

Developing an internal model to determine the Solvency Capital Requirement

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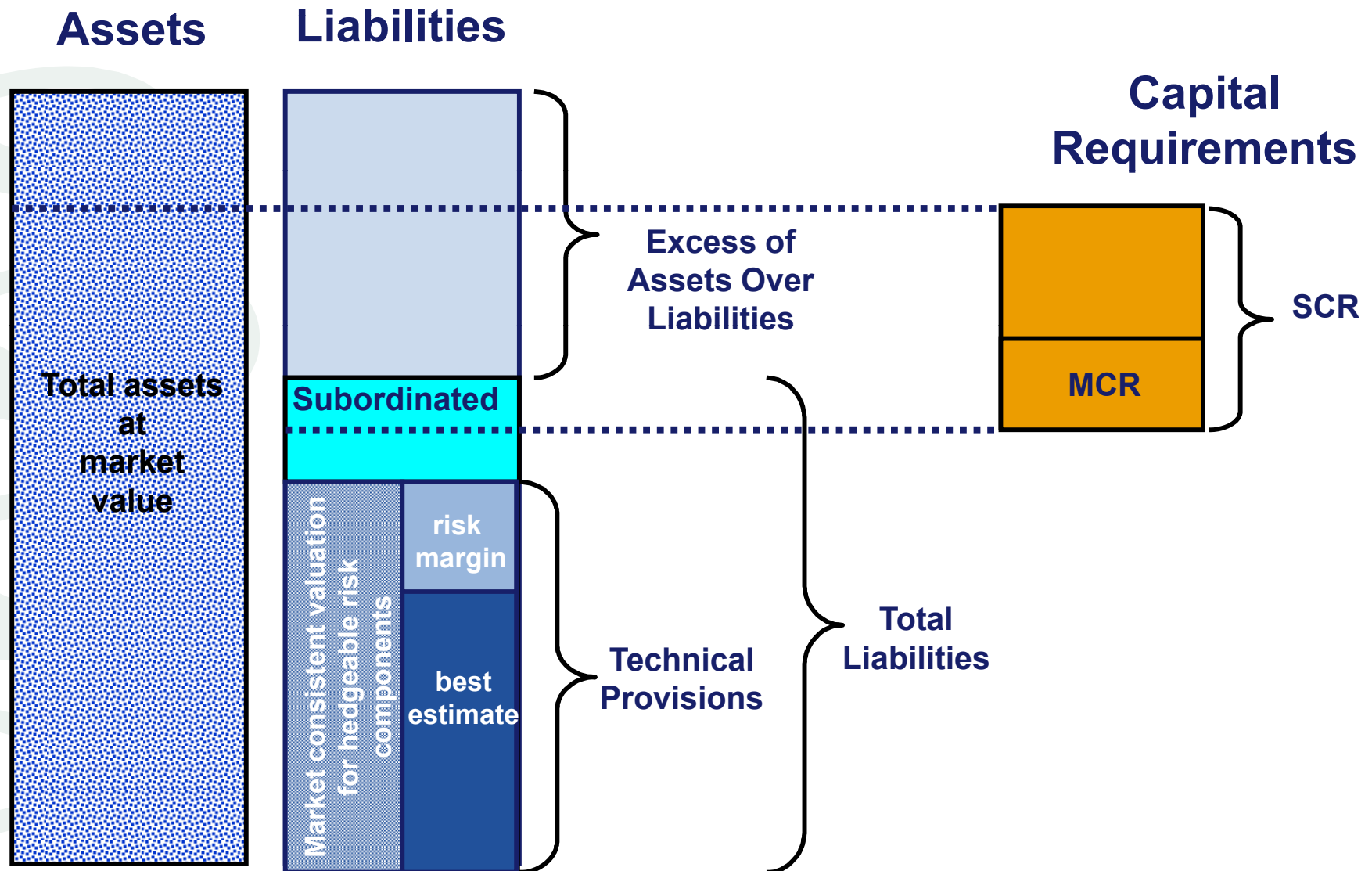
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Outline



- **Internal Models under Solvency II: setting the scene**
- **What is an internal model?**
- **What are the expected benefits?**
- **Approval process and requirements**
- **Questions**

Internal Models under Solvency II: setting the scene.....



Solvency Capital Requirement (SCR)



- **“The SCR should deliver a level of capital that enables an insurance undertaking to absorb significant unforeseen losses over a specified time horizon and gives reasonable assurance to policyholders that payments will be made as they fall due”**

