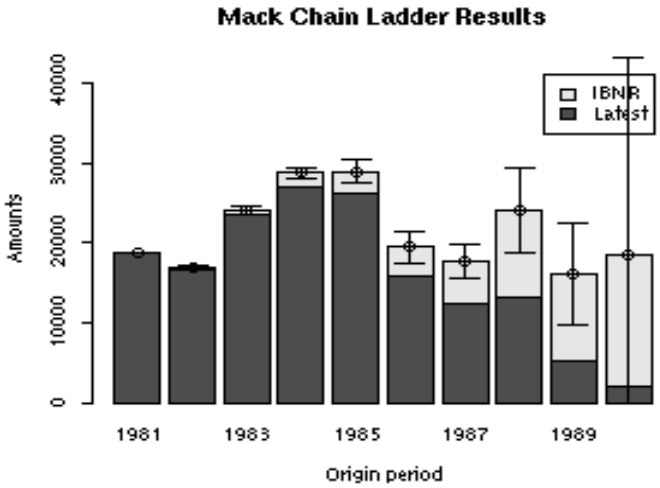
Open Source R – Chain Ladder + Lattice Plots example

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





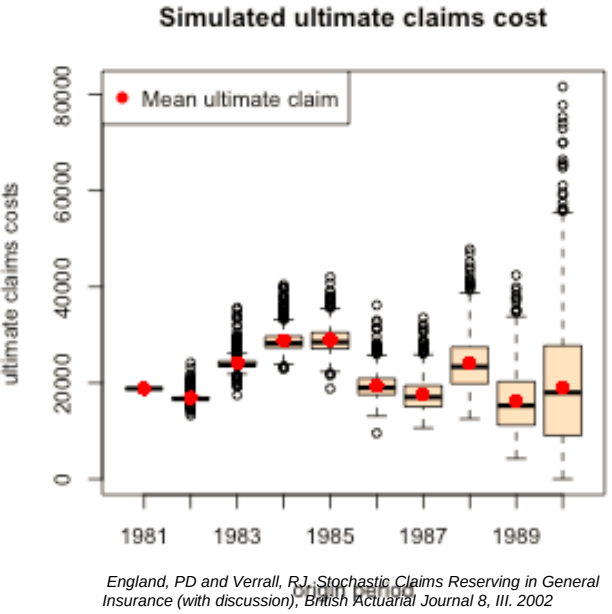
"Measuring the Variability of Chain Ladder Reserve Estimates "

