OLIVER WYMAN

ACTUARIAL MODERNIZATION: WHY BOTHER?

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Agenda

1 **Benefits of modernization**

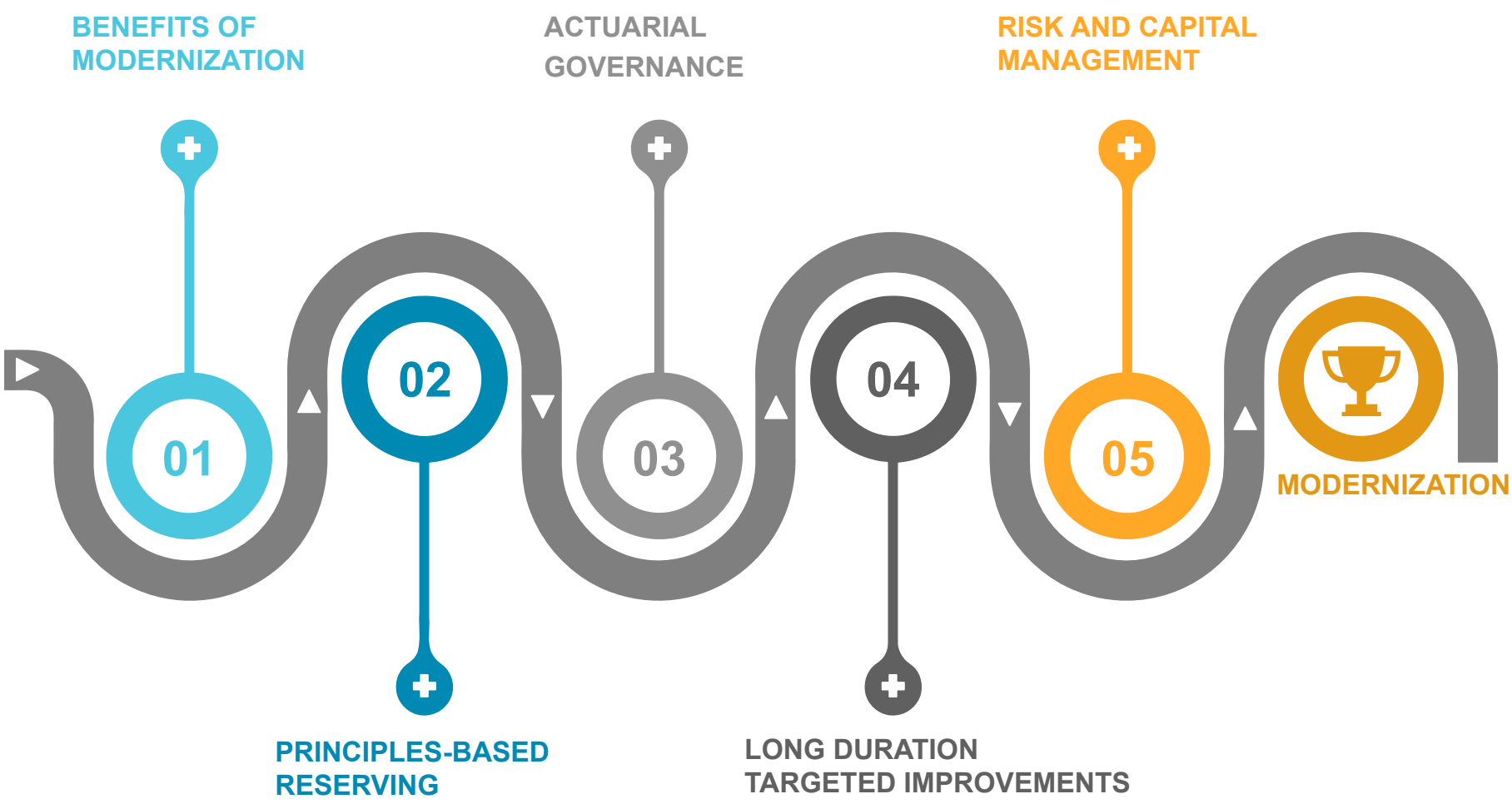
2 **Life PBR: It's here, now what?**

3 **Actuarial governance**

4 **LTDI: improving more than just GAAP**

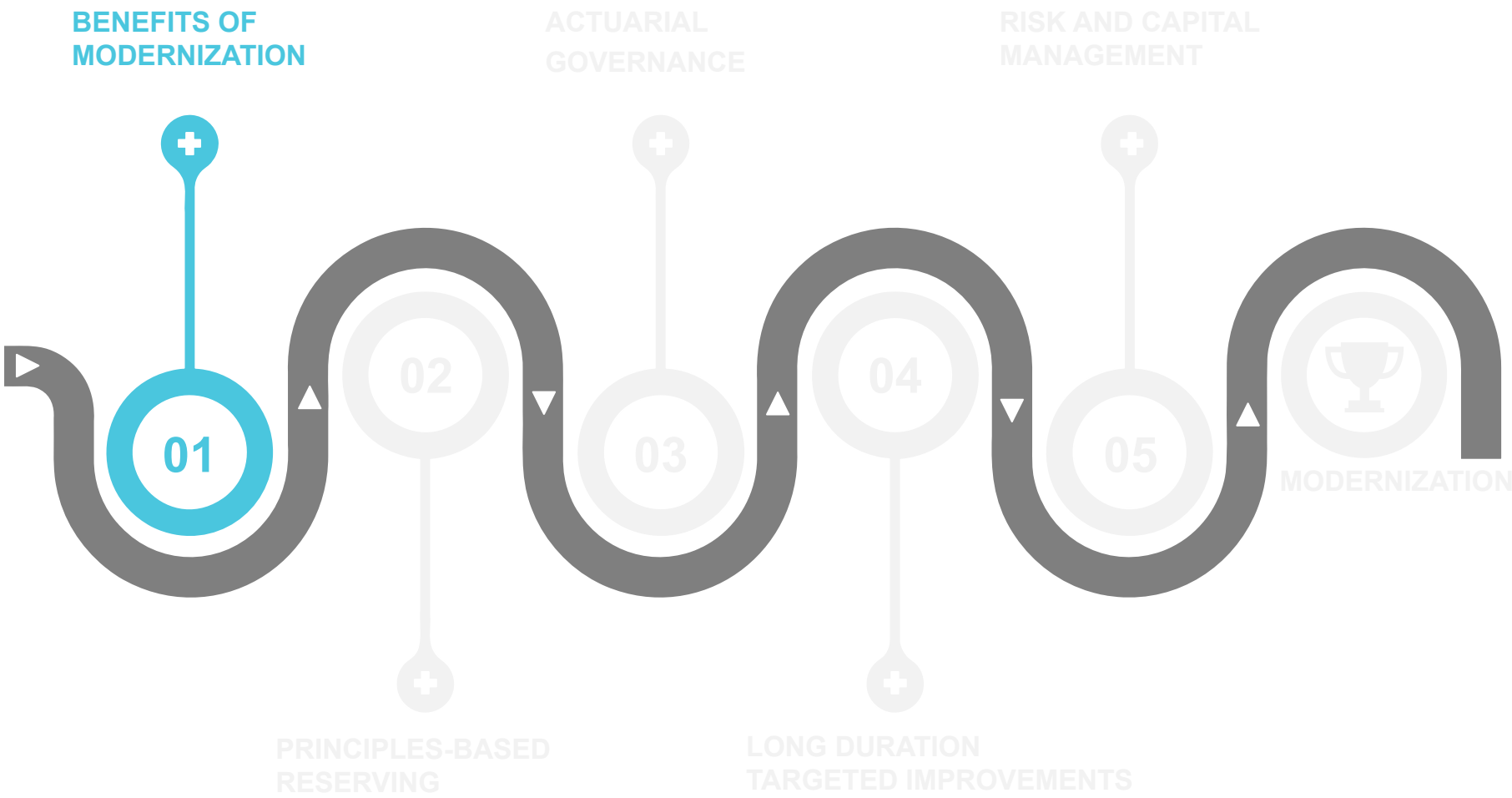
5 **Risk and capital management**

Roadmap to modernization

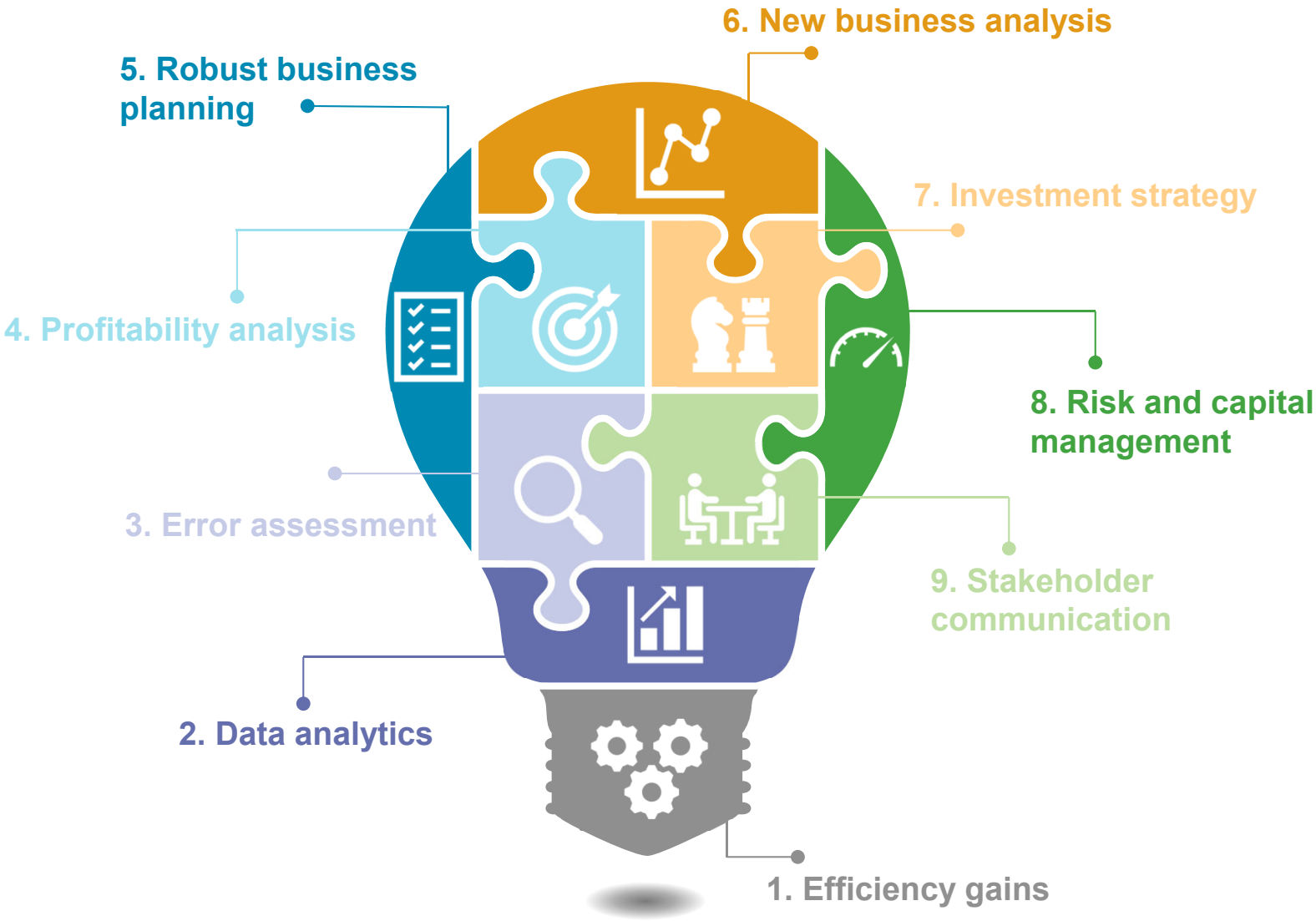


1 Benefits of modernization

Roadmap to modernization

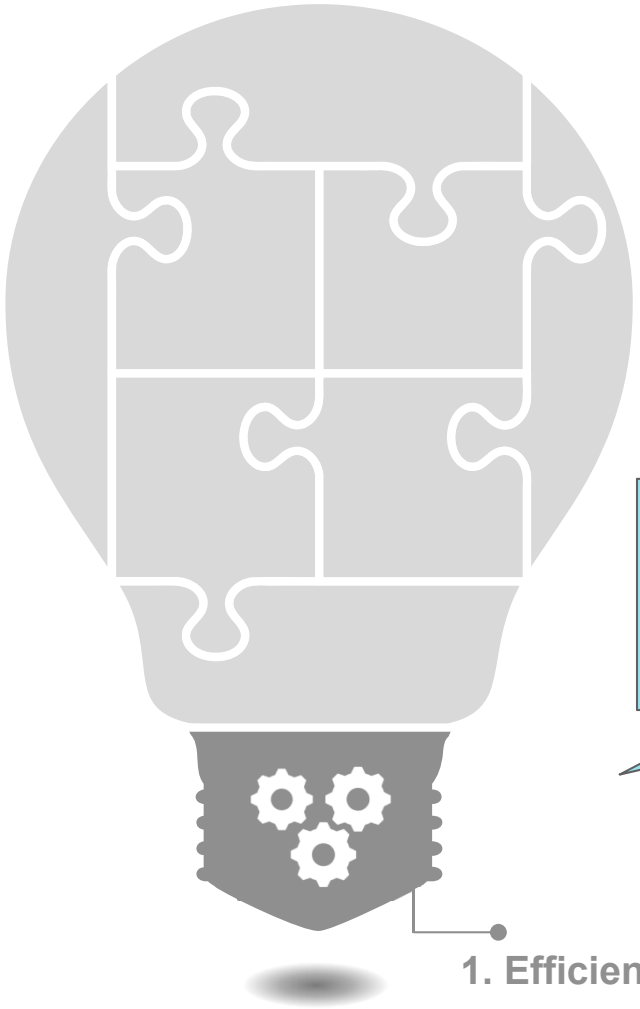


Benefits of actuarial modernization



Efficiency gains are the fundamental benefit of an actuarial modernization

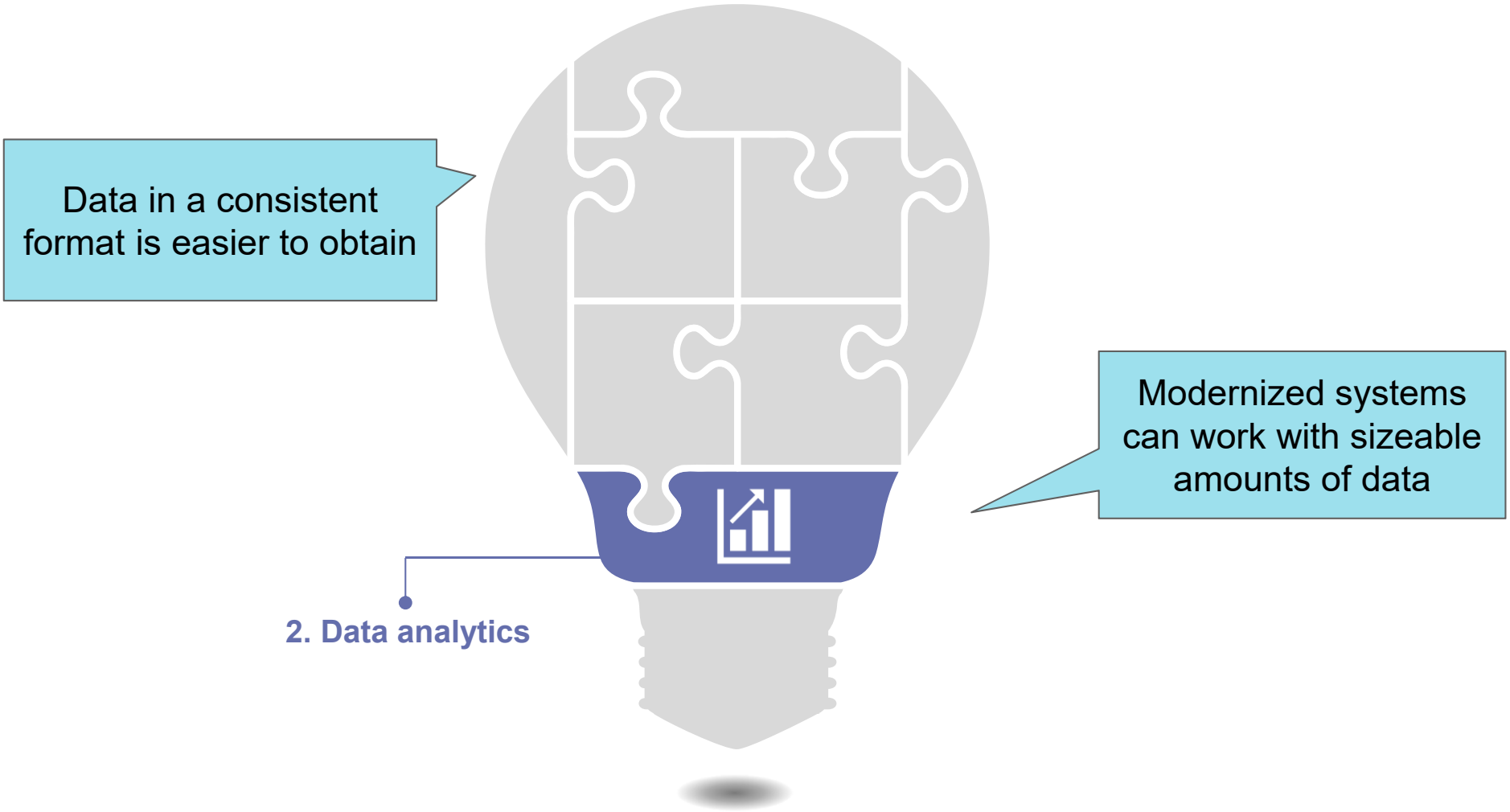
Efficiency gains can be made in many different functions and areas of the company



As resource time becomes less focused on manual tasks, there is more availability for robust analysis

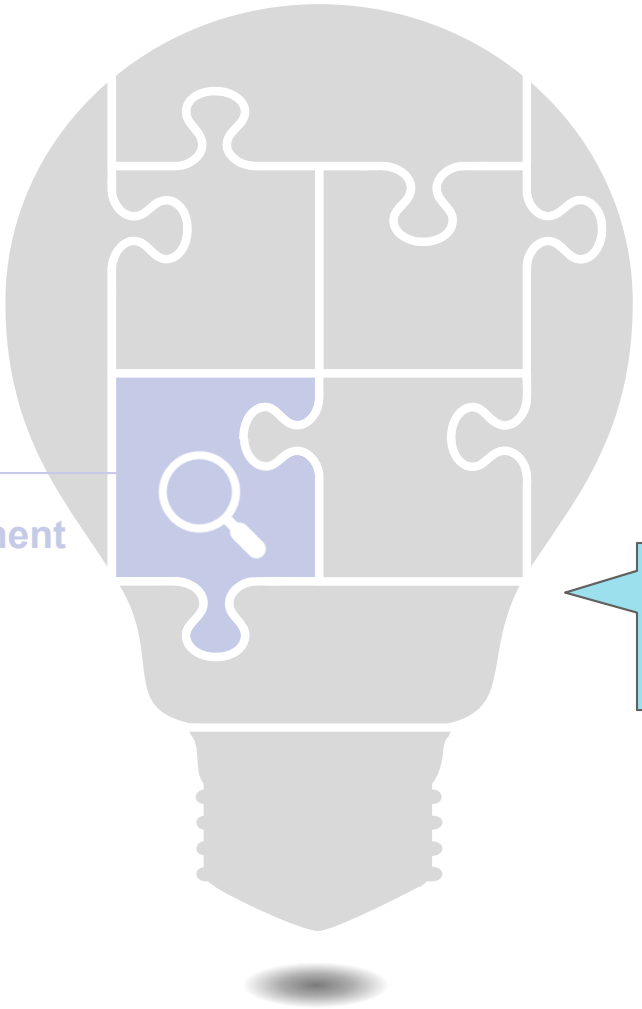
1. Efficiency gains

Improved data analytics allows companies to use the data for more robust and informed decision-making