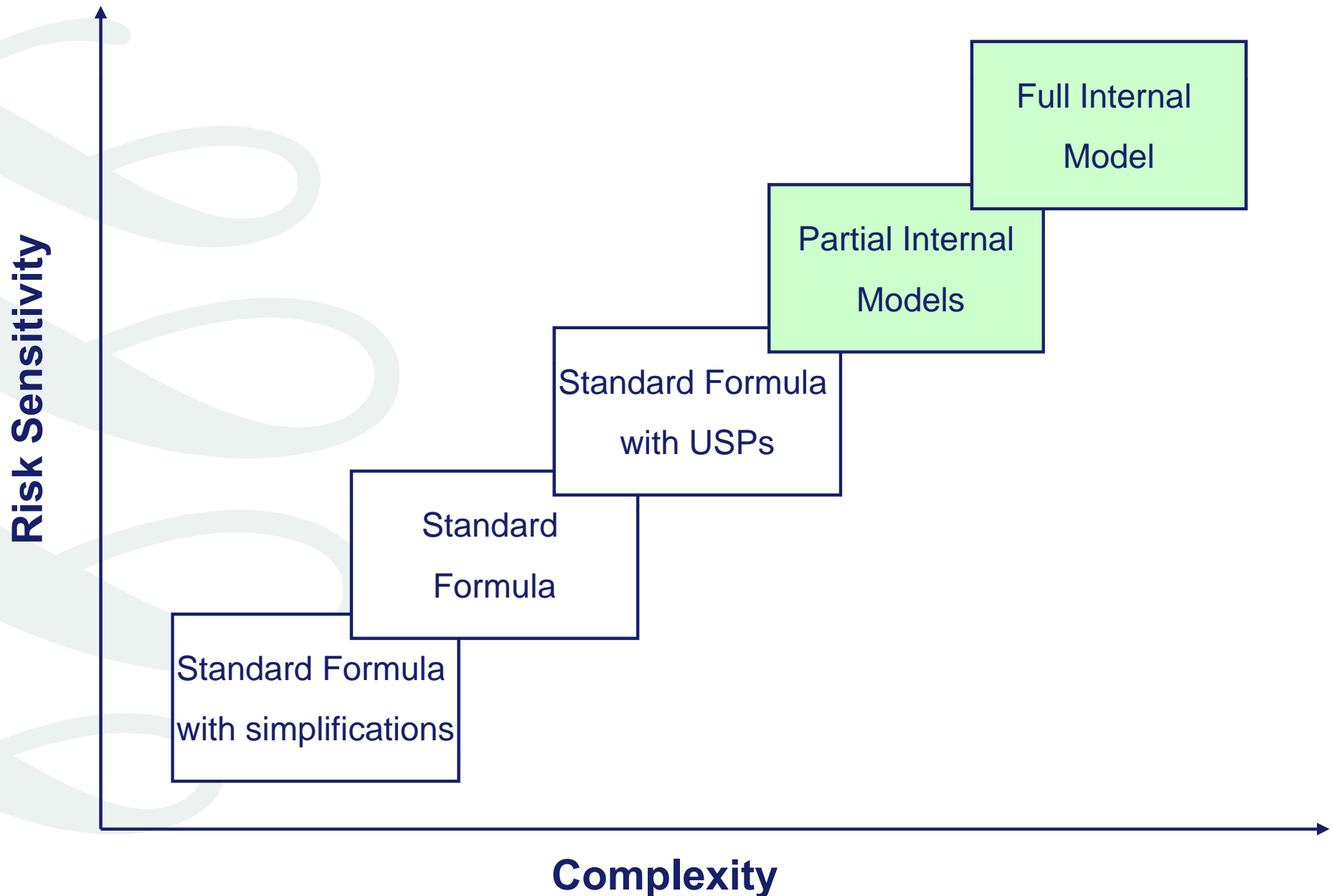
- **Derived using either an approved internal model or a ‘standard formula’**
 - Partial internal model
 - Full internal model
 - Standard formula

- **99.5% confidence level over 1 year**

- **As a minimum to cover insurance, market, credit and operational risks**

- **Part of supervisory review process (SRP)**

The different approaches to calculate the SCR



The starting point: what is an internal model?



- **What is an internal model according to the CEA/GC?**

“A risk management system developed by an insurer to analyse the overall risk position, to quantify risks and to determine the economic capital required to meet those risks”

- **What is an internal model according to the IAA?**

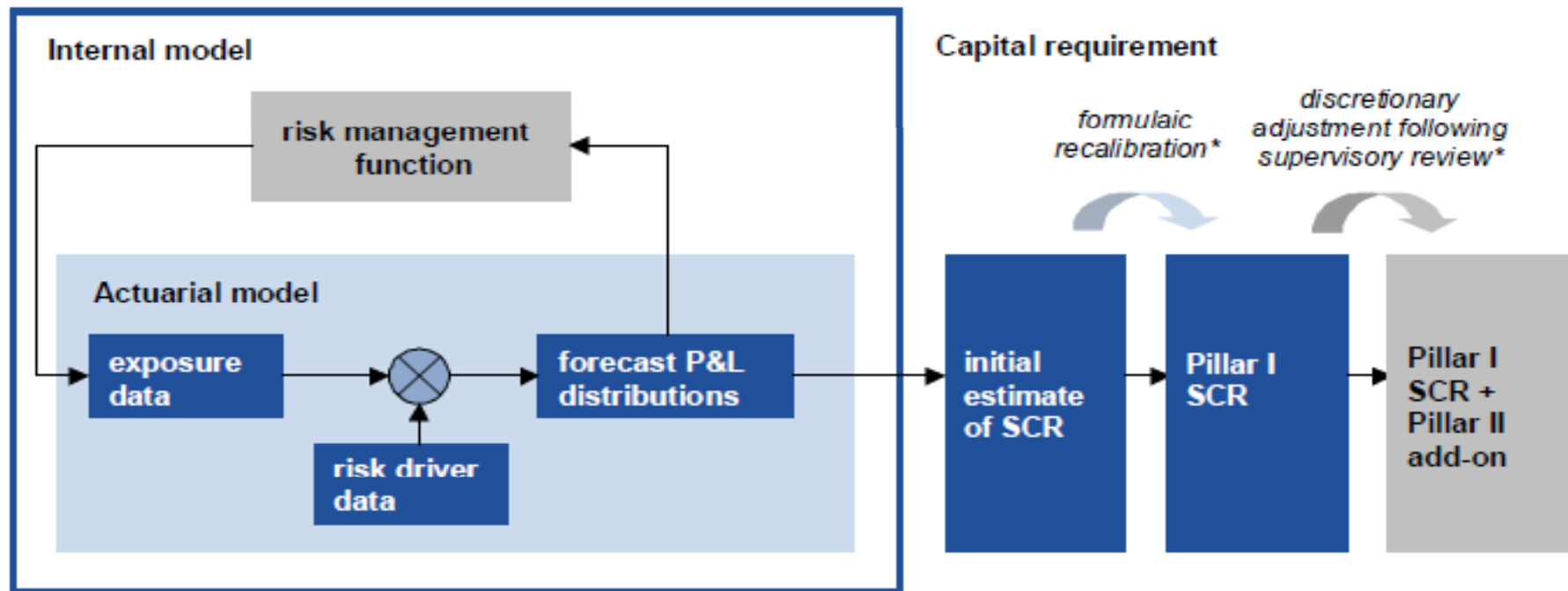
“Mathematical model of an insurer’s operations to analyse its overall risk position, to quantify risks and determine the capital to meet those risks”

- **What is an internal model under Solvency II?**

*No definition provided by the Solvency II Framework Directive.....
But...*

The Internal Model is more than simply a calculation engine...

- Should be an integral part of the risk management system
- Meet the tests and standards for internal model approval



* where necessary

What are the expected benefits?