Thomas Mack,1993

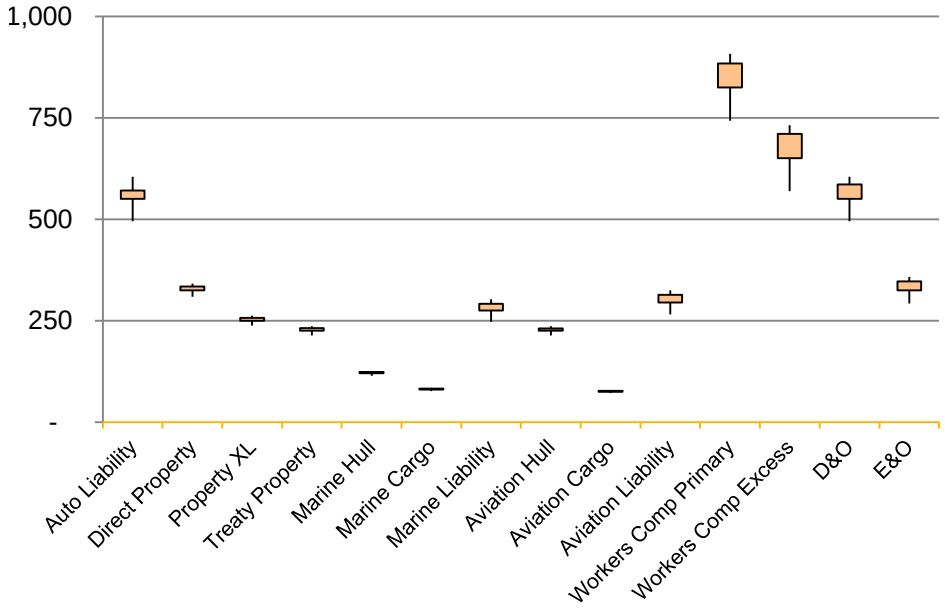
Tools and Outputs - Reserving

Example: Reserve Variation by Line of Business

Individual Bootstrapped Estimates → **Portfolio View** → **Visualization**



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



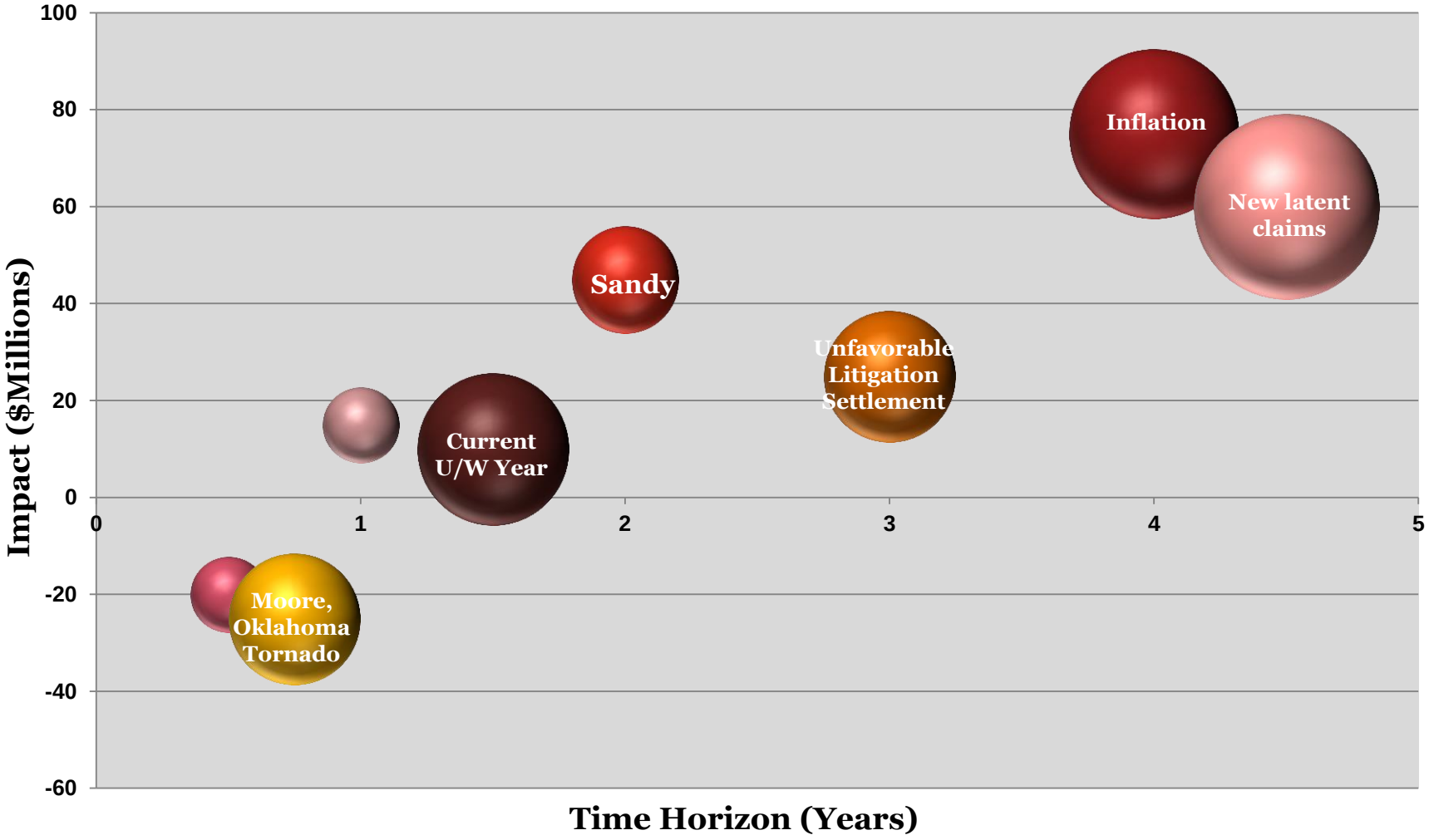
Visualize Data

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."