Modernization can help identify and reduce errors in your processes

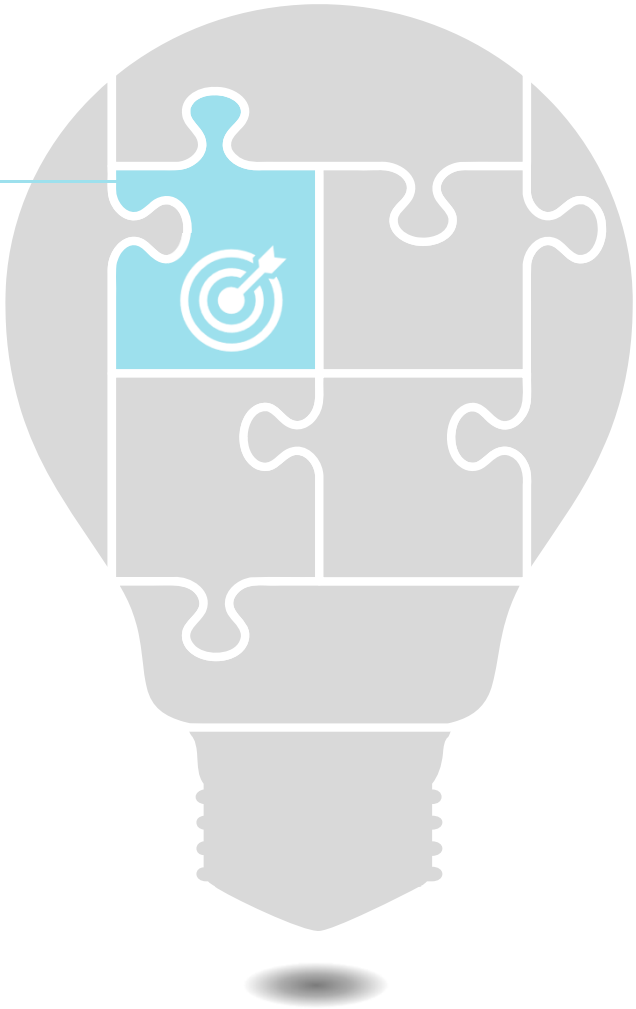
Reduces future errors



3. Error assessment

Existing errors will be found in modernization process

Profitability analysis becomes easier and more transparent



4. Profitability analysis

Drivers of profitability have greater visibility

Can conduct sensitivity testing of profit drivers

Business planning can become more robust and integrated

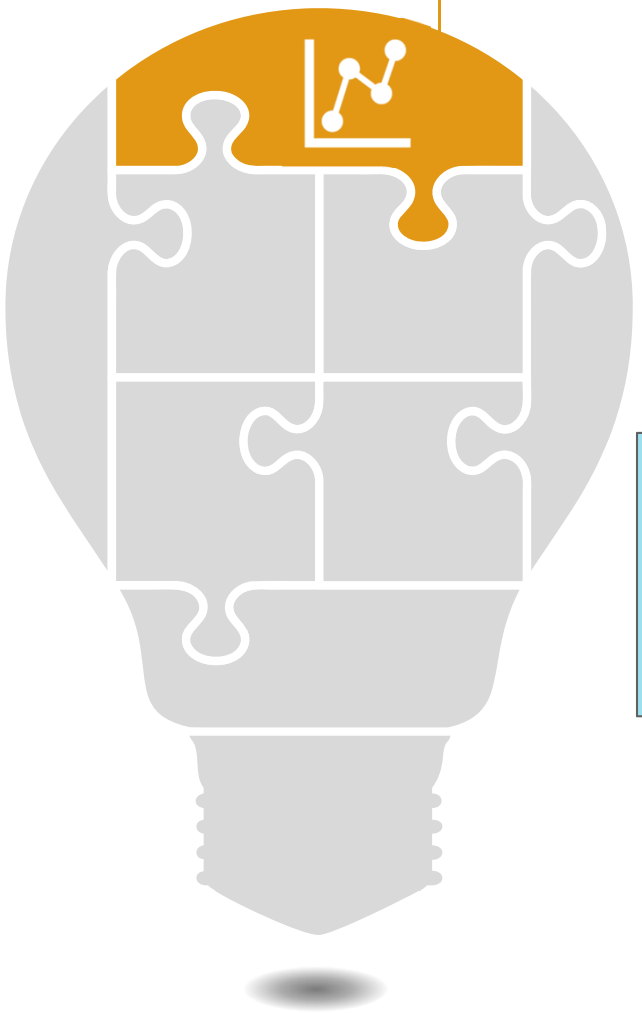
5. Robust business planning

Annual budget planning is improved

Improve financial outcomes

Improvements to new business analytics and help companies manage their product suite and risk/return profile

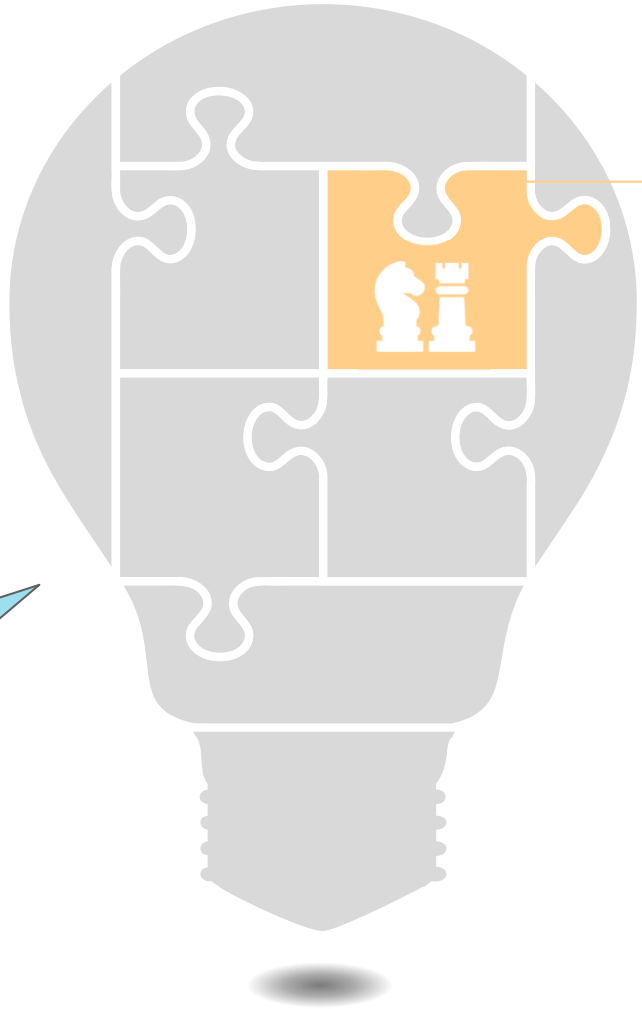
6. New business analysis



Improves pricing of existing business

Can focus capital spending on the products or projects that provide the best risk/return profile for the company

Modernization can inform refinements to the investment strategy



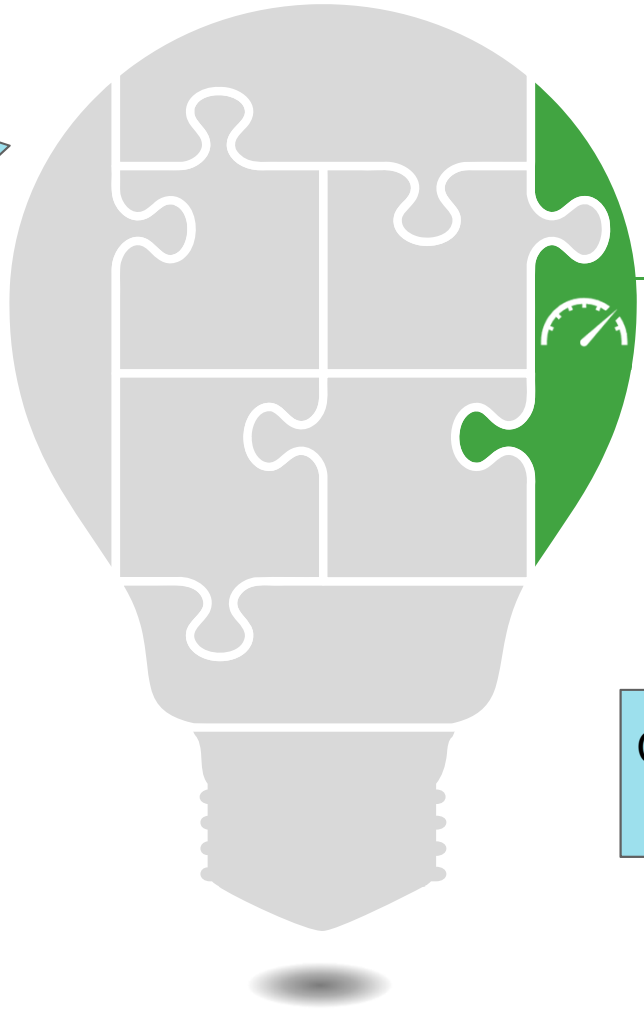
7. Investment strategy

Current and alternative investment strategies can be analyzed

Integrated modeling of liabilities, assets, hedging and reinvestment strategies

Risk and capital management becomes more transparent and information is more readily available for decision making

Central system to understand, monitor and manage risks

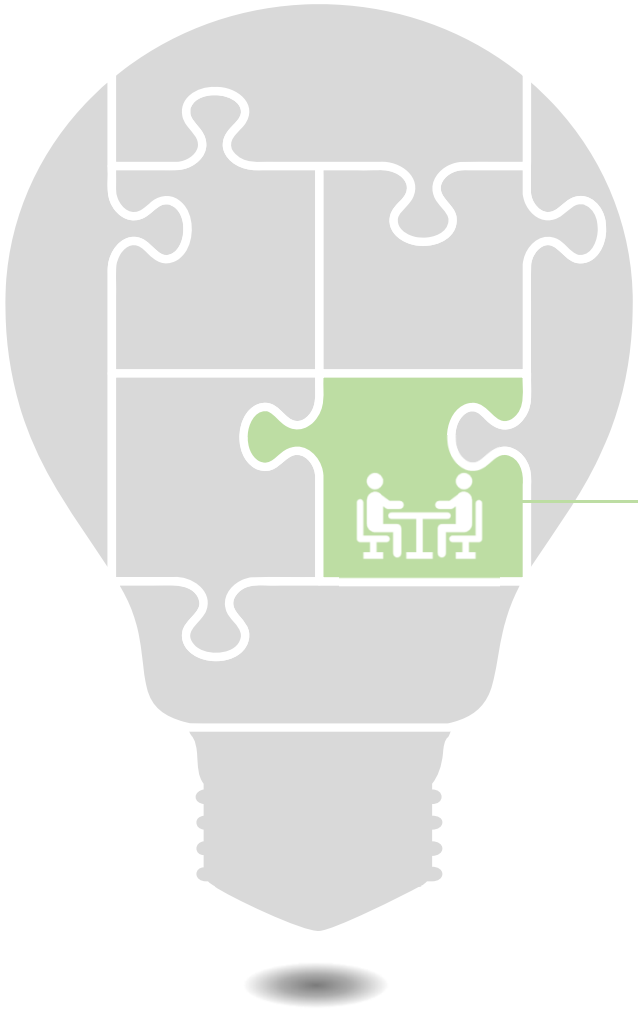


8. Risk and capital management

Conduct robust scenario analysis

Modernization improves communication with all stakeholders

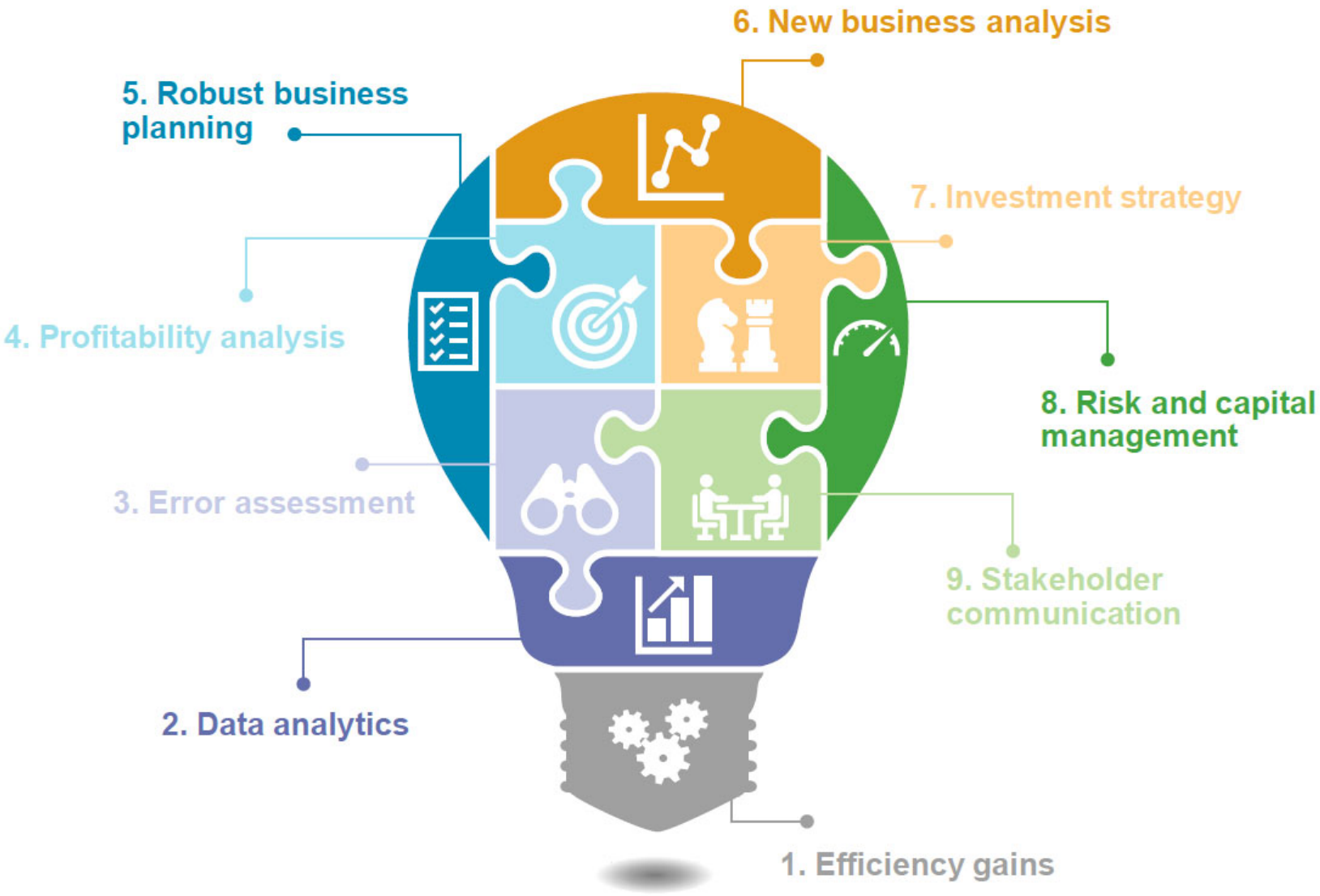
Information for and communication to key stakeholders can expand



Reduction in surprises and lag time of analysis

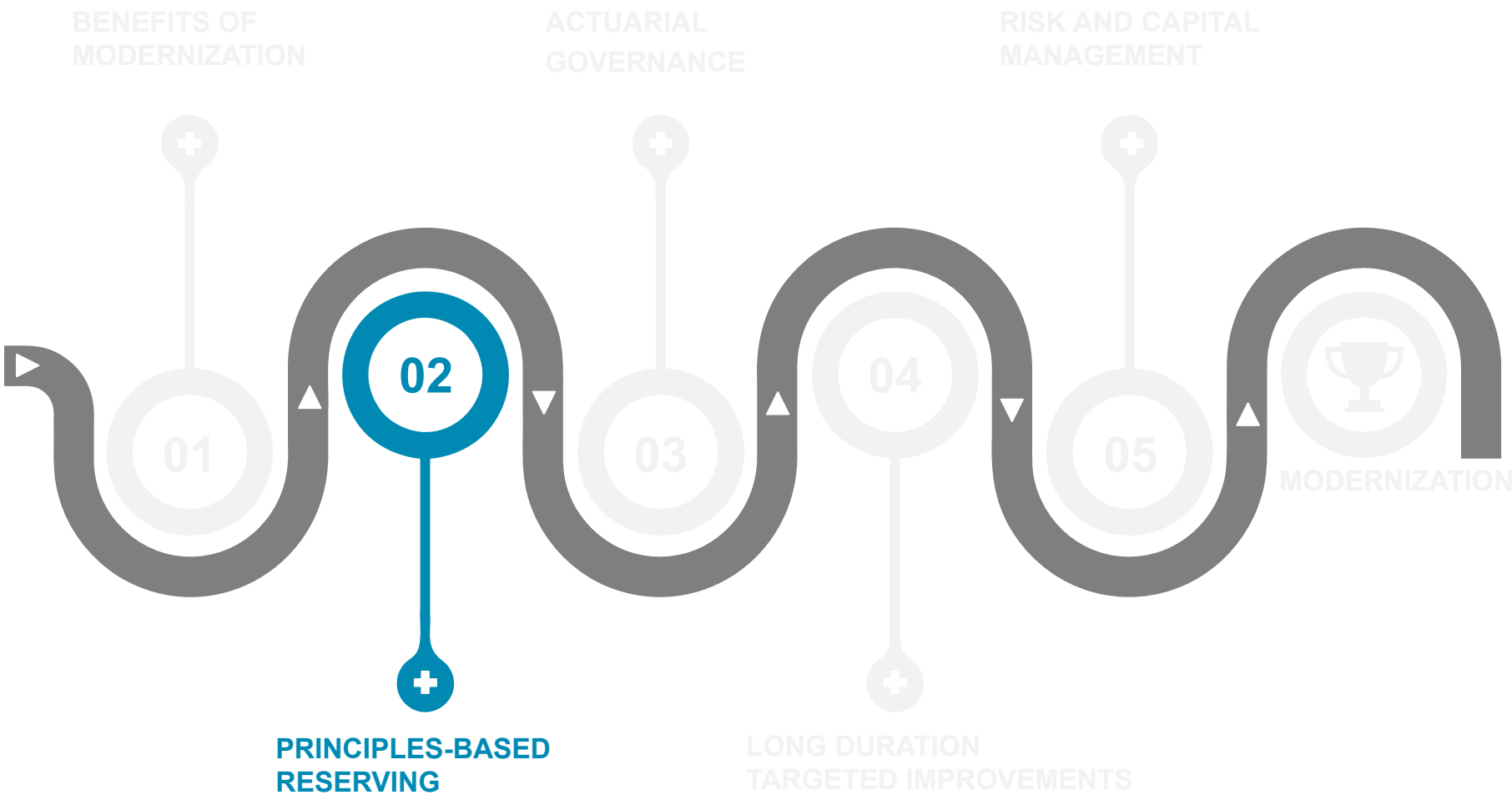
9. Stakeholder communication

Benefits of actuarial modernization



2 | Life PBR: It’s here, now what?