- **Improved risk sensitivity** of SCR related to the insurer's specific profile leading to a more adequate modelling of non-standard, especially non-linear, contracts,
- **Better alignment** of regulatory capital requirements with economic capital
- **Encouragement of innovation in risk management methodology** leading to higher competitiveness through better risk management and hence lower costs of capital,
- **More effective pillar 2 discussion** and familiarity of the supervisor with more detailed exposure data than is generally available in accounting records,
- **Cost efficiencies through re-use of risk modelling** infrastructure for discussion with supervisors, rating agencies, analysts and shareholders.

The Approval Process

Approval process \neq Validation



* Includes the policy for model changes

The Approval Process



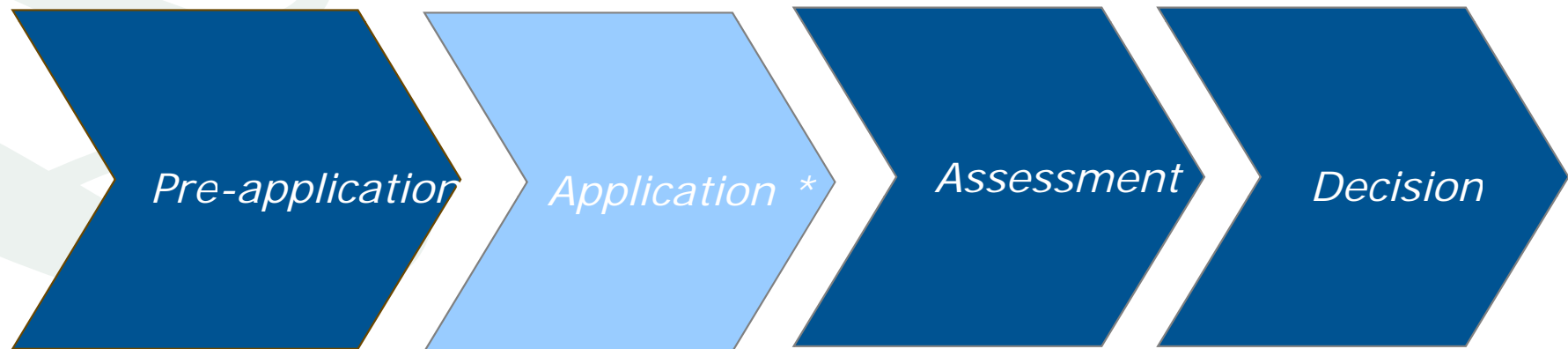
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Pre-application

NB: Pre-application does not mean pre-approval

- Recommended by CEIOPS
- Beneficial both for supervisors and undertakings
 - Allows supervisors to better plan their resources
 - Undertakings engage with supervisors while developing and implementing their Internal Model
 - Early identification and communication of concerns
- The pre-application process is going to be iterative:
 - Undertakings will not have all elements of their IM ready at the outset As undertakings get feedback from supervisors the IM may change
 - The depth of review will vary within the IM
 - Information to be reviewed is linked to the application (approval process)
 - Regular feedback to undertakings on the IM
- Supervisors give their view on how prepared the undertaking is to submit the application

The Approval Process



* Includes the policy for model changes

Application

- **Formal application**
 - Documentary evidence that requirements are met (art. 112.3)
 - The administrative or management bodies have overall responsibility for application – role of internal committees (art.116.1)
 - Systems must be in place to ensure internal model operates properly on a continuous basis (art. 116.2)
 - Internal model governance policies (e.g. policy for changing the full and partial internal model (art. 115))

- **Supervisors shall decide on the application within six months (art. 112.4)**
 - reason for rejection must be provided (art. 110.6)

- **Supervisor may require the firm to provide an estimate of the SCR determined in accordance with the standard approach (art. 112.7)**

Undertakings need to evidence...

- Use test (art. 120)
 - Statistical quality standards (art.121)
 - Calibration standards (art. 122)
 - Profit and Loss Attribution (art.123)
 - Validation standards (art. 124)
 - Documentation standards (art. 125)
 - An adequate system for identifying, measuring, monitoring, managing and reporting risk
-
- **Requirements shall not be considered in isolation – interrelations shall not be ignored**
 - **Use of external models and data does not exempt insurers from any of the requirements (art. 126)**

What does this mean in practice?



- **Approval is not based on undertaking's chosen software platform**
 - Nor is it simply based on the number generated by the undertaking's model

- **Approval is required at the level of the model itself**
 - **i.e. its scope, coverage, design, build, integrity and application**
 - To embed the model into the business, undertakings first have to embed the business into their models

Use test (art. 120)

- **Internal model is widely used and plays an important role in:**
 - risk management and decision-making
 - economic and solvency capital assessment
 - system of governance
- **Must be fully embedded in the operational and organisational structure of the insurer**
- **Demonstrate that the model remains useful and is applied consistently over time**
- **Board is responsible for ensuring the ongoing appropriateness of the model**

Use Test

Principle 9

recalculation

Principle 1

understanding of the
internal model

Principle 8

integration into the risk-
management system on a
consistent basis for all uses

Principle 2

fit the business
model

Principle 7

improve the
undertaking's risk-
management system

Principle 3

support and verify
decision-making

Principle 6


widely integrated with
the risk-management
system

Principle 5

design to
facilitate analysis
of business
decisions

Principle 4

cover sufficient risks:
useful for risk
management and
decision-making



***Foundation Principle:
Inherent desire to
improve quality***

Statistical quality standards (art. 121)