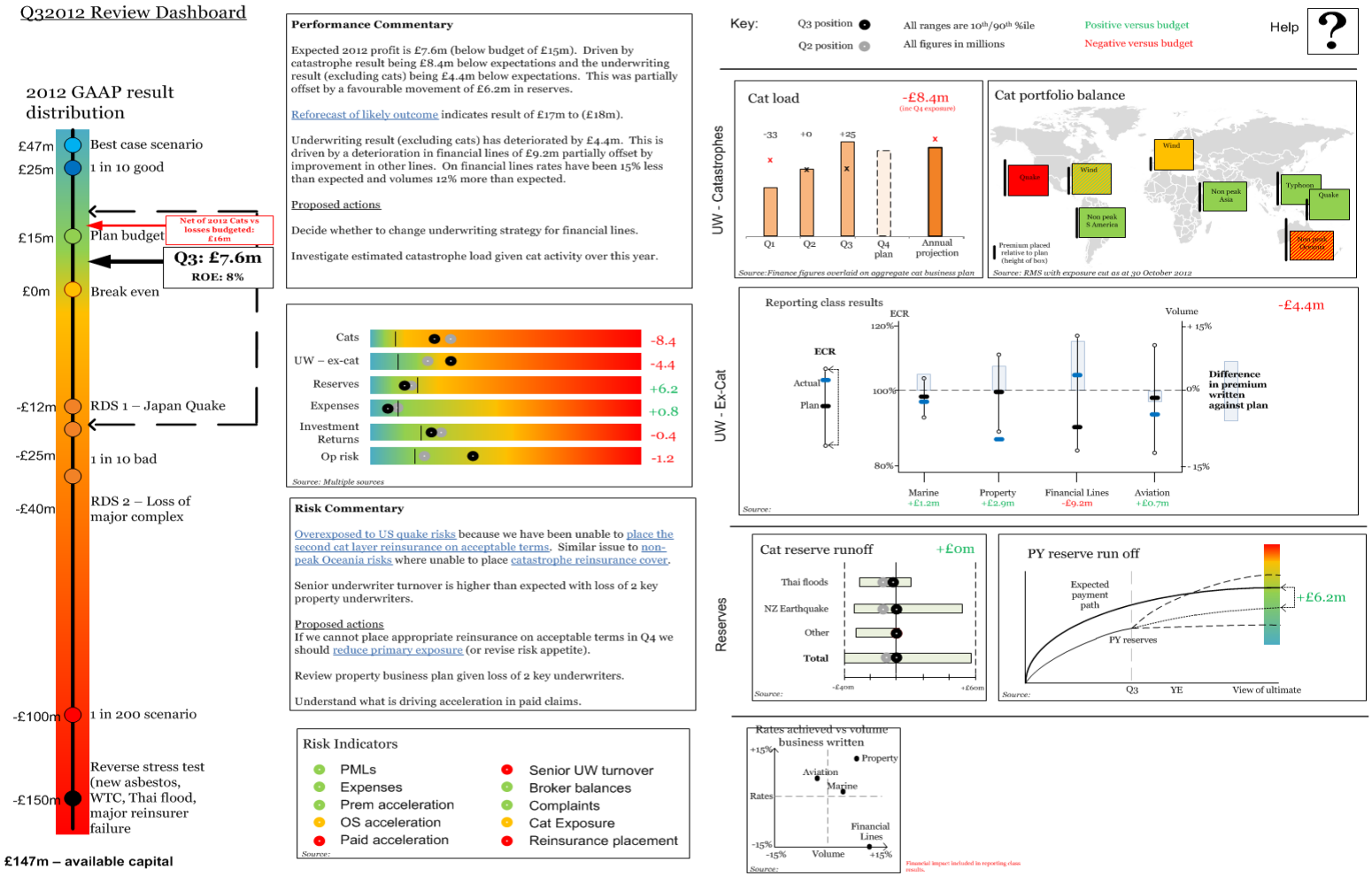
Tools and Outputs – Visualizing Drivers

Reserve Variation Risk: Severity vs Horizon vs Uncertainty



Tools and Outputs – Results and Scenario

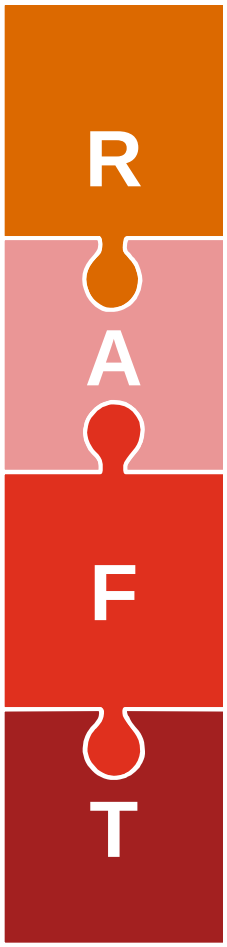
Risk Indicators – Enterprise level



Goal Alignment

Goal Alignment

Decision enablers have to "think more about thinking"



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

- Non-Data Driven Decision makers show regular use of *System 1** thinking based on small experiential samples, heuristics and resulting in cognitive biases:
  - E.G: Experiments show some Underwriters in controlled environments with same information calculate varying prices for same risk

Question: How can Decision Enablers better help Decision Makers?

- Understanding decisions and incorporating these into analysis and technology to reduce cognitive bias