Roadmap to modernization



Agenda

Background and key findings

Analysis to date

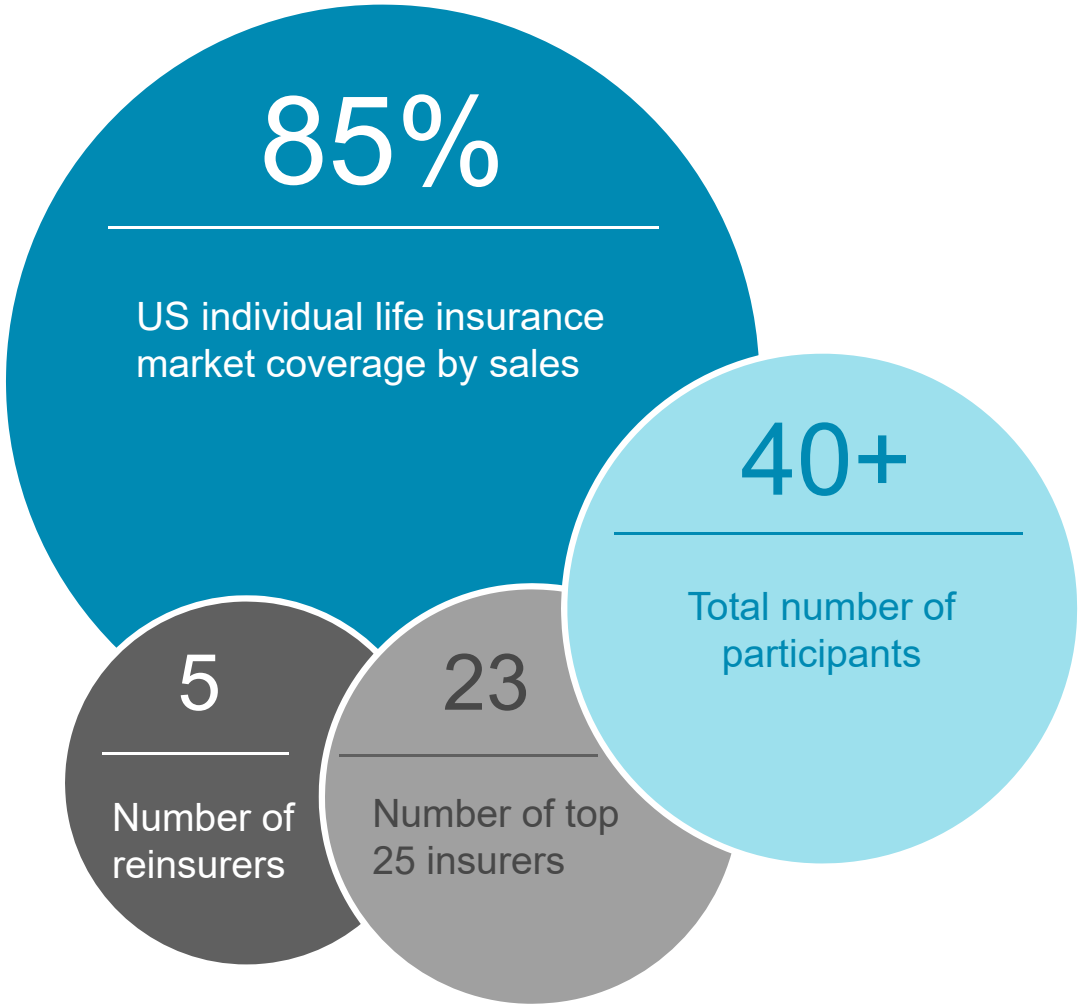
Assumptions and margins

Emerging topics

2.1 Background and key findings

Background

This presentation contains select results from a survey that Oliver Wyman conducted in 2019 related to PBR implementation plans and emerging topics

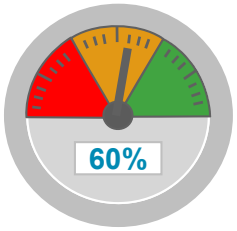


Respondents were asked to describe their practices as of December 31, 2018

2.2 Analysis to date

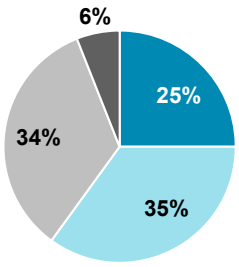
All products

PBR has been analyzed on more than half of survey participants' products and implementations are heavily back-loaded

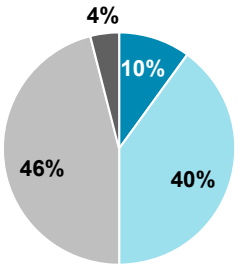


60% **Life writers have analyzed the impact of PBR on more than half their products**

Impact on reserves
% of Life products



Impact on profitability
% of Life products



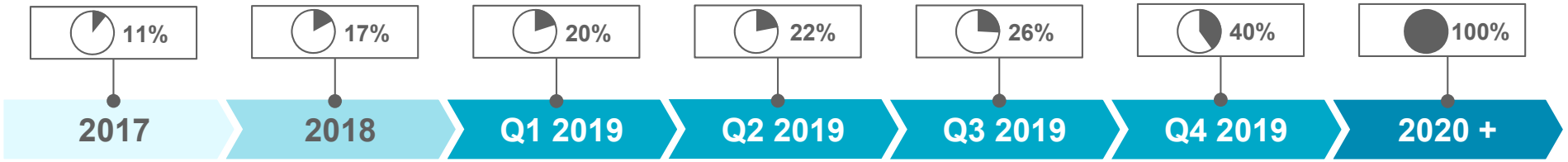
- Large Decrease (-)
- Small Decrease (-)
- No impact
- Small Increase (+)
- Large Increase (+)

Exclusion testing
% of Life products

50% of products for which writers anticipate passing stochastic exclusion tests

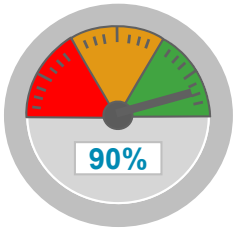
23% of products for which writers anticipate passing deterministic exclusion tests

% of Life products on PBR
Across all participants



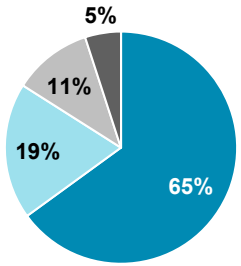
Term

A large majority of writers have analyzed PBR on their Term products and tend to see large reserve decreases

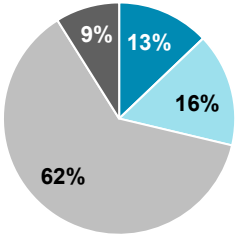


90% of Term writers have analyzed the impact of PBR on their offerings

Impact on reserves
% of Term writers



Impact on profitability
% of Term writers



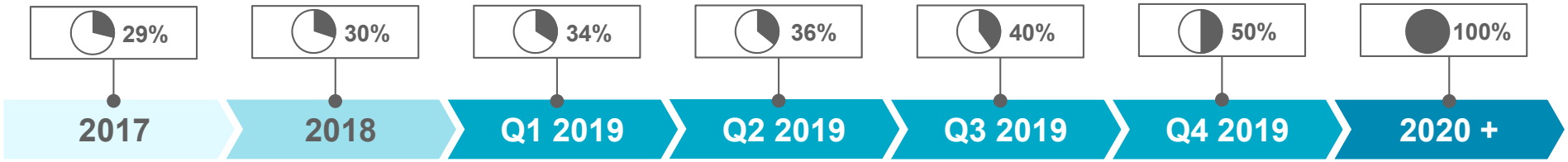
- Large Decrease (-)
- Small Decrease (-)
- No impact
- Small Increase (+)
- Large Increase (+)

Exclusion testing
% of Term writers

85% of writers anticipate passing stochastic exclusion tests

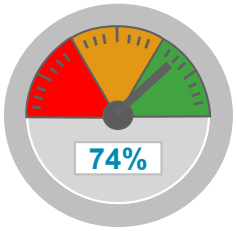
0% of writers anticipate passing deterministic exclusion tests

% of Term products on PBR
Across all participants%



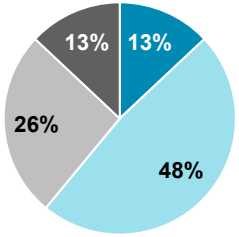
Universal life with secondary guarantee (ULSG)

PBR readiness for ULSG is the second highest and most participants are seeing small changes in profitability under PBR

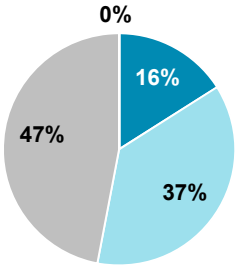


74% of ULSG writers have analyzed the impact of PBR on their offerings

Impact on reserves
% of ULSG writers



Impact on profitability
% of ULSG writers



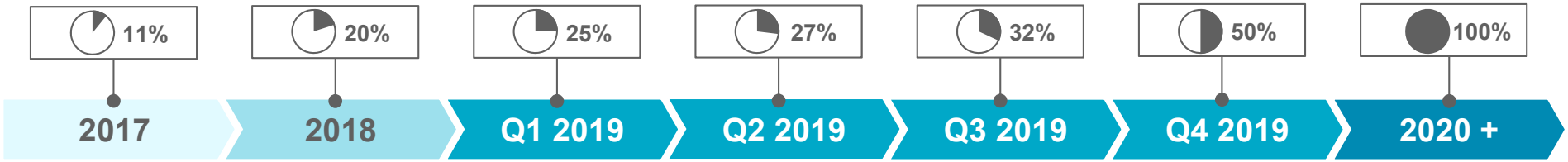
- Large Decrease (-)
- Small Decrease (-)
- No impact
- Small Increase (+)
- Large Increase (+)

Exclusion testing
% of ULSG writers

21% of writers anticipate passing stochastic exclusion tests

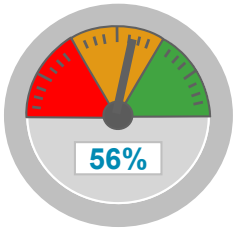
0% of writers anticipate passing deterministic exclusion tests

% of ULSG products on PBR
Across all participants



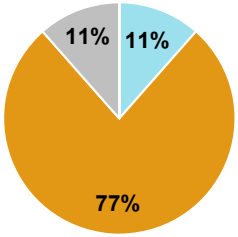
Whole Life (WL)

Adoption is delayed to Q4 2019 and beyond for a majority of WL writers and most expect to be exempt from modeled reserve requirements

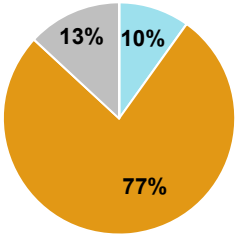


56% of WL writers have analyzed the impact of PBR on their offerings

Impact on reserves
% of WL writers



Impact on profitability
% of WL writers



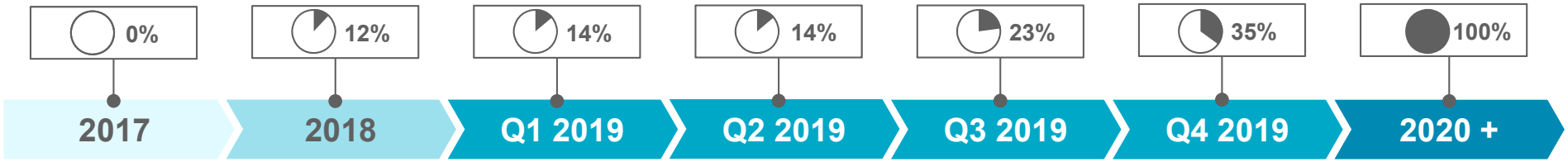
- Large Decrease (-)
- Small Decrease (-)
- No impact
- Small Increase (+)
- Large Increase (+)

Exclusion testing
% of WL writers

87% of writers anticipate passing stochastic exclusion tests

77% of writers anticipate passing deterministic exclusion tests

% of WL products on PBR
Across all participants

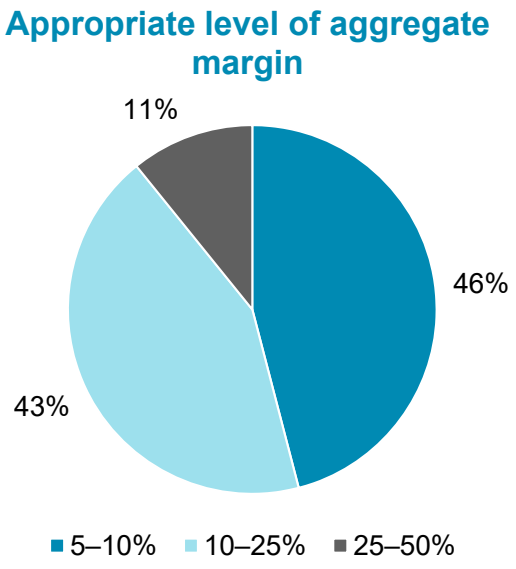


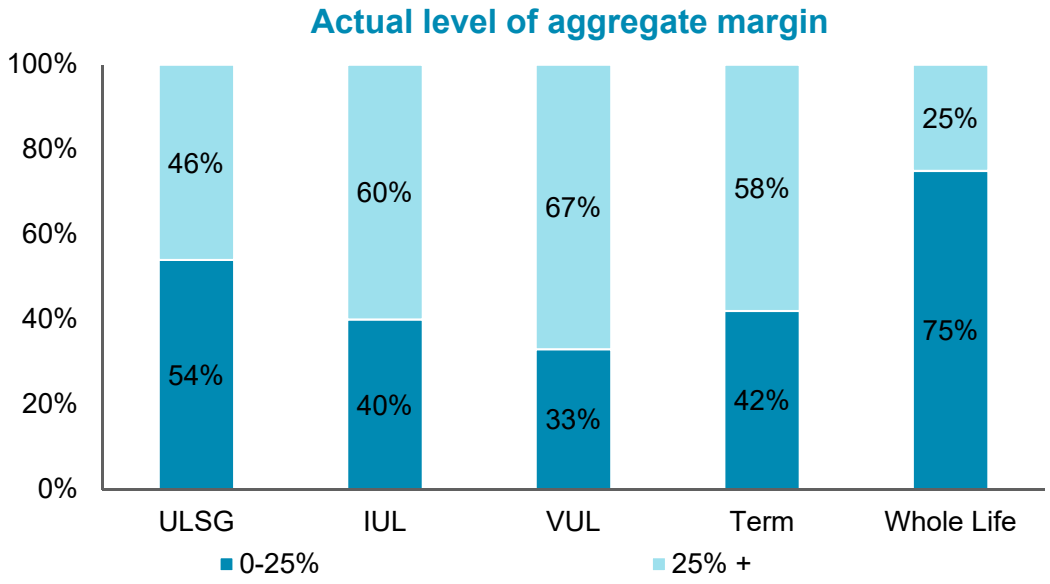
2.3 Assumptions and margins

Aggregate margin levels

Reserve margins are more than double what participants feel is an appropriate level for Term, ULSG, IUL, and VUL

89% of participants think an appropriate level of aggregate margin is less than 25%





Note: ULSG includes IUL SG and VUL SG

Observed margins in excess of 25% are common across all product types

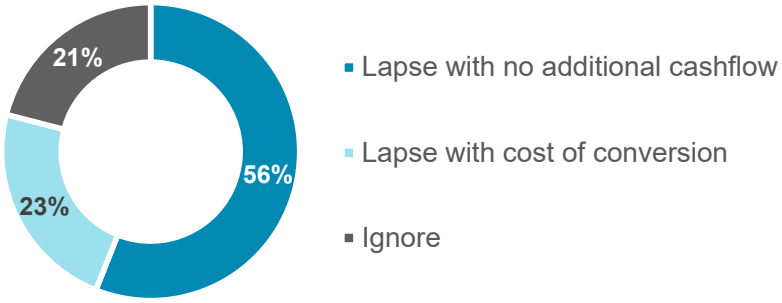
2.3 Emerging topics

Conversions

A wide range of practice exists for the incorporation of conversion options into PBR

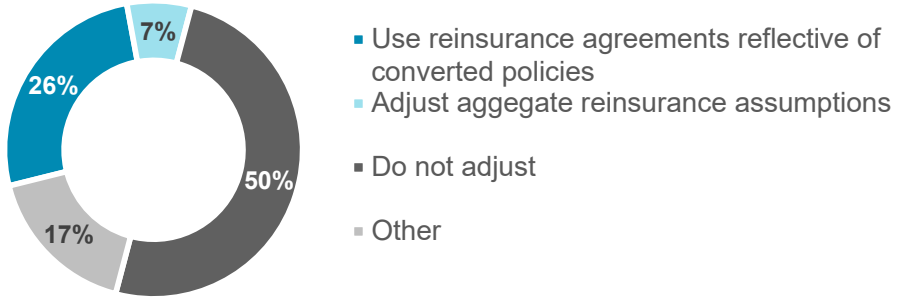
Methodology: Term reserves

Which of the following best describes your approach to recognizing Term conversions in your Term reserves (DR and if applicable, SR)?



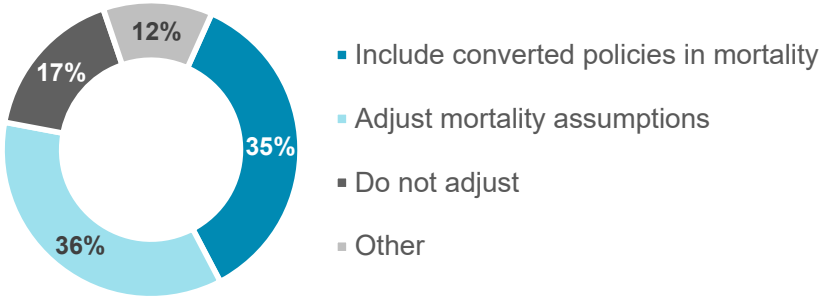
Methodology: Permanent reserves

Which of the following are you doing to reflect conversions in your permanent product reserves (DR and if applicable, SR)?