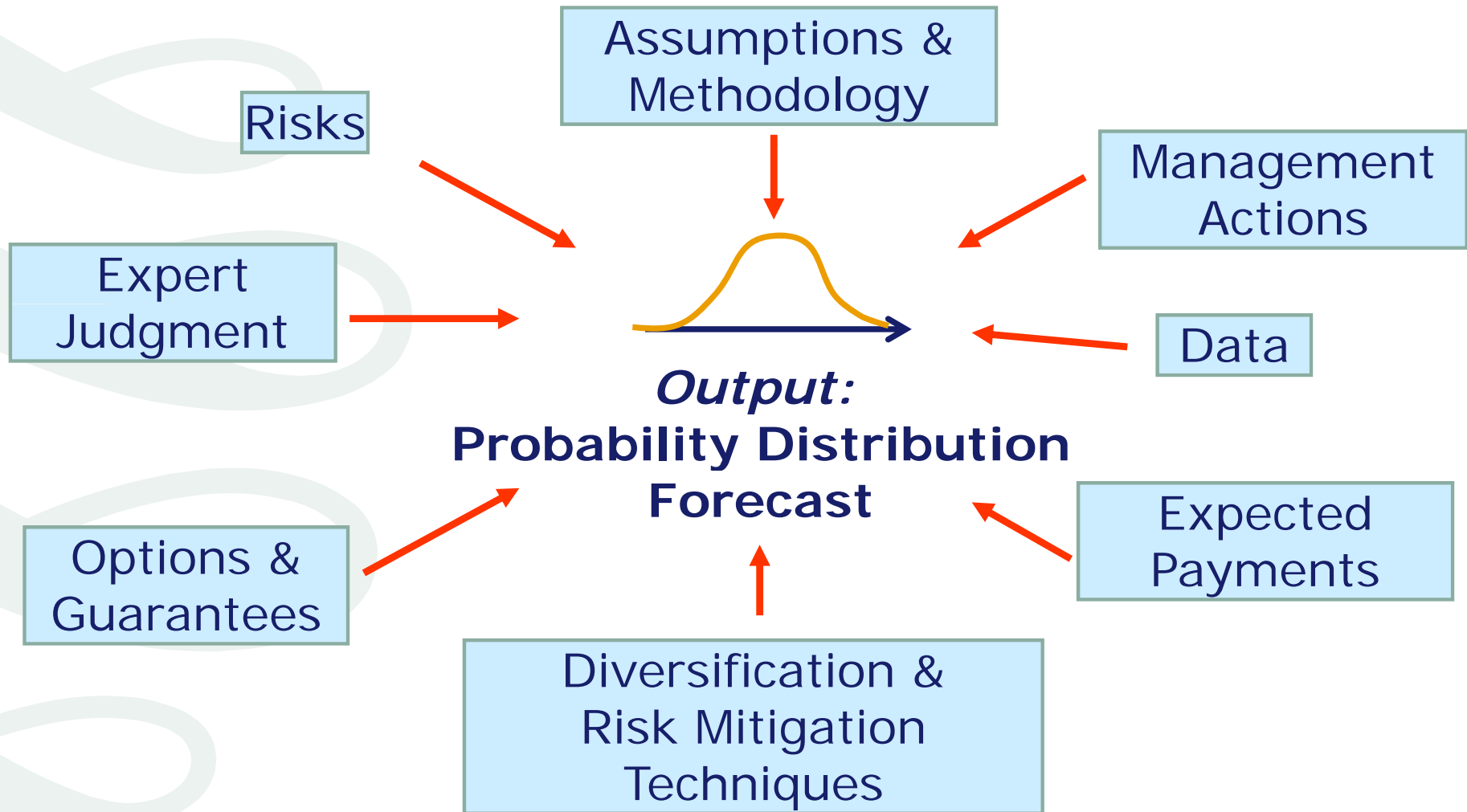


- **Probability distribution forecast:**
 - based on sound actuarial/ statistical techniques
 - current, credible info/ realistic assumptions
 - broadly consistent with approach to technical provisions
 - assumptions justified by firms
 - data appropriate and accurate
 - no particular method, provided IM meets criteria of use test

- **All material risks to be covered, including all those addressed in Standard Formula**

Statistical Quality Standards

What is all about?



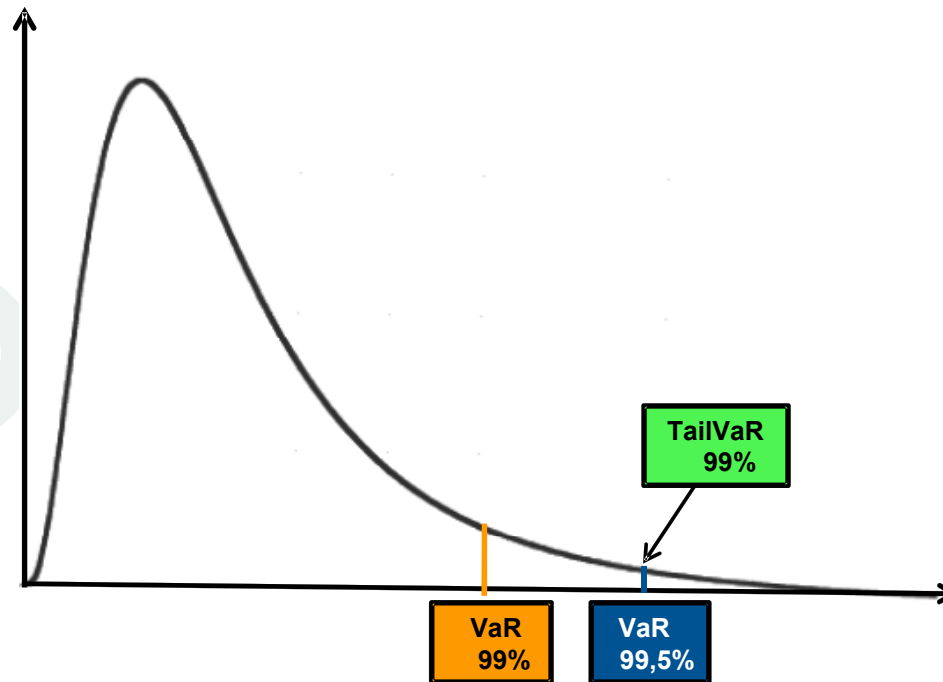
Calibration standards (art. 122)



- **Where feasible, use VaR at 99.5% over 1 year confidence level**
- **Different risk measure/ time horizon permitted provided policyholders' protection equivalent to Standard Formula i.e. 99.5% over 1 year, VaR**
- **Approximations permitted where firm demonstrates approach provides equivalent protection**
- **Supervisors may require undertakings to run their IM on relevant benchmark portfolios and using assumptions based on external data rather than internal data to verify the calibration of the IM and to check that its specification is in line with generally accepted market practice**