  - (***RA***FT) Underwriting and Claims adjusters could receive better information to process new information
  - (RA***FT***) Underwriters could receive psychometric style questionnaires that check information grasp and feedback loop impact before assigning prices

*Instinctive, intuitive, based on heuristics

Goal Alignment

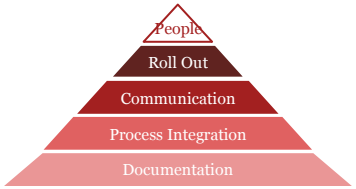
Enabling decision makers see your data driven world

- Decision makers incorporate their prior beliefs
- Potentially biased to the individual
- Decision Enablers can help by:
  - Communicating the limits of the 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.*"
- Aim is to inform human decisions to reduce variation on same information and use all available data

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

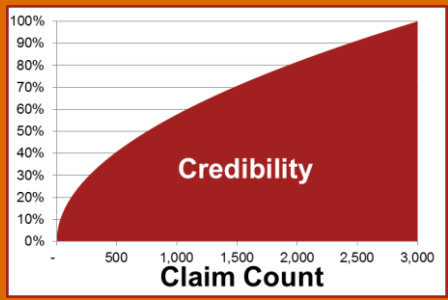
Loss_Paid; Loss_OS; Loss_Developed; Z_Score