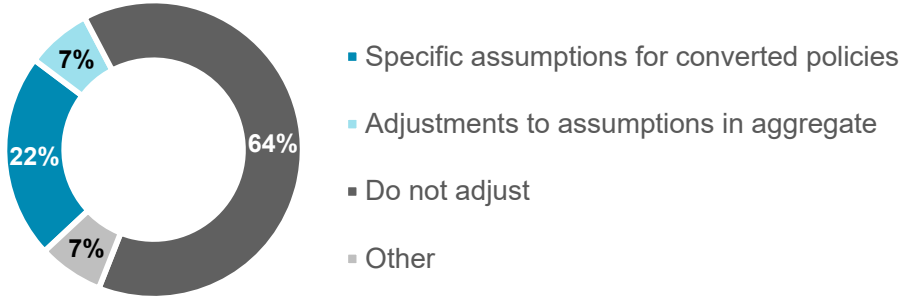
Assumptions: Mortality

How are conversions treated with respect to mortality?



Assumptions: Other updates for conversions

Are other adjustments made to assumptions to account for conversions?

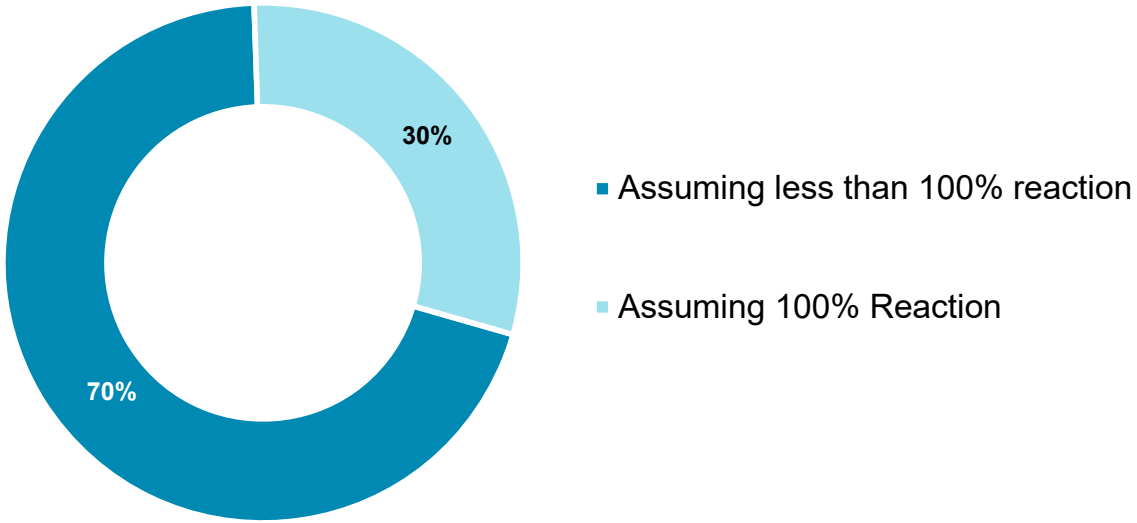


Reinsurance

PBR has necessitated robust modeling of reinsurance and may have an impact on reinsurance treaties

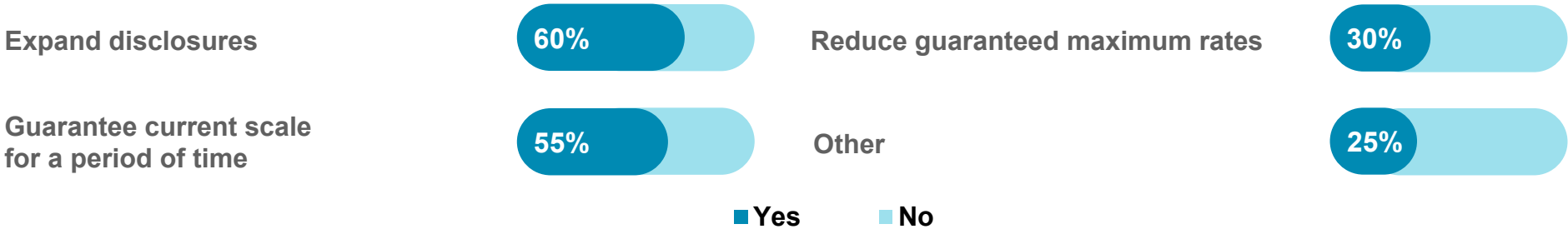
YRT modeling approach

Nearly three-quarters of companies are assuming less than 100% reaction to adverse mortality under PBR



Potential changes to reinsurance arrangements

Close to a third of companies anticipate making changes to their reinsurance agreements because of PBR, with the prevalence of various changes summarized below (as a percent of those that anticipate making changes)



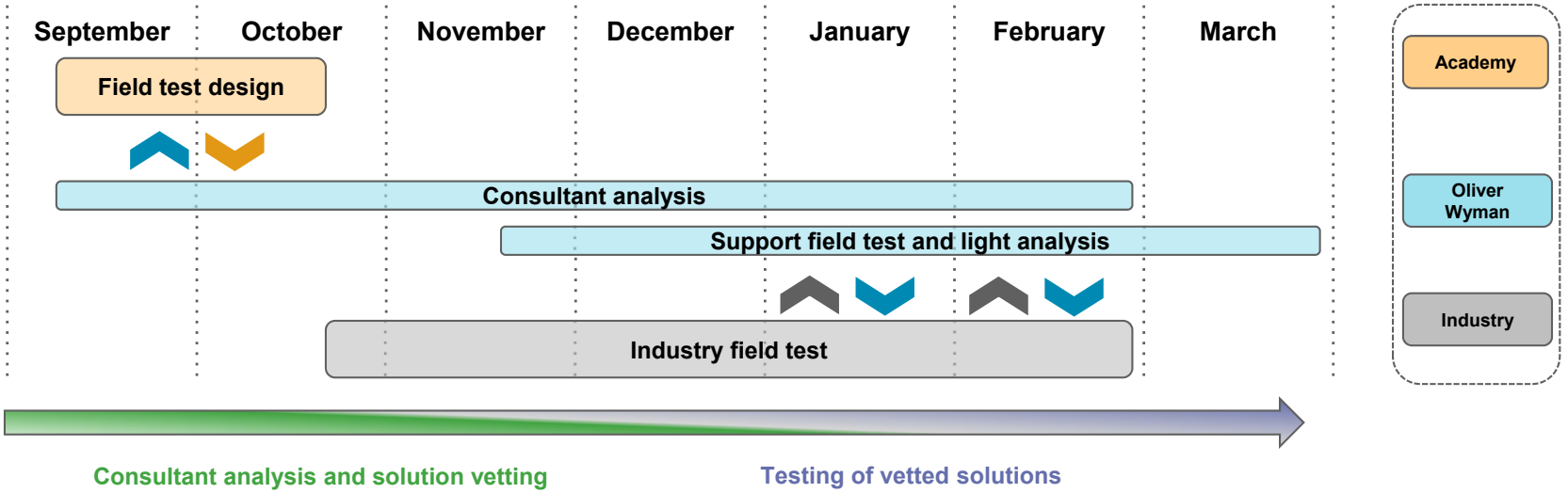
Reinsurance
June 2019 LATF decision on non-guaranteed reinsurance

APF number	APF 2019-39
Applicability	Business issued in 2020 and beyond; optional to business on PBR in 2017-19
Modeling of reinsurance	Not required
Reserve credit for reinsurance	½ C_x
Solution	Temporary

Link to APF: https://naic.org/documents/cmte_a_latf_exposure_apf_2019-39_revised.docx

Reinsurance

Field testing will inform a long-term solution on the treatment of non-guarantee reinsurance under PBR



Consultant analysis and solution vetting

- Field test participants will prepare their models for the field test. Analysis across a range of products and reinsurer-action scenarios to provide regulators with representative results which inform the impacts from potential solutions on an apples-to-apples basis
- The industry field test will commence; initially the focus will be on model preparation and testing of simple solutions with a goal of identifying model challenges and testing the integrity and range variability

Testing of vetted solutions

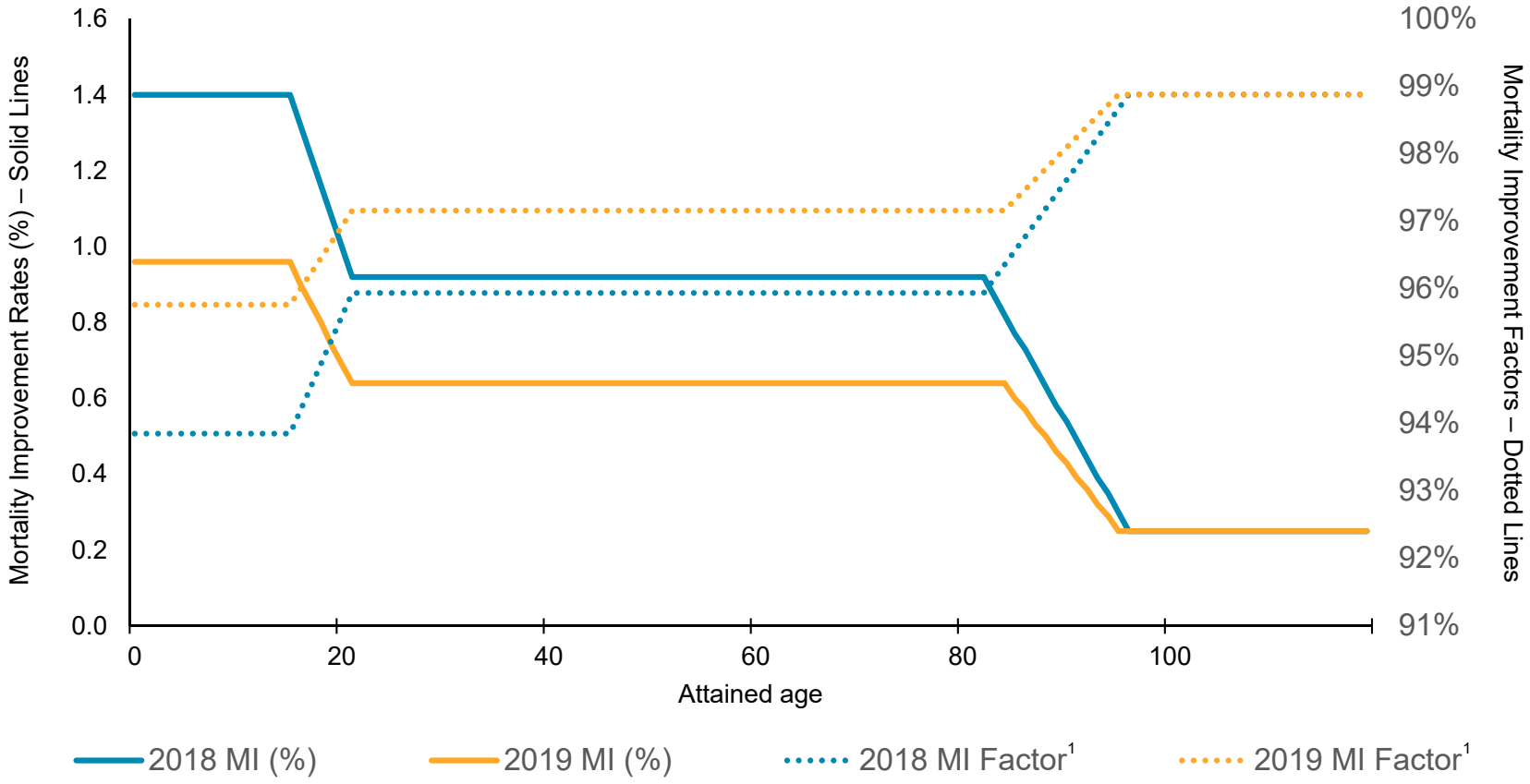
- Field test participants will produce results for the various solutions. The results of this test will give regulators additional comfort with the analysis by extending the range of results for optionality and variation not previously captured.

The goal is to allow regulators to make a decision in time for inclusion in the 2021 Valuation Manual

Mortality

Prescribed industry mortality improvement rates have been reduced up to age 95, resulting in higher PBR mortality rates

Male

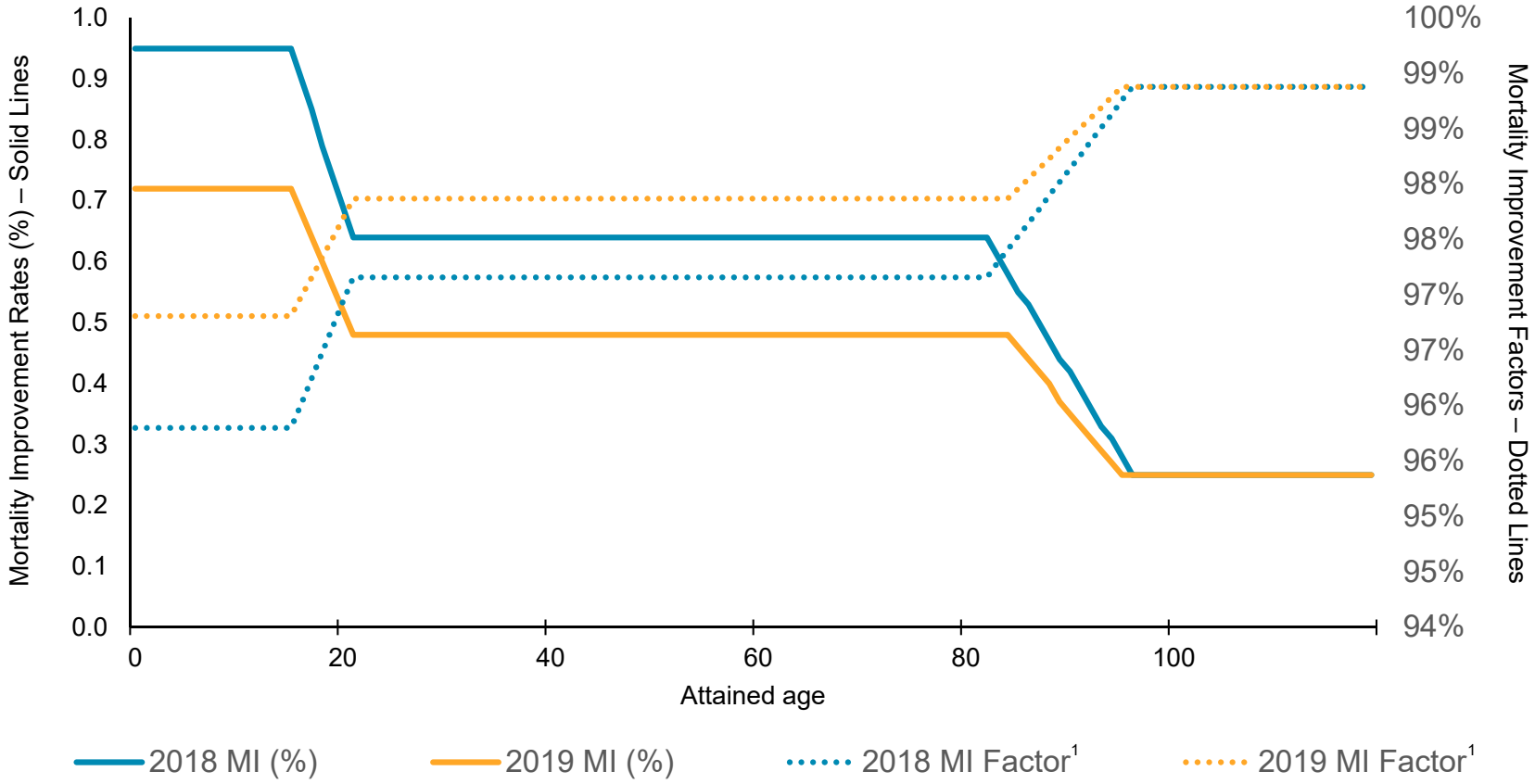


[1] Mortality improvement factors reflect historic improvement from the "as of" date of the 2015 VBT tables to 12/31/2019

Mortality

Prescribed industry mortality improvement rates have been reduced up to age 95, resulting in higher PBR mortality rates

Female



[1] Mortality improvement factors reflect historic improvement from the "as of" date of the 2015 VBT tables to 12/31/2019

Mortality

The mortality assumption uses prescribed margins and incorporates grading to an industry table for durations at which credible data no longer exists

PBR Mortality Assumption

	Applicable Duration*	Assumption Structure
1. 100% Experience Phase	Duration < Sufficient data period + maximum years before grading start	**Experience Best Estimate** ⊠ **(1 + Experience Margin**)**
2. Grading to Industry Phase	Duration between 1) and 2)	Linearly Grade from 100% of Company (1) to 100% of Industry (2)
3. 100% Industry Phase	Duration > Sufficient data period + maximum end point for grading	**2015 VBT** ⊠ **(1 + Industry Margin)**

*Sufficient data period and other grading parameters are a function of the credibility of the underlying experience
**Experience margin is a function of credibility of experience (Limited Fluctuation or Bühlmann) and attained age

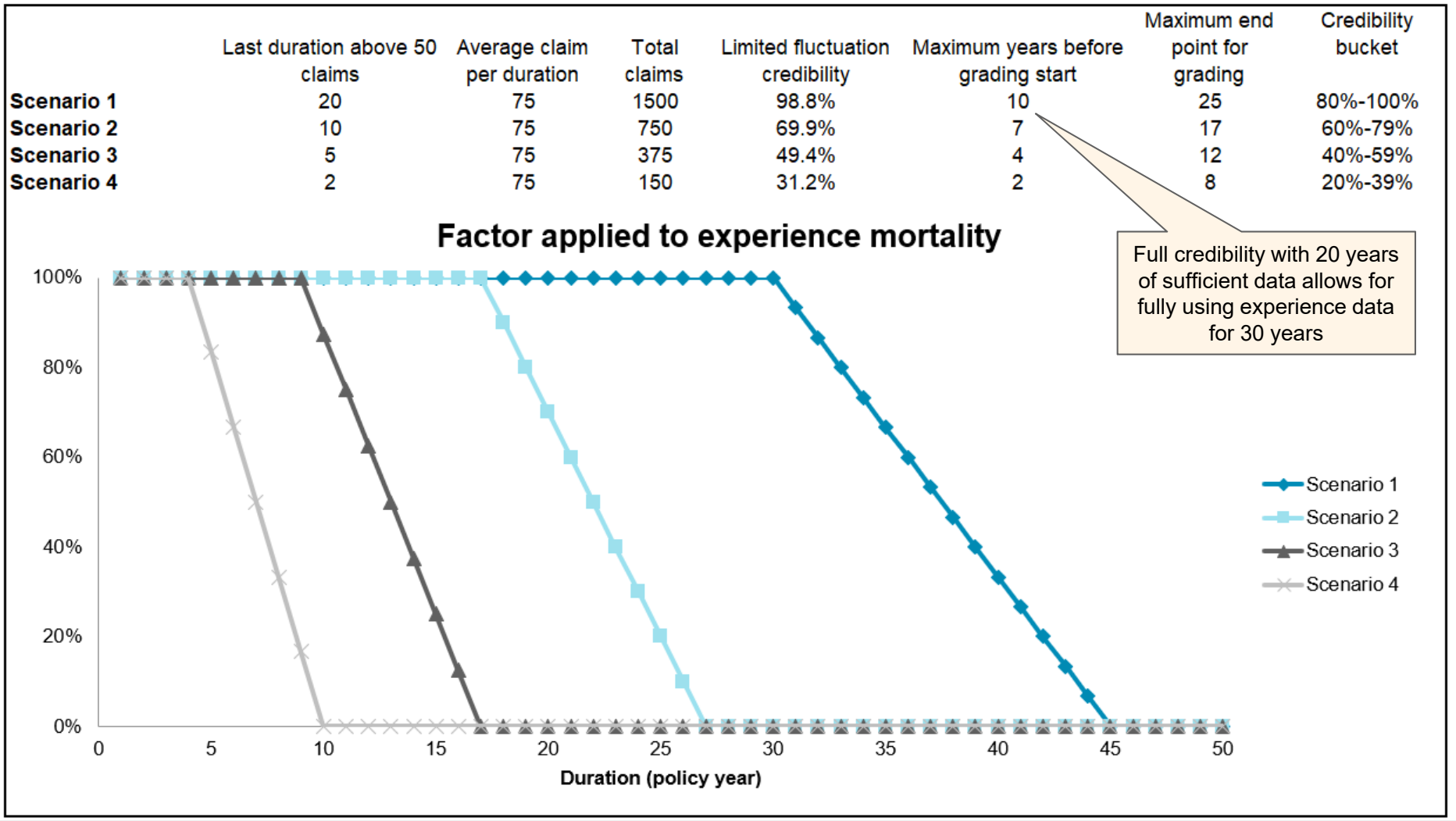
Examples of grading are provided on the next slide for varying levels of credibility

Mortality

The grading to the industry table is a source of margin which is minimized at higher credibility levels and longer sufficient data periods

Grading Factors (Experience)

	Last duration above 50 claims	Average claim per duration	Total claims	Limited fluctuation credibility	Maximum years before grading start	Maximum end point for grading	Credibility bucket
Scenario 1	20	75	1500	98.8%	10	25	80%-100%
Scenario 2	10	75	750	69.9%	7	17	60%-79%
Scenario 3	5	75	375	49.4%	4	12	40%-59%
Scenario 4	2	75	150	31.2%	2	8	20%-39%



Key takeaways

The industry is in the final stretch of the phase-in period and regulators continue to weigh in on areas where significant discretion exists

PBR Emerging Practices

Analysis to date

- PBR implementations are heavily back-loaded, with 75% of participants' products moving to PBR in Q3 2019 and later
- Less than 20% of participants' products were on PBR at the end of 2018 with delayed implementation more prevalent for accumulation oriented products (WL, UL, IUL, VUL)

Assumptions and margins

- Reserve margins are more than double what participants believe to be an appropriate level for Term, ULSG, IUL, and VUL
- Before the LATF decision, a third of the surveyed companies anticipated making changes to reinsurance agreements as a result of PBR. In general, participants had trended toward more conservative modeling approaches compared to our prior years survey.