Calibration Standards - Example

- Example of the direct derivation of the SCR from the IM's PDF



Supervisory tools

- benchmark portfolios
- test alternative assumptions based on external data

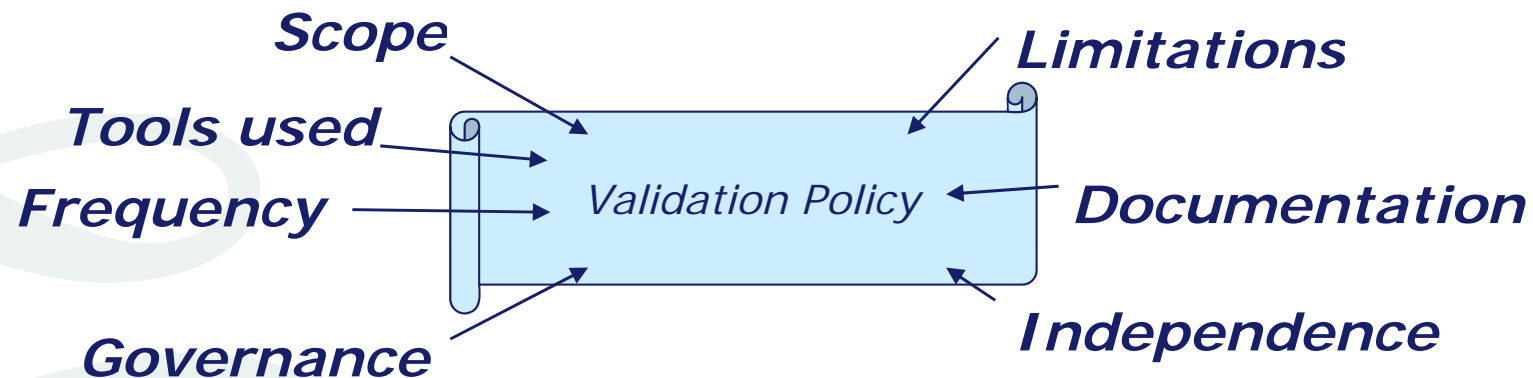
Validation standards (art. 124)

- **The undertaking has a primary responsibility for validation**
- **Validation is an iterative process**
- **There is no single validation method**
- **Validation should encompass both quantitative and qualitative elements**
- **Validation should be subject to independent review**
- **Validation policy**

Validation standards (art. 124)

- Regular cycle of model validation shall include:
 - Monitoring the performance of the model
 - Reviewing the ongoing appropriateness of its specification
 - Testing its results against experience
 - Analysis of stability of the model
 - Testing the sensitivity of the results to changes in key underlying assumptions
 - Assessment of the accuracy, completeness and appropriateness of data used by the internal model
 - A process to evidence that the resulting capital requirements are appropriate

Validation policy



- Firms should have a documented Validation Policy that sets out how the internal model is validated and why it is appropriate.
- Set of tools to gain confidence in the model: testing against experience; sensitivity testing; reverse stress testing

Profit & Loss Attribution (art.123)



- **Analysis of profit and loss by cause/source for each major business unit, at least annually**
 - Need to be able to identify and quantify sources of profit and losses

- **Demonstrate how categorisation of risk chosen explains the causes/sources of P&L**

- **Two main purposes: validation and strategic**
 - Need to consider how these will be used (link with Use test) and reflect in granularity of assessment
 - Need to understand/reconcile differences to profits and losses on accounting basis
 - Should be an important validation tool

Documentation (art. 125)

- **It must be thorough, detailed and complete enough to allow third parties to understand and replicate the model**
- **It shall provide a detailed outline of:**
 - The theory
 - Assumptions
 - Mathematical and empirical basis underlying the model
- **It is a crucial tool for the firm to demonstrate the supervisor that the undertaking really understands and has mastered the internal model it is using**
- **It shall indicate any circumstances under which the internal model does not work effectively (weaknesses)**
- **It must be revisited and, if necessary, updated in line with the complexity and stability of the risk profile of the insurer**

External models and data (art. 126)