Where

State in (CT, MA); Policy_Symbol = 2

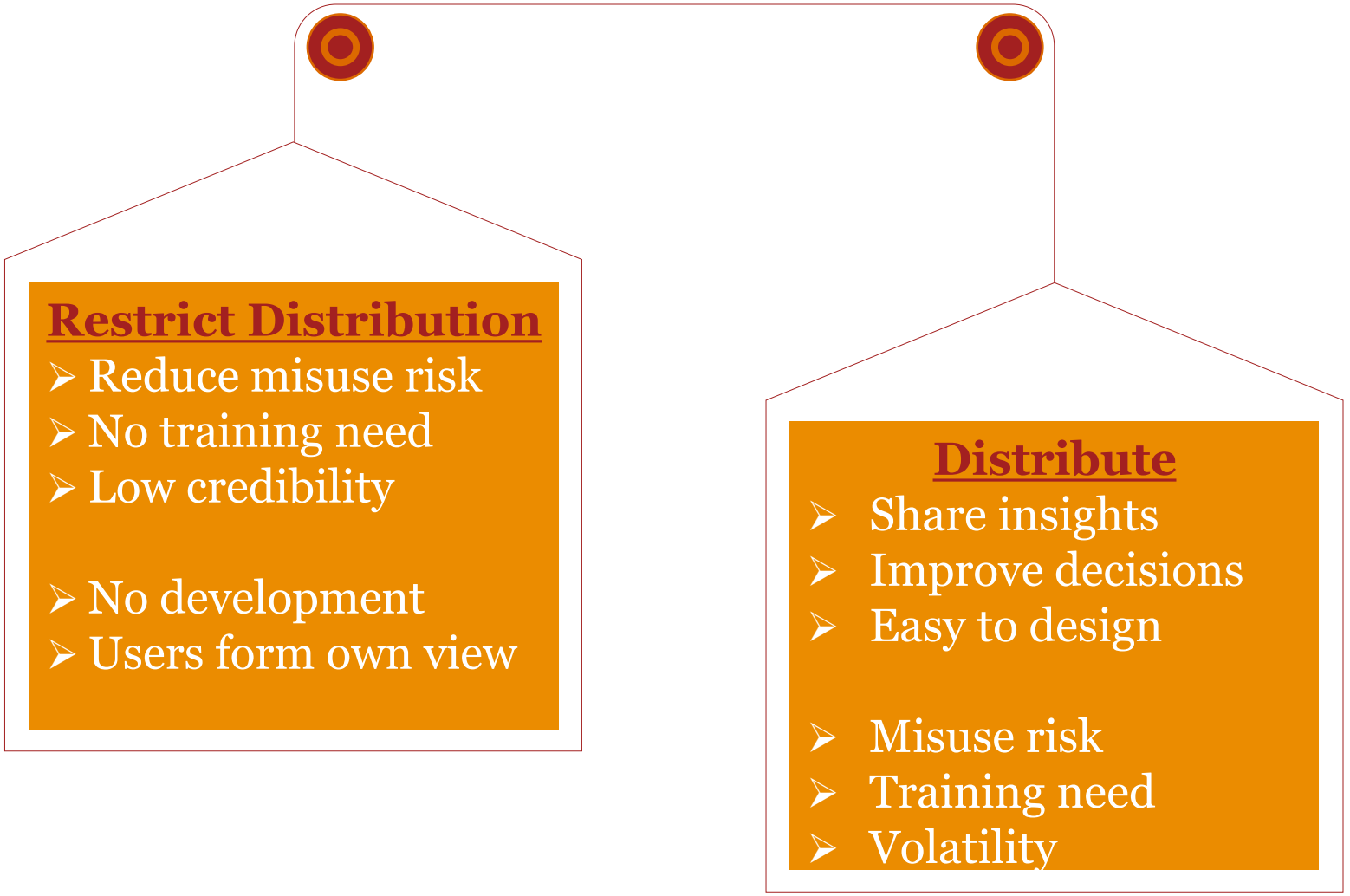
LDF, GLM, or IBNR Allocation Routines

Call Out Credibility Issues



User Application

Distributing Actuarial Insights



Conclusion

Conclusions

Actuarial Modernization and Business Intelligence

Modernize Business Intelligence by:

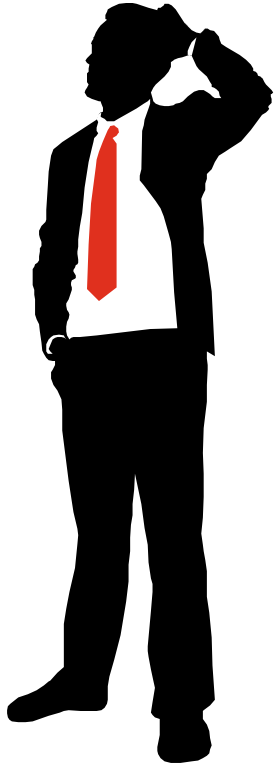
1) "Right to left" data selection
2) Dashboards facilitate understanding—pick the right tool for you
3) Communicate and train to improve decision making
4) Fill information vacuums; caveat if needed

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 the Institute of Actuaries of Australia, and is a Member of the American Academy of Actuaries. He is persuing 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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