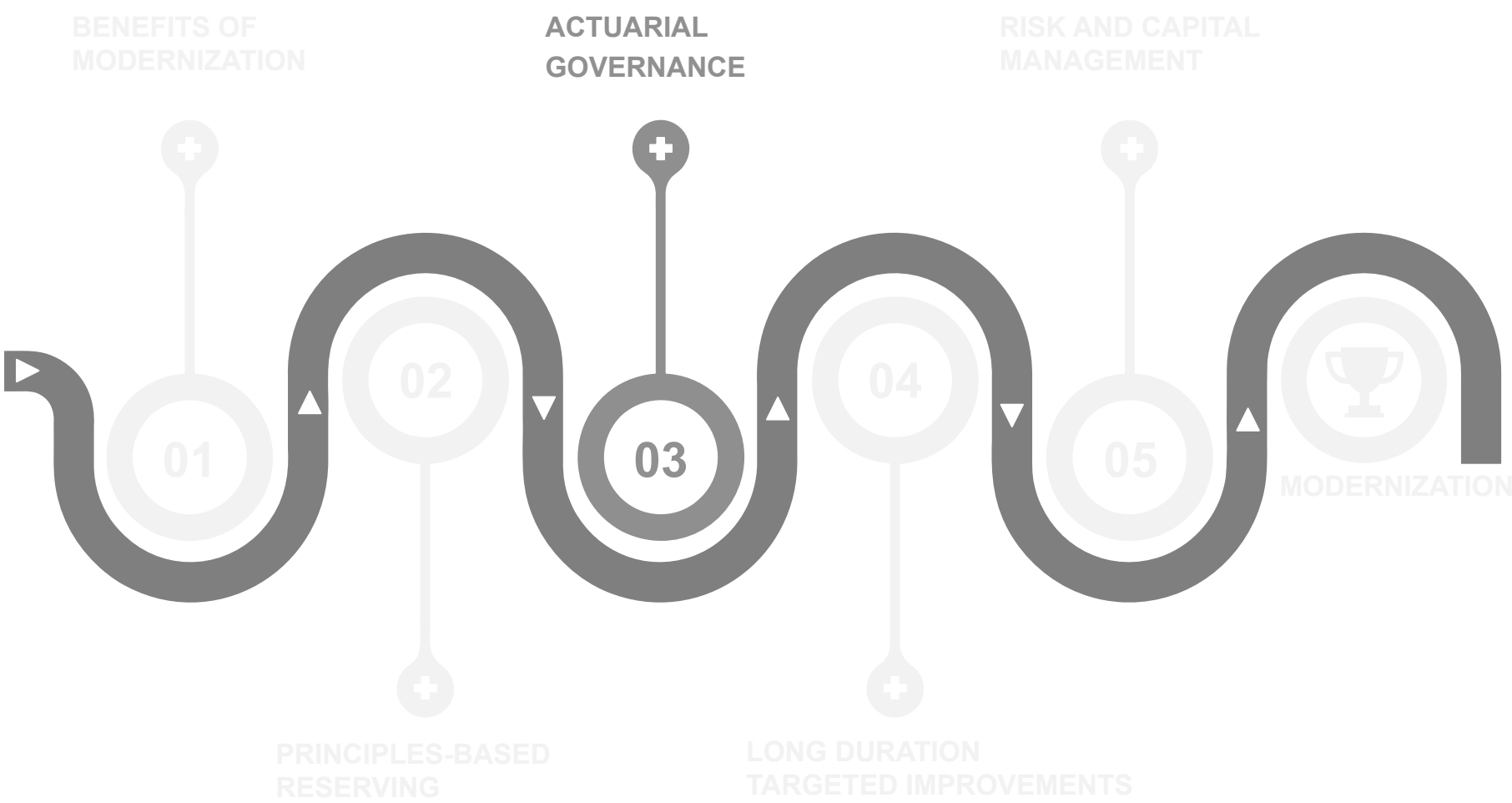
Emerging topics

- The recent temporary prescription on non-guaranteed YRT rates sets a precedent of regulatory intervention where significant discretion exists
- VM-20 allows for changes that will impact prudent estimate assumptions, even in cases where the underlying company experience has not changed

Questions

3 Actuarial governance

Roadmap to modernization



Actuarial governance

Governance supports actuarial modernization

Model governance

Assumption governance

Data governance

Ongoing review procedures, clear controls, and a risk mitigation framework make modernization efforts last

3.1 Model governance

Model governance helps manage risk

Three dimensions of governance reduce the risk that models are misused or not working as intended

Oversight

- Governance framework including roles, responsibilities, and standards
- Model inventory and risk assessment

Development & use

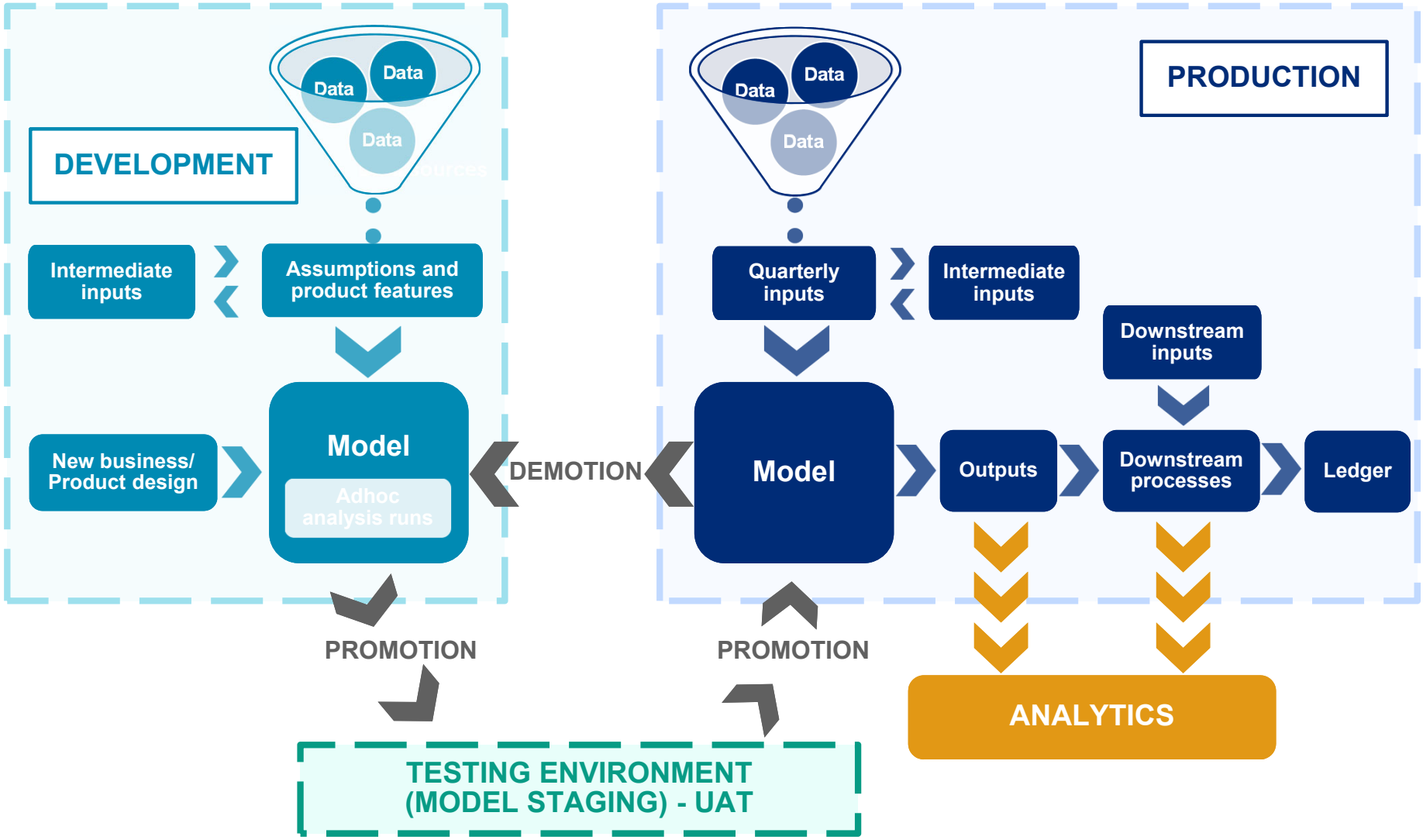
- Separate production and sandbox environments
- Change controls
- Input and output management
- Documentation

Validation

- An ongoing & independent verification activity
- Ensures that models calculations are performing as expected and used consistently with intended purpose

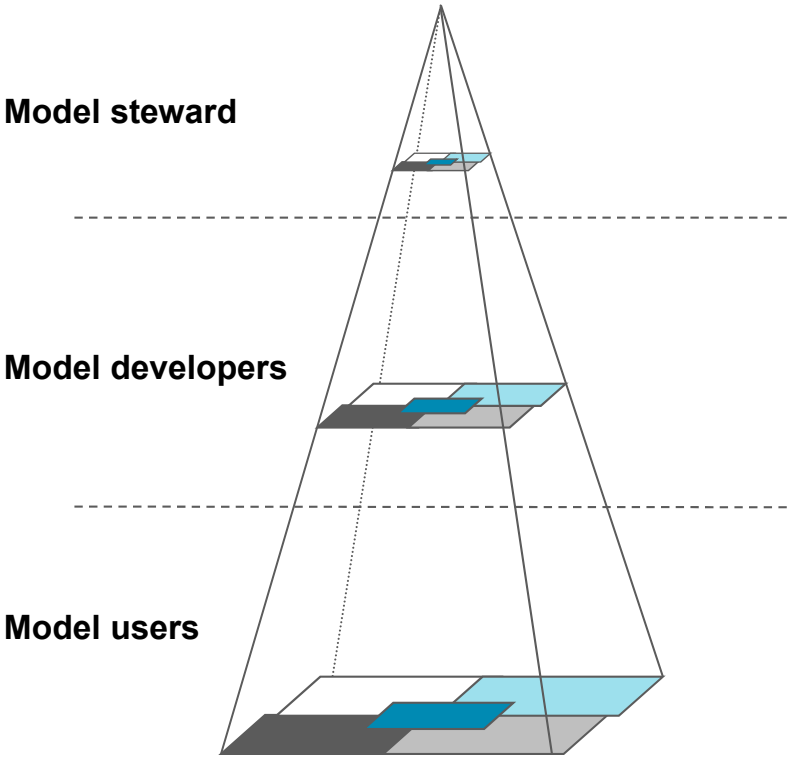
Model development and use

Separate production and development environments plus analytic tools that do not affect results are sensible architecture components



Model oversight
How are roles defined and who is responsible?

Roles



Framework

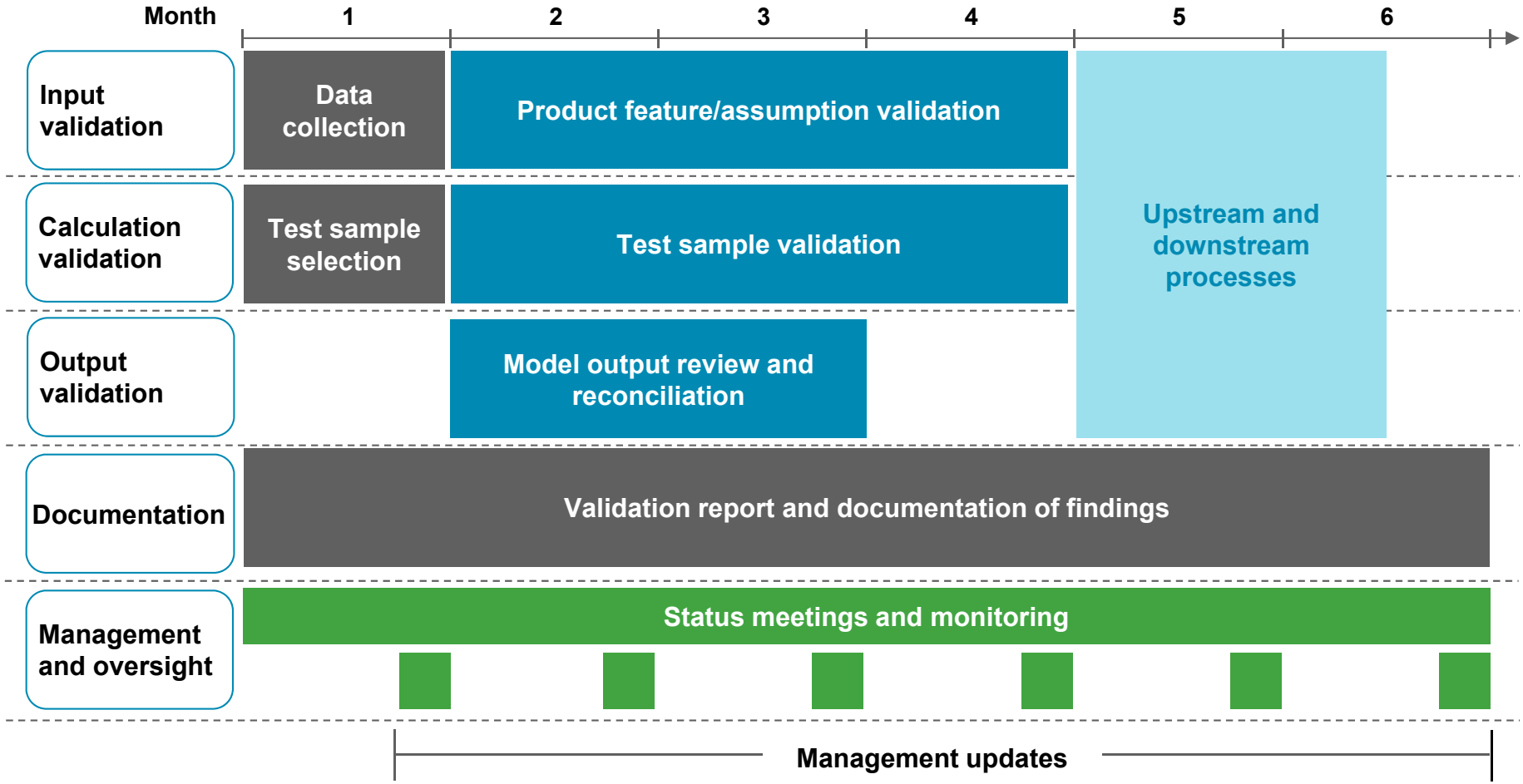
- Who at the company is responsible for governance? Is the function centralized or decentralized?
- If a central vetting team is used, is it reasonable to expect the team to be experts across all lines of business and valuation bases? If not, then can they fully assess the “fit for purpose”?
- Is the same group responsible for implementation and execution of the policy?
- Should the model standards give guidance for other specific roles, e.g., model developers, model testers, model users?