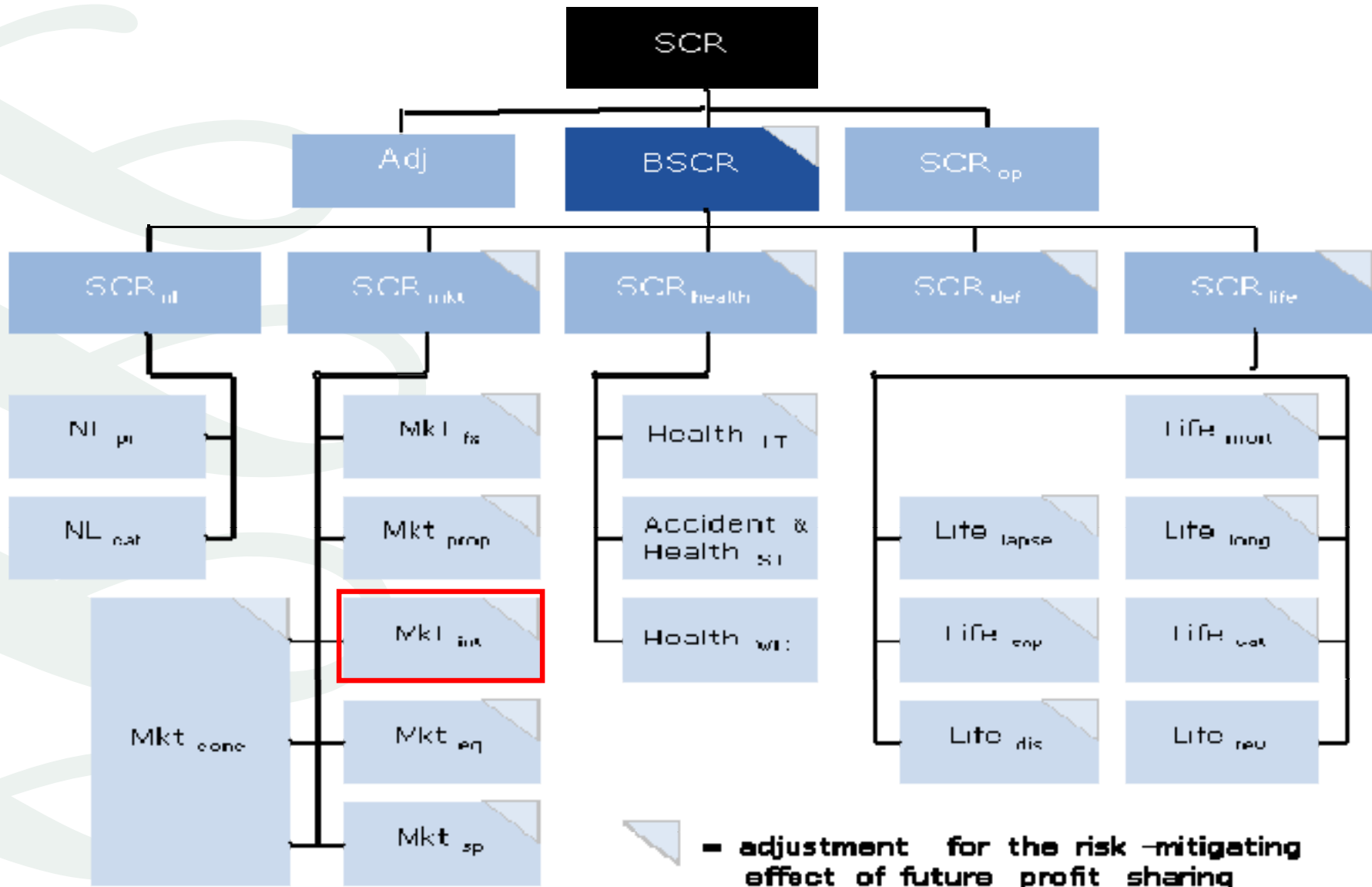
- **The use of a model or data obtained from a third party shall not be considered to be a justification for exemption from any of the requirements for the internal model**
- **Firms must be able to document and explain the role of vendor products and the extent to which they are used within their internal processes**
- **Firms must be able to demonstrate a thorough understanding of vendor products used in their internal processes**
- **Vendor products should be appropriate to the *nature, scale* and *complexity* of the risks incorporated within the firm's risk strategy and business objectives**
- **Firms must have clearly articulated strategies for regularly reviewing the performance of vendor model results and the integrity of external data used in their risk quantification process**

'Partial internal models' (PIMs)

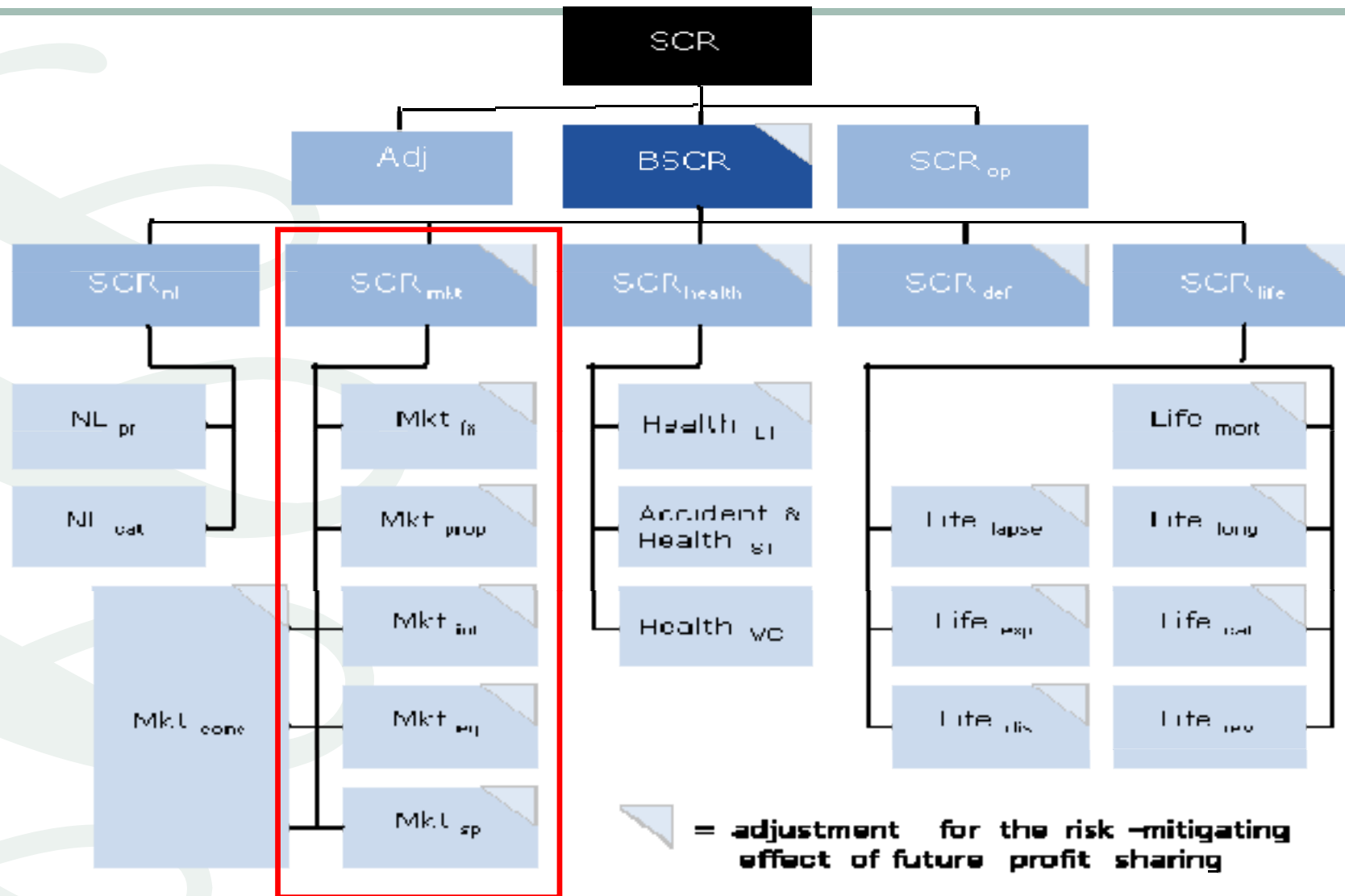


- **Insurance and reinsurance undertakings may use them for the calculation of one or more:**
 - risk modules or sub-modules of the SCR
 - operational risk
 - adj. for the loss-absorbing capacity of TPs and deferred taxes
- **In addition to:**
 - the whole business of insurance and reinsurance undertakings, or
 - only one or major business units
- **Approval subject to the same requirements as full IM, plus additional conditions:**
 - Reason for the limited scope of application
 - IM SCR reflects more appropriately the risk profile of the undertaking