Clearly assigned responsibilities promote accountability and reduce duplicated effort

Illustrative timeline

Model validation

Elements that affect a validation project timeline include purpose, complexity, degree of uncertainty, breadth of use, materiality



Validating a high risk model is a stand-alone activity and should be integrated into a continuous validation framework covering all major modeling activities

Common pitfalls in applying model governance

These themes are practical barriers to effective model risk management

“IT’S NOT A MODEL”

CHAMPIONS WITH LIMITED INFLUENCE

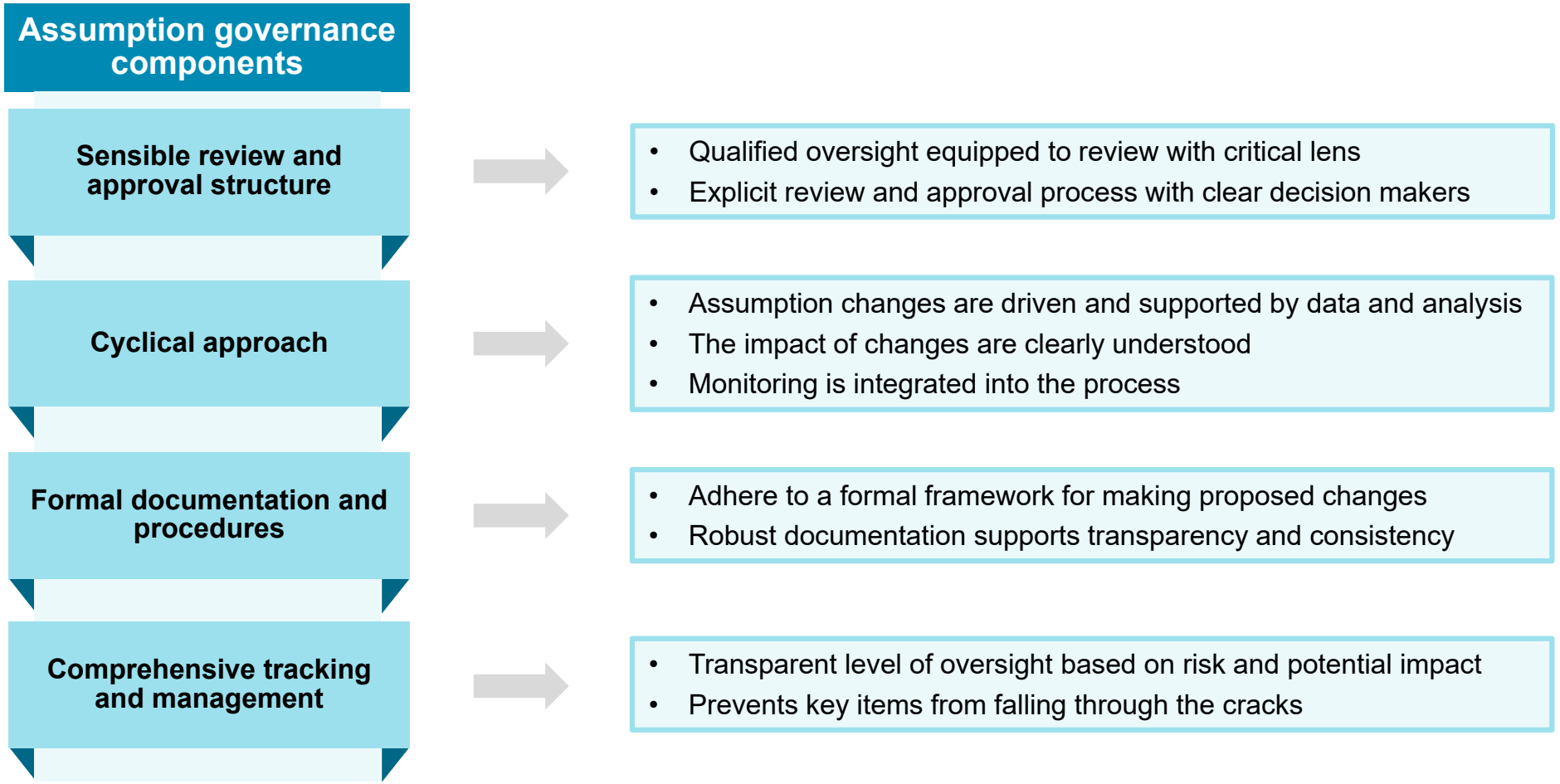
ONEROUS STANDARDS

Addressing the human and practical elements of model risk management supports more effective oversight, validation, and use

3.2 Assumption governance

Assumption governance

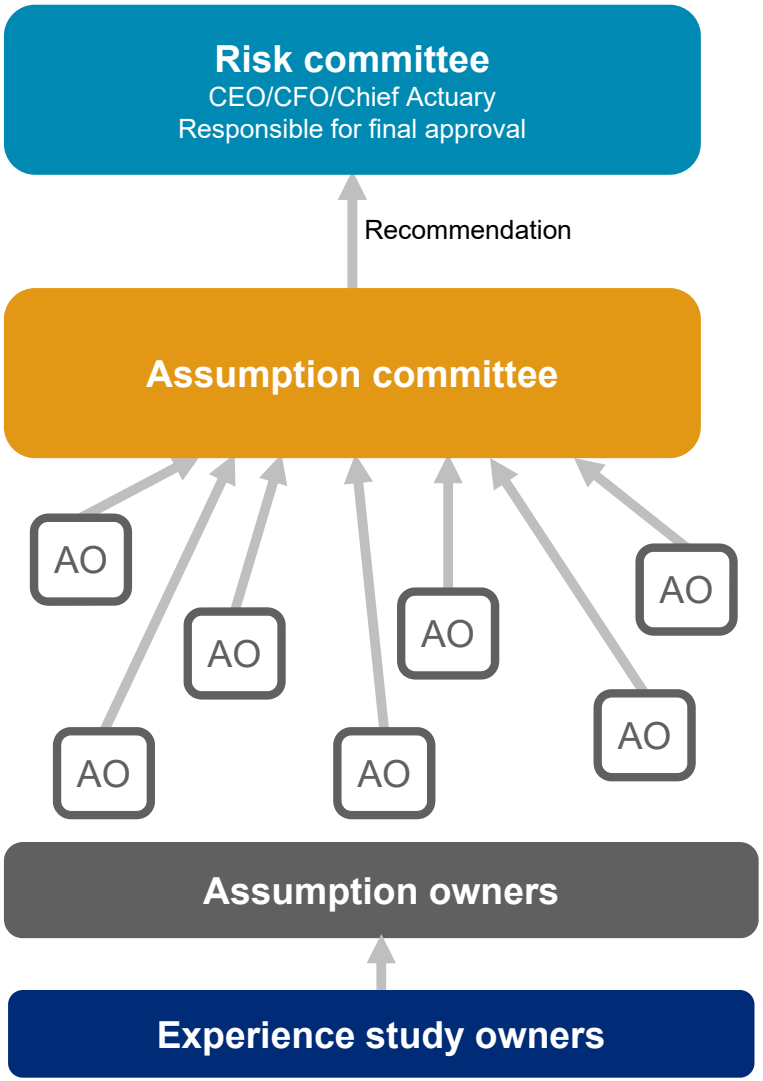
Increased internal complexity and regulatory scrutiny has driven the industry towards reinventing how assumptions are managed

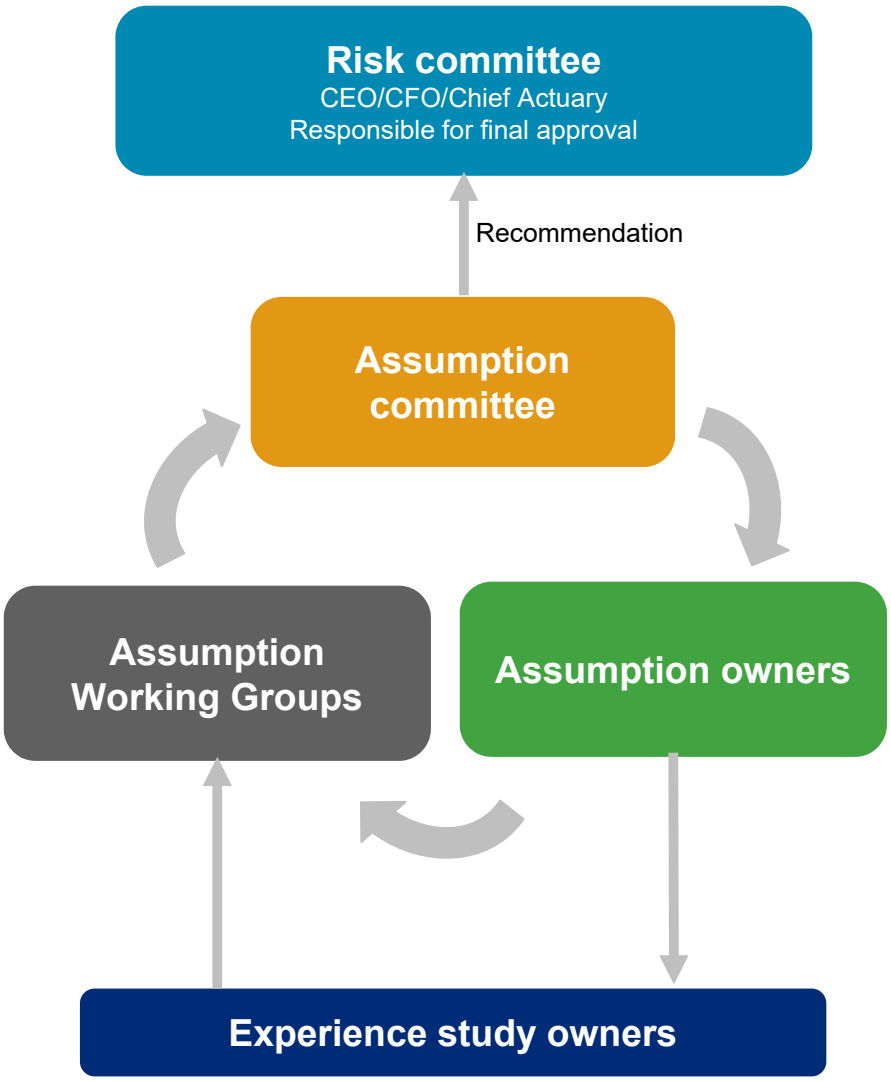


These are components of a well-controlled assumption governance

Assumption review and approval structure

Diverse practices have emerged in the industry to address the challenges of complexity, materiality, and scale





Assumption governance cycle
Detailed steps

New assumptions
- Due to:
  - A newly issued product
  - New methodologies or accounting practices
  - Better data

Data and experience studies
- Refresh data
- Transform into usable format
- Calculate experience studies

Analysis and recommendation
- Analyze experience study
- Consider external data sources
- Propose recommended assumption

Impact assessment
- Calculate financial impacts
- Conduct sensitivity tests
- Refine assumption as necessary

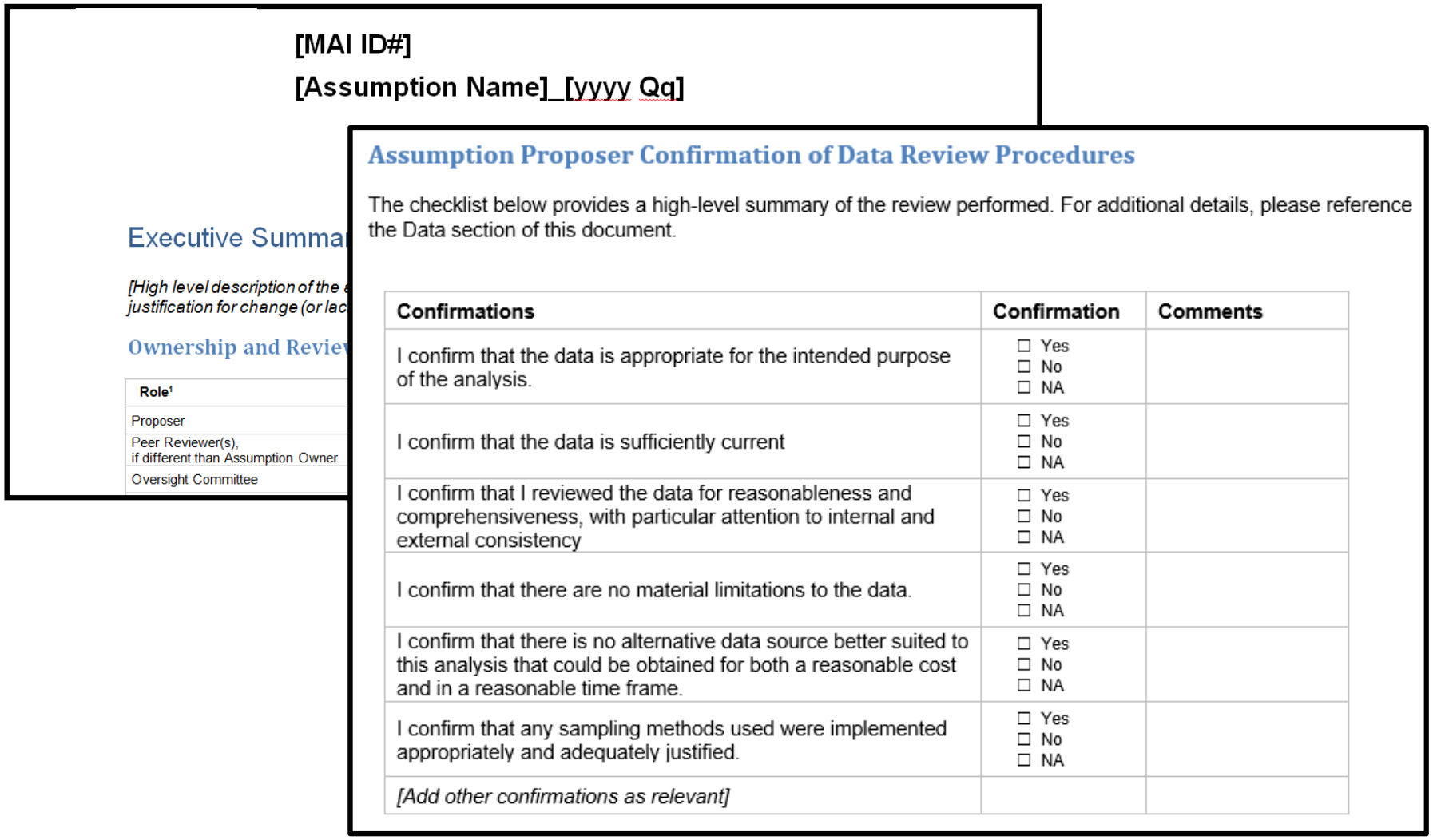
Controls and monitoring
- Peer review assumption
- Challenge assumption using focused working groups
- Formal committee approval
- Continuously monitor assumption
- Restart the development process as new data and results emerge

Iteration

Committee rejection

Assumption proposal process and documentation requirements

Formal documentation and proposal process supports changes that are transparent, fully understood, and hold up to independent scrutiny



[MAI ID#]

[Assumption Name]_[yyyy Qq]

Executive Summa

[High level description of the a
justification for change (or lac

Ownership and Reviev

Role[1]
Proposer
Peer Reviewer(s), if different than Assumption Owner
Oversight Committee

Assumption Proposer Confirmation of Data Review Procedures

The checklist below provides a high-level summary of the review performed. For additional details, please reference the Data section of this document.

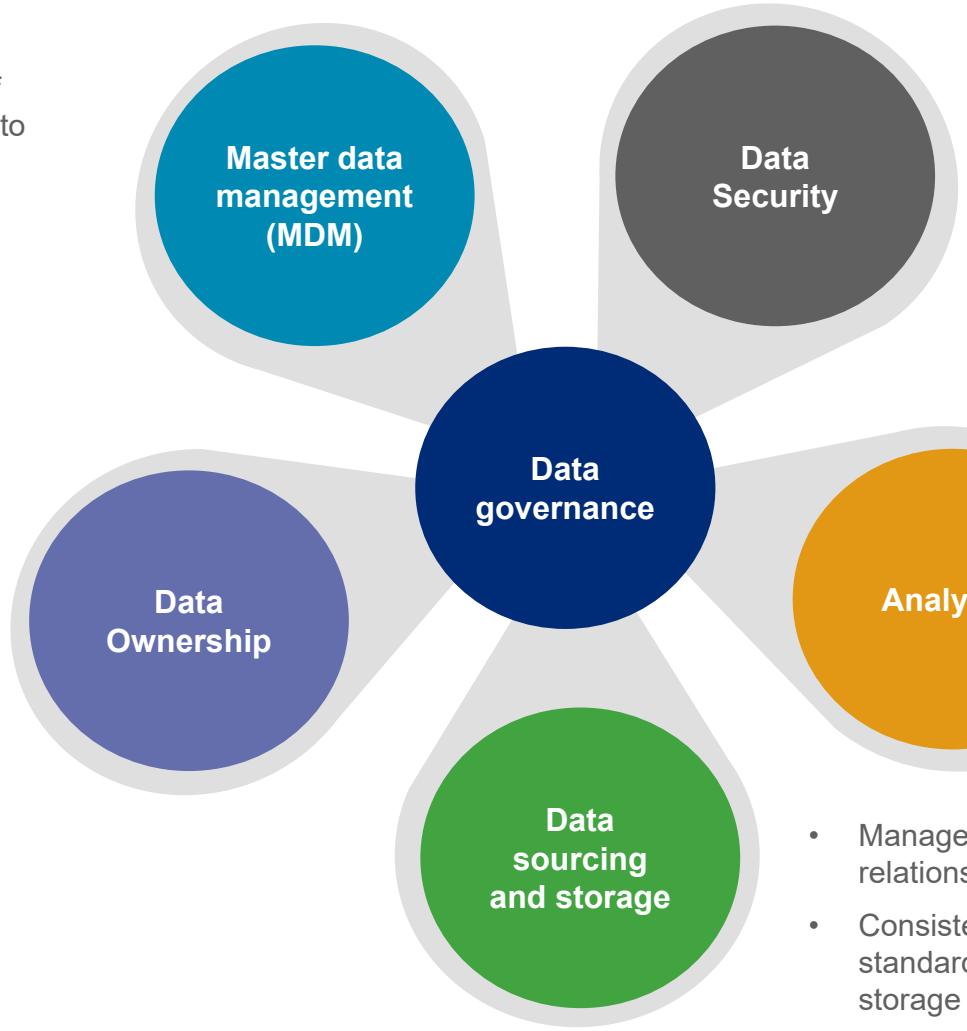
Confirmations	Confirmation	Comments
I confirm that the data is appropriate for the intended purpose of the analysis.	☐ Yes ☐ No ☐ NA	
I confirm that the data is sufficiently current	☐ Yes ☐ No ☐ NA	
I confirm that I reviewed the data for reasonableness and comprehensiveness, with particular attention to internal and external consistency	☐ Yes ☐ No ☐ NA	
I confirm that there are no material limitations to the data.	☐ Yes ☐ No ☐ NA	
I confirm that there is no alternative data source better suited to this analysis that could be obtained for both a reasonable cost and in a reasonable time frame.	☐ Yes ☐ No ☐ NA	
I confirm that any sampling methods used were implemented appropriately and adequately justified.	☐ Yes ☐ No ☐ NA	
[Add other confirmations as relevant]		

3.3 Data governance

Data governance

Increasing demand for data is driving governance frameworks that focus on the effectiveness of managing, securing, storing, and using data

- Manage single repository of master data and definitions to improve data quality
- Manage business rules and lookup data
- Source of dimensions for analytical reporting



- Provide cyber security to structured and unstructured data
- Prevent unauthorized access
- Security to manage data workflows by data ownership
- Security to manage master data

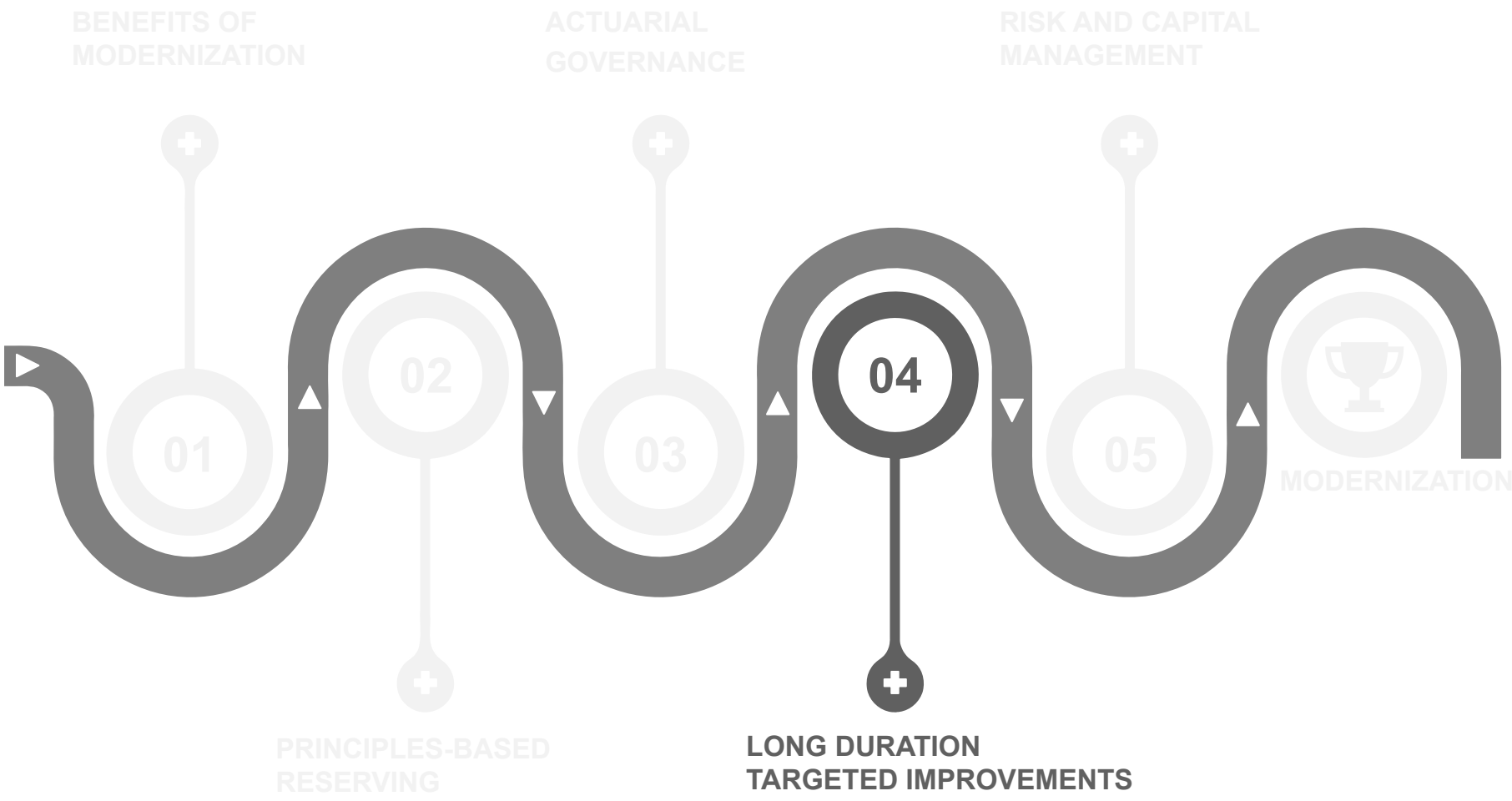
- Segregate data by ownership (e.g., life vs annuities)
- Assign data owners, stewards, and custodians

- Encourage and enable self service reporting
- Use analytics to improve data quality
- Manage reporting refresh time

- Manage data classifications and relationships
- Consistent transformation and standardization for structured data storage
- Manage unstructured data

4 LTDI: improving more than just GAAP

Roadmap to modernization



Agenda

1 **Overview of LDTI**

2 **Implementation considerations – spotlight on DAC and AP factors**

3 **Organizational considerations**

4.1 Overview of LTDI

GAAP Long Duration Targeted Improvements objectives
Revisions to simplify and enhance financial reporting

Simplify amortization of deferred acquisition costs

Improve timeliness by recognizing changes in expected traditional and limited pay future liability payments

Simplify reporting of market-based guarantees through consistent fair value accounting

Enhance effectiveness of required disclosures

Summary of LDTI changes

	DAC	Traditional liabilities	Market risk Benefits	Disclosures
UL type	✓	✗	✗	✓
Market based guarantees	✓	✗	✓	✓
Long duration traditional type	✓	✓	✗	✓
	• "Straight-line" • No longer tested for impairment • No shadow OCI • Similar changes to "DAC-like" balances	• Unlocking • Best estimate assumptions • Market bond yield discount rates[1] • Interest rate risk to OCI	• All other-than-nominal market risks that provide protection to contract holder measured at fair value • Instrument specific credit risk to OCI	• DAC and liability roll-forwards • Assumptions updates and judgements • LRT/NP cap details • And more…

[1] Cash flows are discounted using upper-medium grade (low credit risk) fixed-income instrument yields.

Opportunities for improvement with LDTI

Data and assumptions

- Modernize data architecture and processes to extract, transform, and load
- Refine assumptions and align with other projection bases

Modeling and validation

- Enhance model functionality, remove simplifications, and adopt new software features
- Review modeling standards and methodology decisions

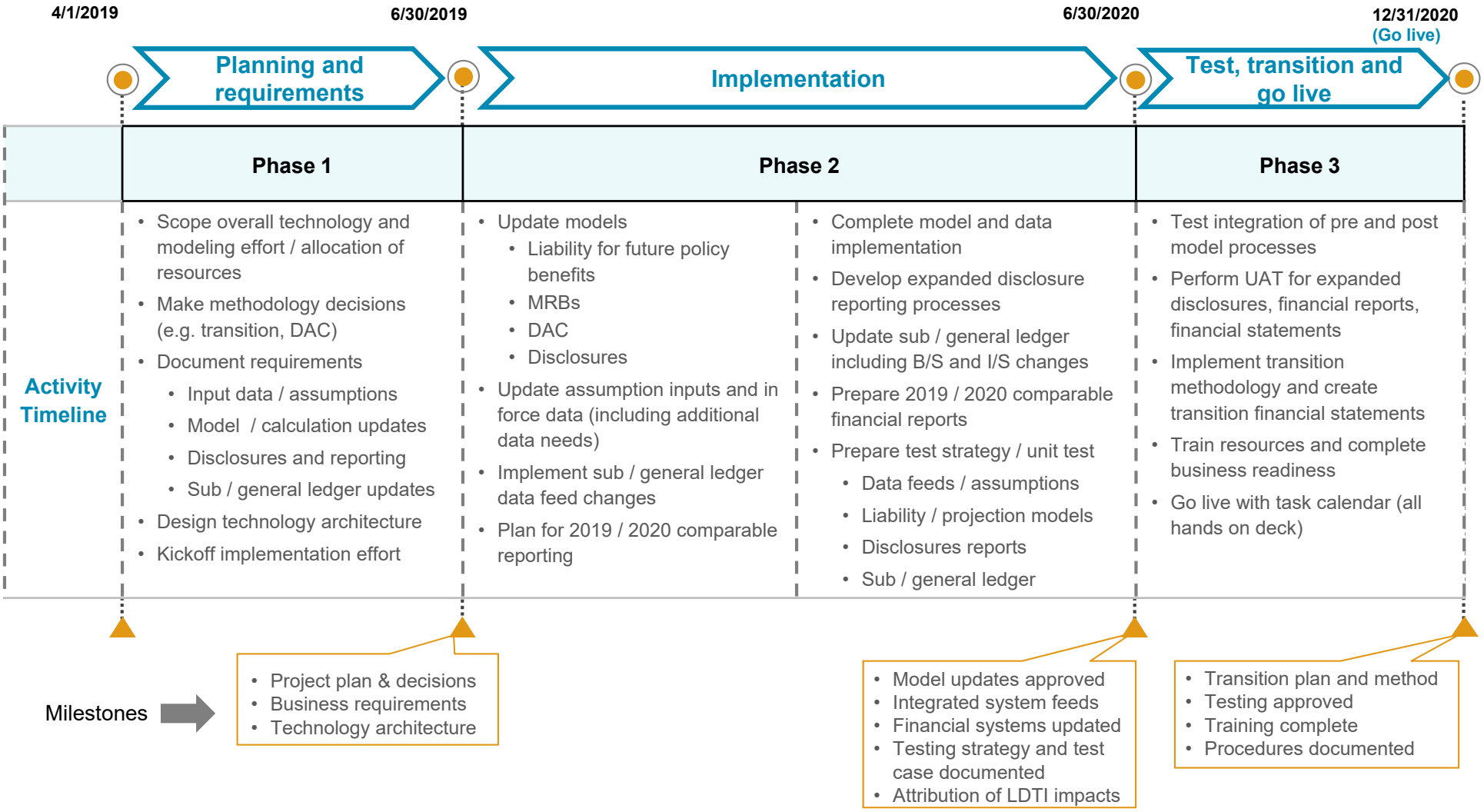
Output and reporting

- Streamline reporting process and minimize downstream processing
- Enhance business decisions through strategic analytics

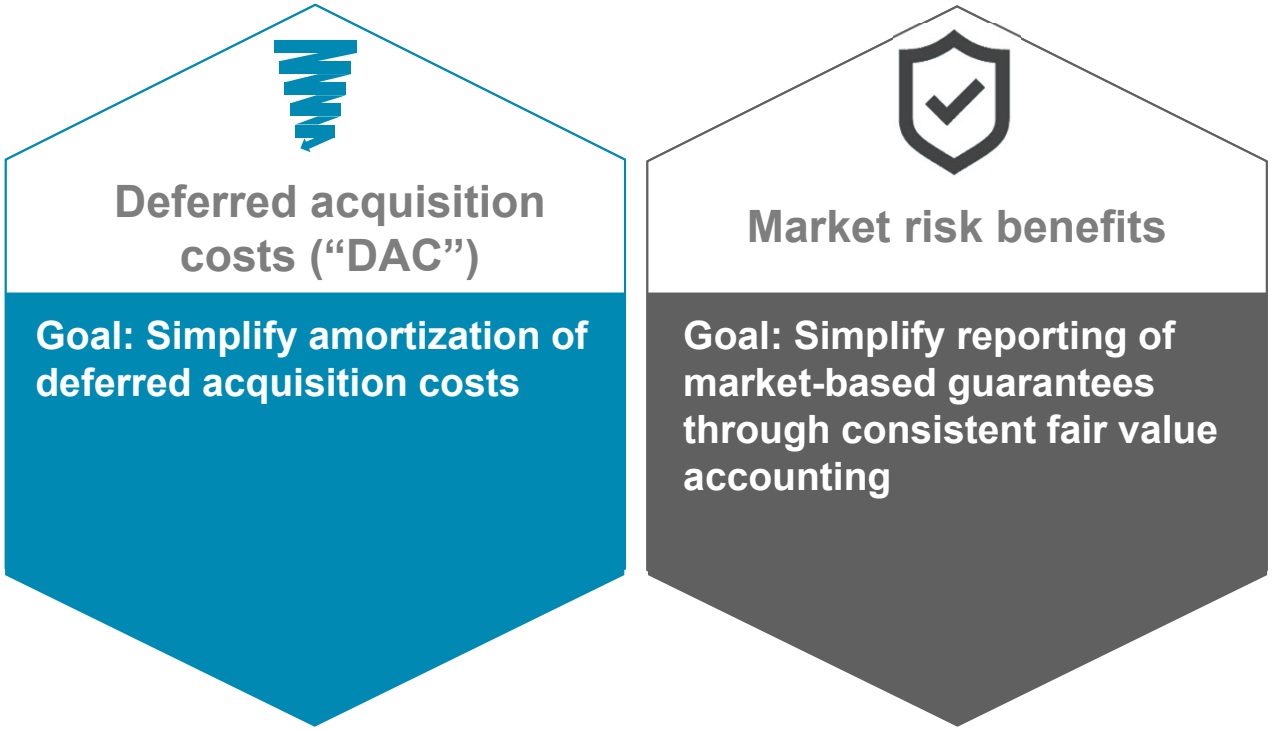
4.2 Implementation considerations

Illustrative LDTI implementation timeline[1]

Implementing changes to comply with ASU 2018-12 will be a multi-year process that will require significant planning, model development, and testing



LDTI implementation considerations – DAC and AP factors
Significant model and data development efforts are required



Simplifying may not be so simple…

LDTI implementation considerations
Deferred acquisition costs ("DAC")

Calculation engine methodology

- Change amortization method to constant-level basis over the expected term of the liability
- Reflect assumption revisions prospectively with measurement starting at beginning of period balance
- Remove future capitalizations from DAC

Input and assumption data

- Update data feeds and assumptions to include actual and projected persistency experience
- Add input fields to facilitate policy grouping (if applicable)
- Make similar updates for unearned revenue and deferred sales inducements

Disclosures and output data

- Update model output, reporting processes and systems for DAC, unearned revenue and deferred sales inducement rollforwards
- Remove shadow DAC AOCI related adjustments from ledger / sub ledger feeds (captured in catch-up adjustment)

LDTI implementation considerations
Market risk benefits ("MRB") – attributed fee ratio recalculations

Calculation engine methodology

- Include fees and claims related to DB and GMIB
- Reflect PV discounting method at time of issue

$$AP\ Factor = \frac{PV\ (LB\ claims + DB\ claims)_0}{PV\ (LB\ fees + DB\ fees)_0}$$

$$MRB_t = PV(LB\ claims + DB\ claims)_t - PV(LB\ fees + DB\ fees)_t * AP\ Factor$$

Input and assumption data

- Consider granularity of factor cohorts and assumption update frequency
- For each issue period, gather and implement
    - Historical policyholder behavior assumptions
    - Historical economic assumptions
    - At-issue seriatim data
- For newly classified MRBs, develop appropriate fair value assumptions at time of issue

Disclosures and output data

- Produce PVs at the seriatim level and aggregate based on original cohort groupings
- Implement recalculated factors into MRB calculation

4.3 Organizational considerations

Organizational impacts of LDTI

Implementation will bring additional responsibilities to different areas of the actuarial department

Valuation & modeling

- Front lines of implementation
- Evaluate systems
- Develop new cash flow models
- Additional effort under LDTI during quarter close (model runs, assumptions)

Financial reporting

- Create new reporting processes
- Understand and explain new guidance and results
- Respond to new audit requirements
- Revise operating earnings framework and non-GAAP measures

Other corporate

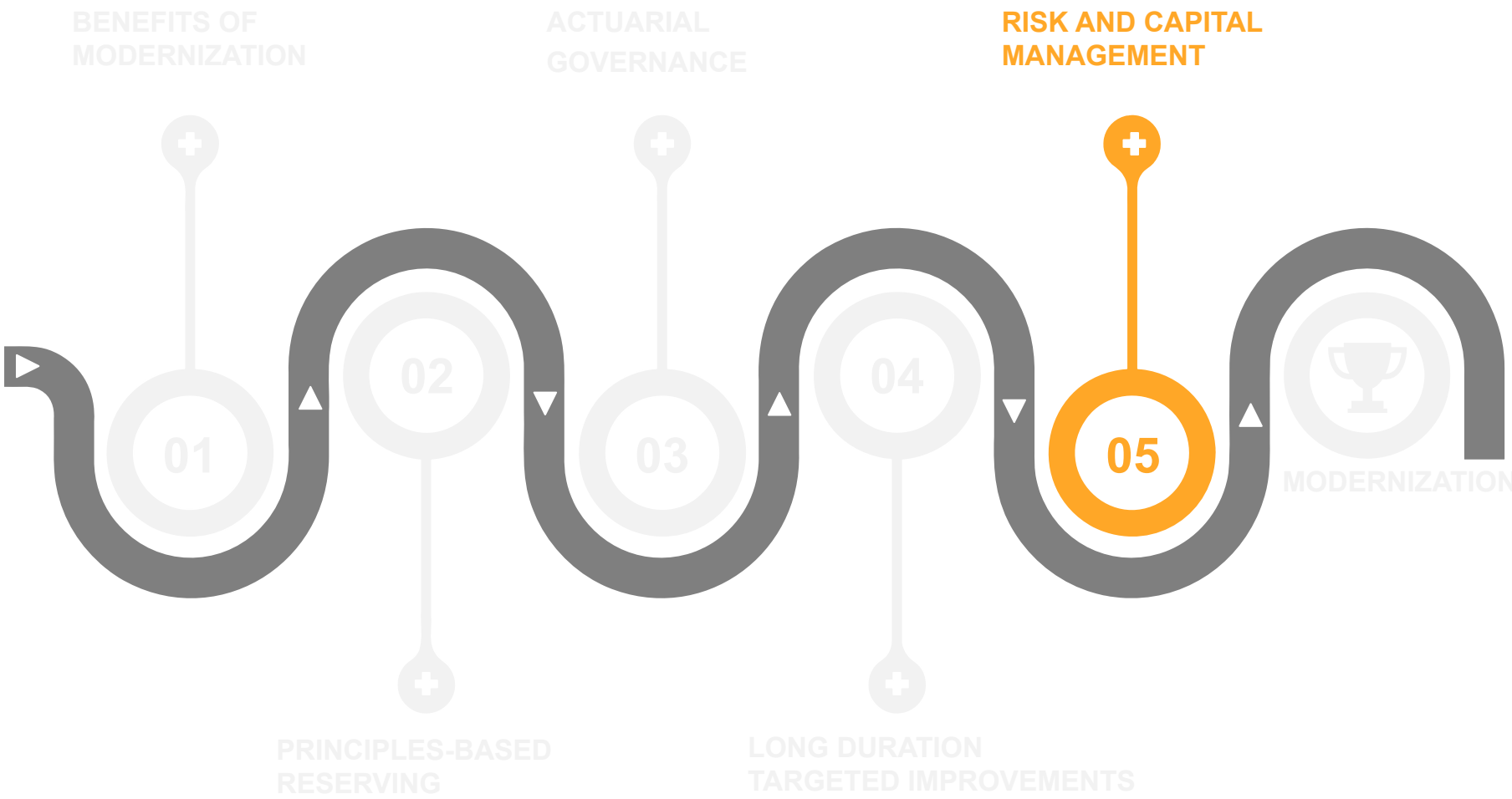
- Updates to model governance
- Changes to control framework
- Evaluate risk management strategies (exit market, hedging, reinsurance)
- Experience studies
- Pricing updates

Additional effort and need for actuaries may be managed through planning and taking advantages of opportunities

Questions

5 Risk and capital management

Roadmap to modernization



Benefits from modernization can apply across the entire landscape of risk and capital management