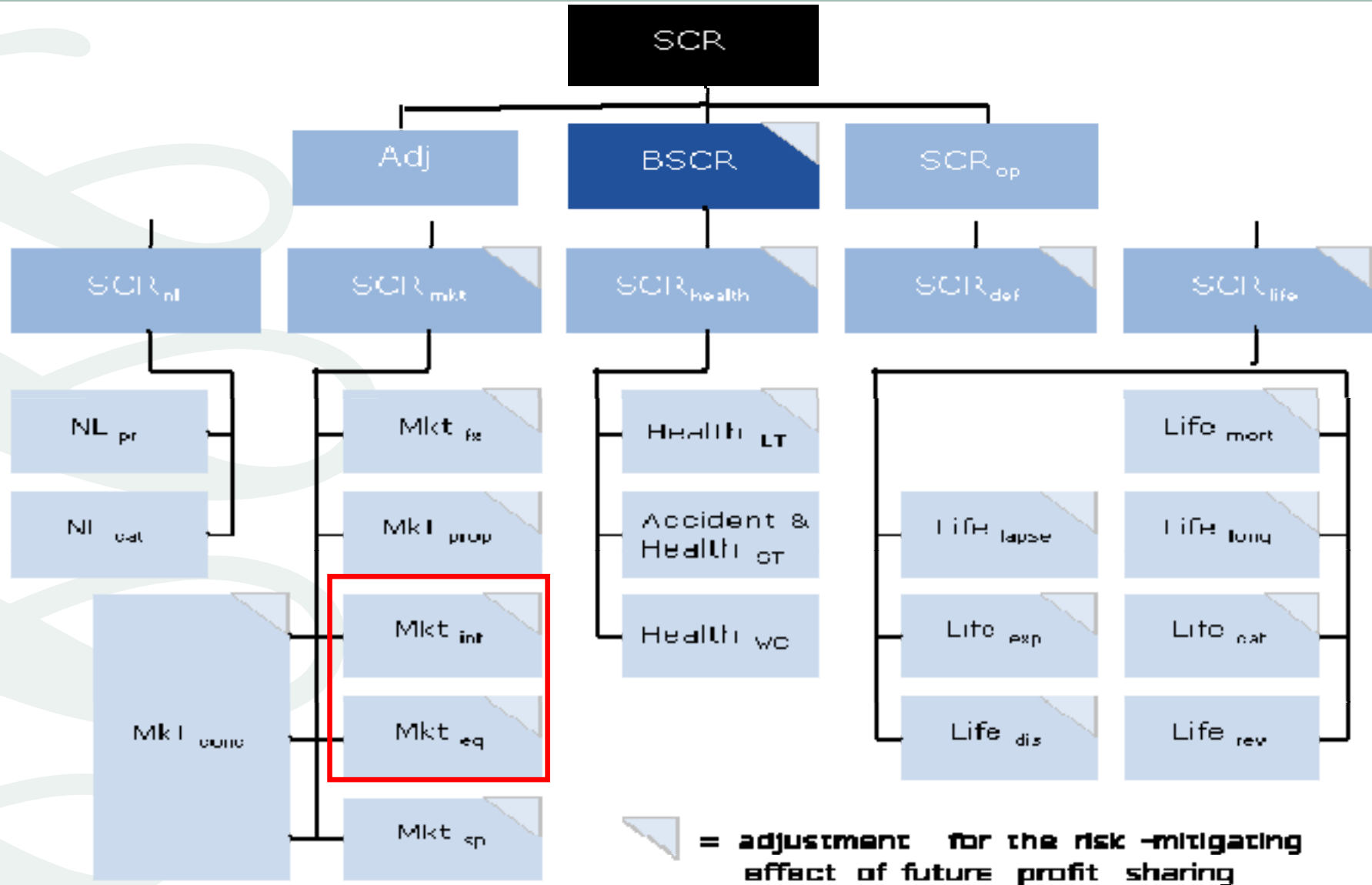
Example 1 - Modelling one risk sub-module