01

Capital management and forecasting

Putting together the pieces of a forecast for a complex corporate structure

02

Risk management

Improving visibility into complex risks and their interactions

03

Multiple valuation frameworks

Navigating the differences between Stat, GAAP, IFRS, and economic frameworks

04

Cross-functional coordination

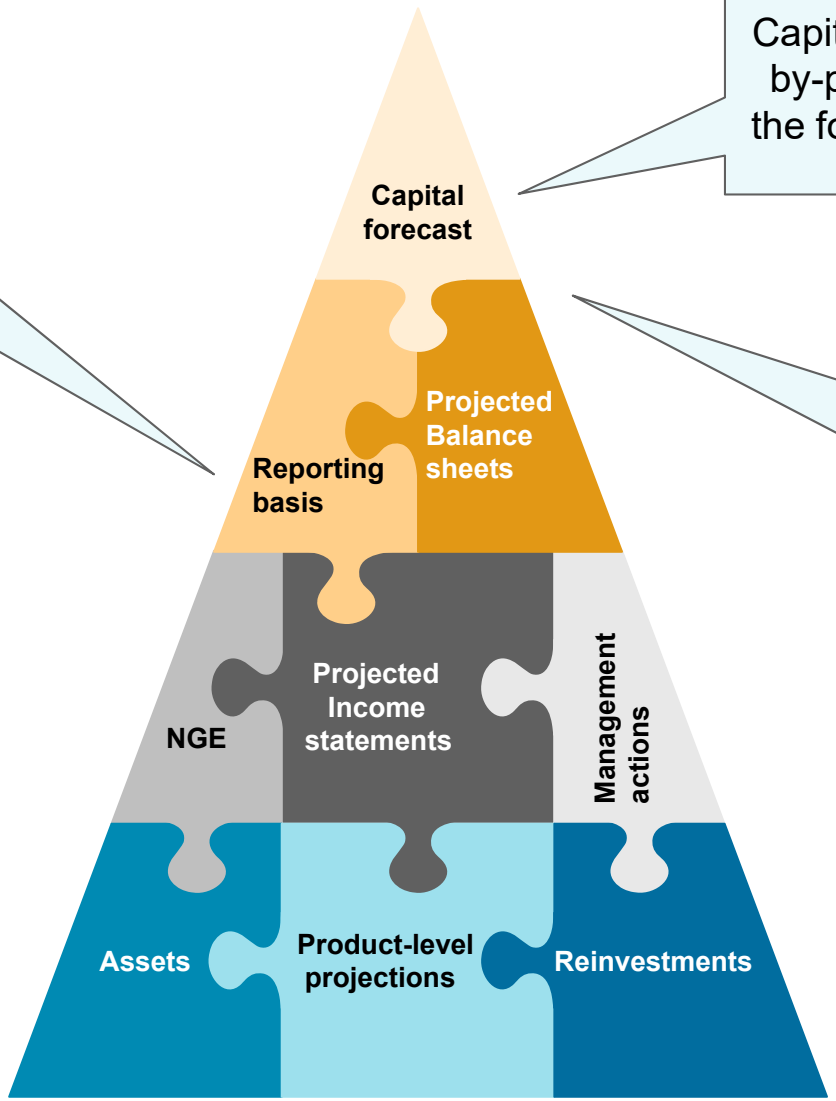
Coordinating with professionals on multiple teams to meet needs

Capital forecasting process is often the last piece in a complicated puzzle

Capital forecasting is often a by-product from the rest of the forecasting infrastructure

Each part of the forecasting process involves its own model, owners, and analysis on a standalone basis

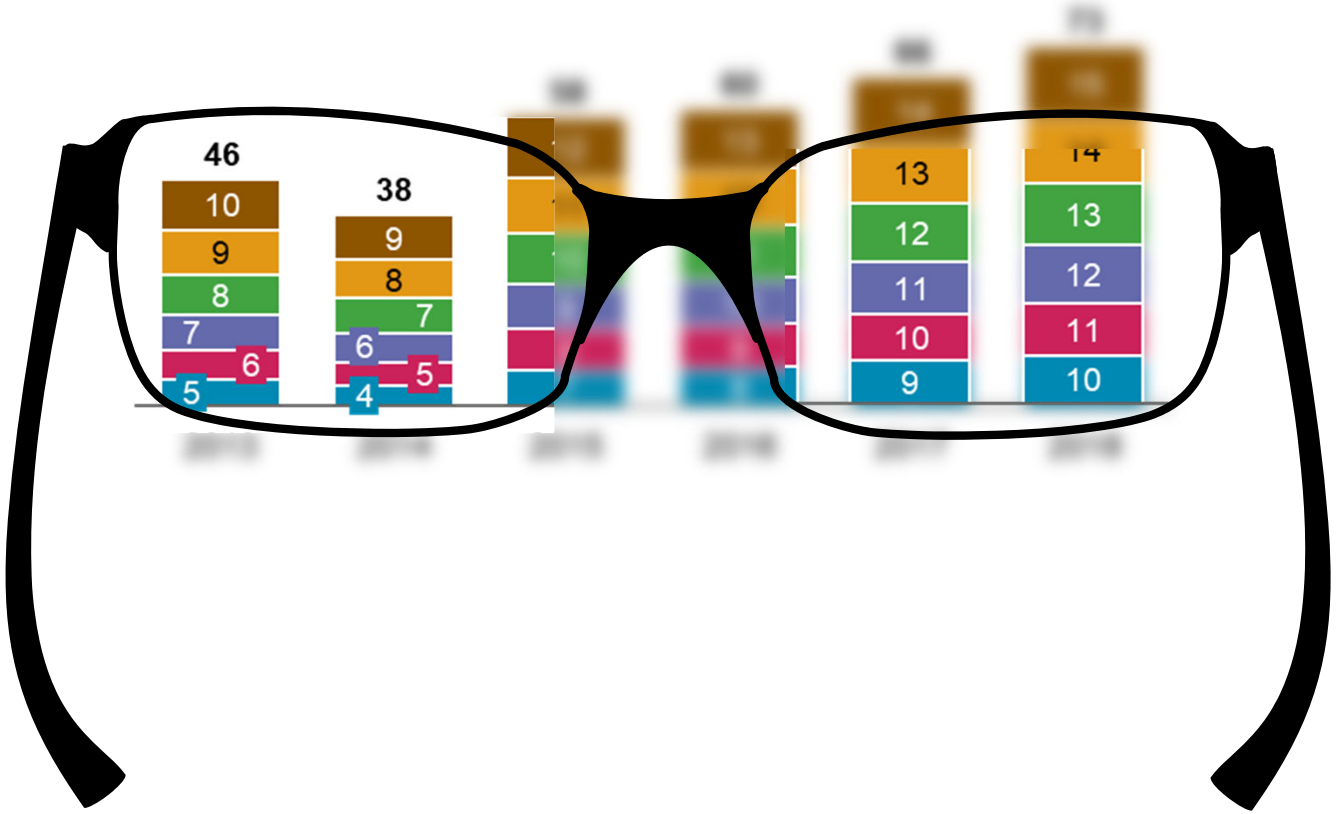
What-if analysis can be very difficult to coordinate among several model owners and subject matter experts



Transformation benefits – capital forecasting

Today			Tomorrow	
1	Scenario	→	10+	Scenarios possible
8	Different models to aggregate	→	1	Consistent model
40	Hours to complete each scenario	→	1	Hour to complete each scenario
Few	Hours available for detailed analysis and what-if testing	→	Many	Hours available for detailed analysis and what-if testing
Little	Confidence in using the model to make decisions	→	More	Confidence in using the model to make decisions

What risks might you see if you had modernized systems?
Modernized framework provides a clearer view of risks and their interactions



Connecting multiple reporting frameworks becomes easier

Decision-making becomes more robust with visibility into impacts in all reporting bases

- Reserve differences can be approximated or calculated more accurately
- Asset and discount rate differences quantified
- Modernized system allows companies to produce results efficiently and consistently
- Primary metrics and constraints can be analyzed concurrently

Even if you don’t use a certain reporting basis today, certain risks or transactions may make that reporting basis important in the future

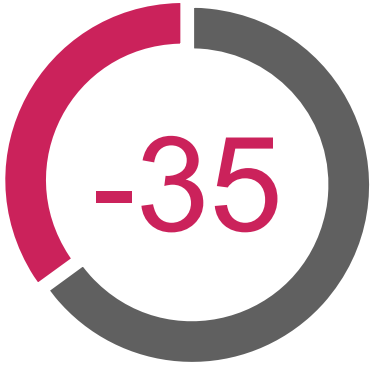
Robust what-if analysis can be performed concurrently in multiple reporting frameworks

It no longer takes multiple rules-of-thumb and simplifications to develop impacts under multiple reporting frameworks

Stat

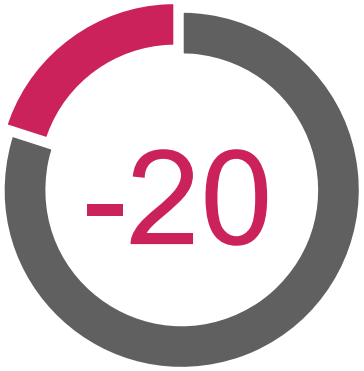
Small release of stat reserves, excluding impacts from asset adequacy testing

GAAP



Recognize a large loss upon updating future assumptions used to calculate reserves

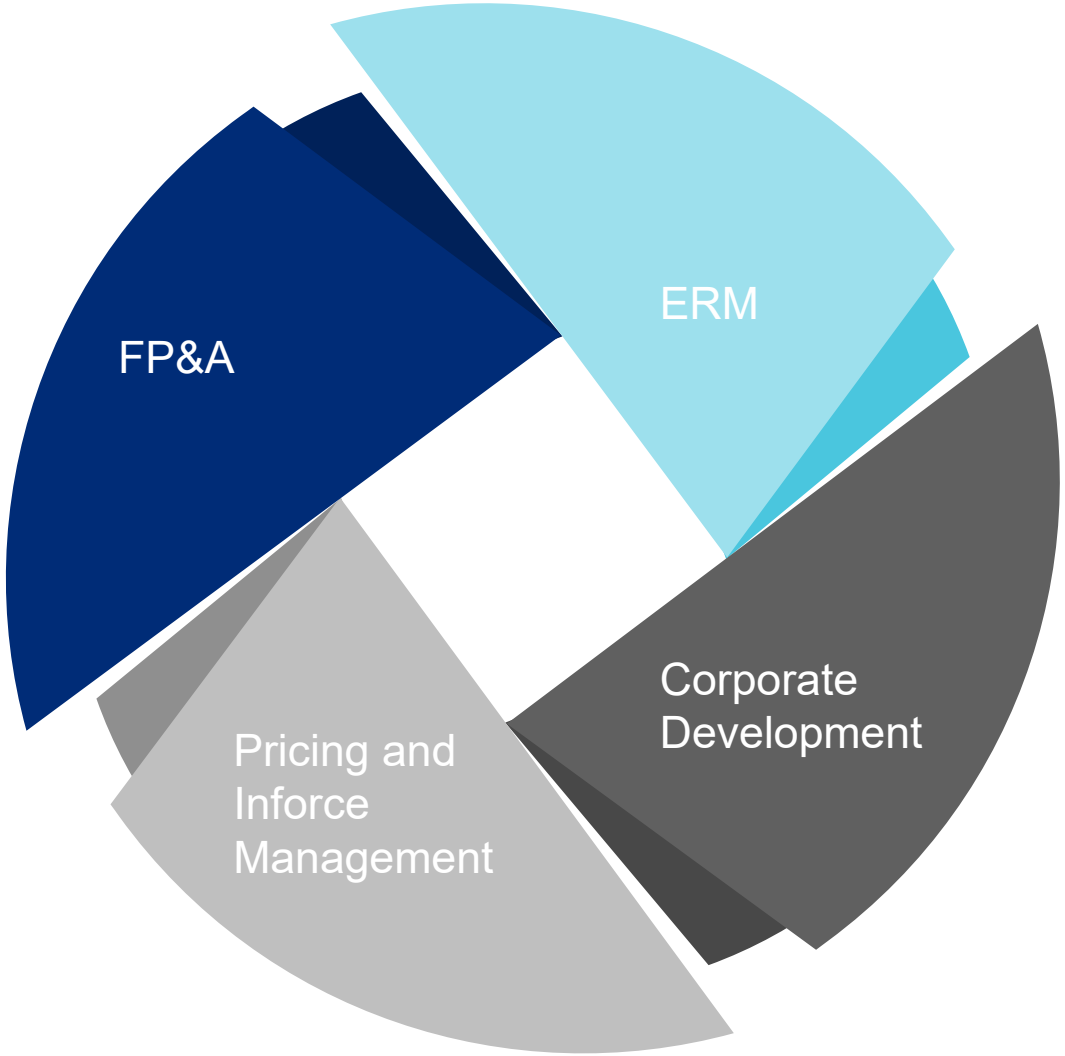
EV



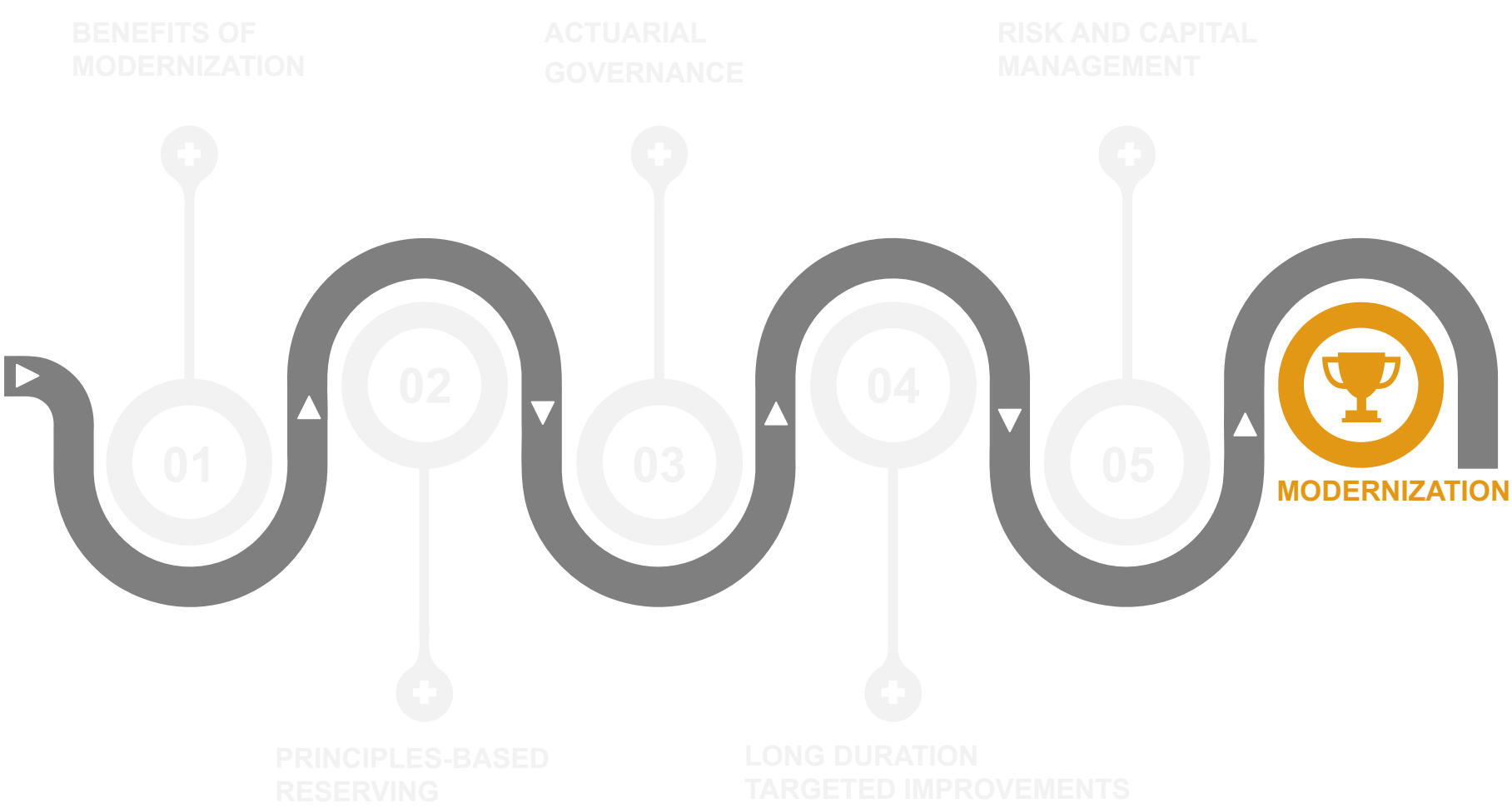
ANW takes a hit from lower than expected earnings. VIF is reduced from business runoff and assumption updates

Coordination is important in getting the most value out of your models

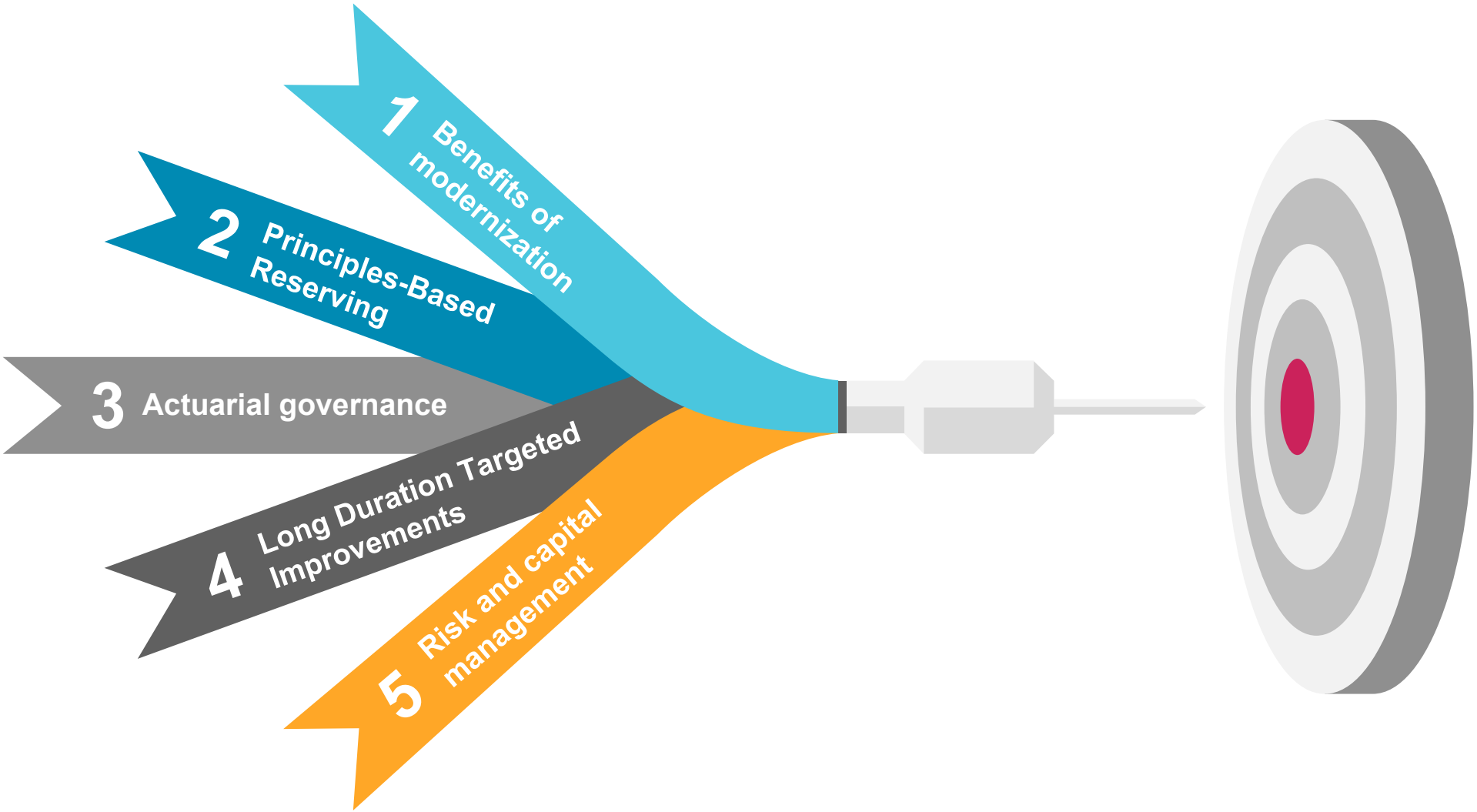
Modernization can bring together more valuable insights into risks and capital if coordinated effectively between all stakeholders



Roadmap to modernization



Now that we've modernized, what's next?



Questions

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