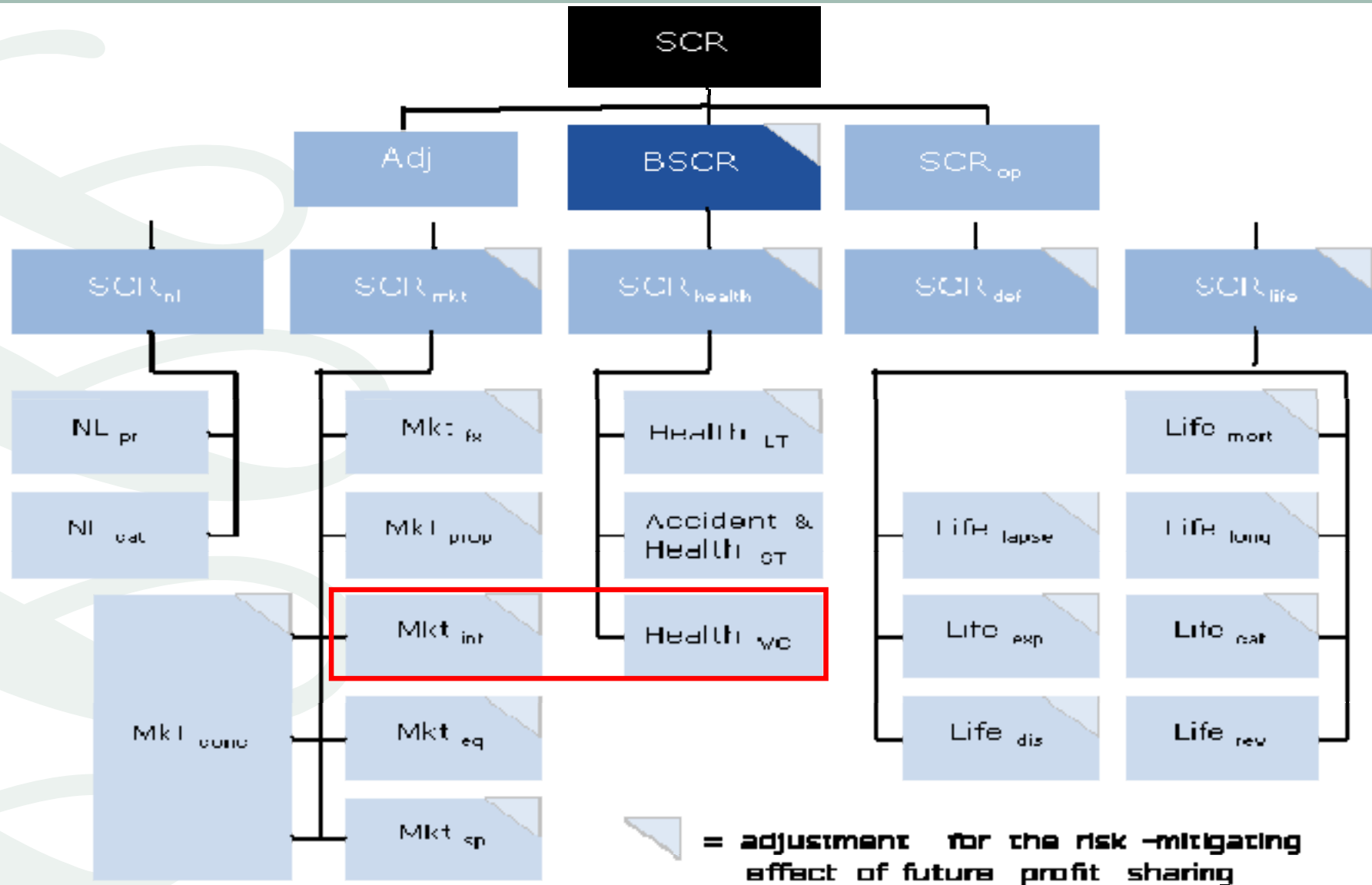
Example 2 - Modelling one risk module



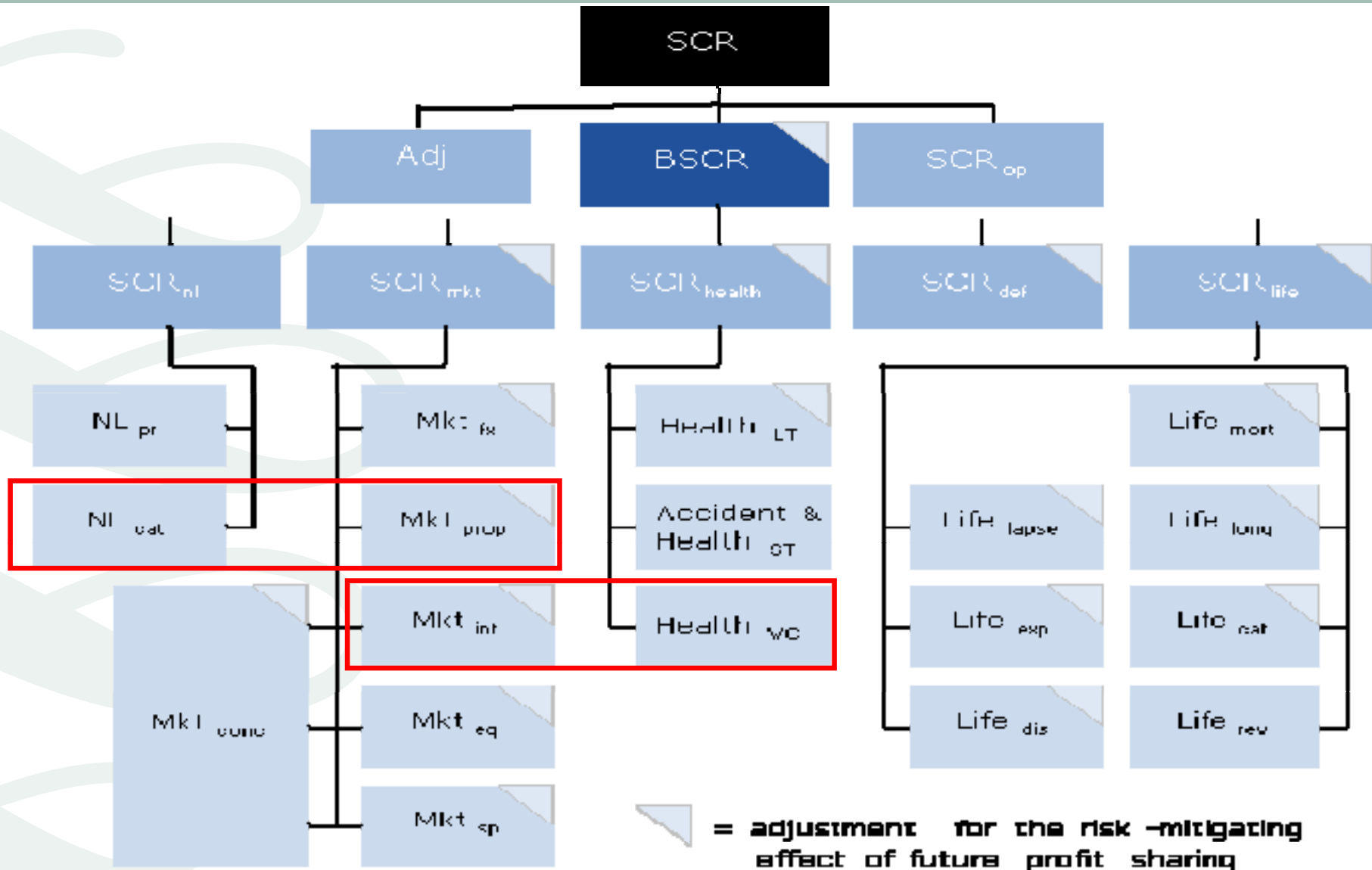
Example 3 - Modelling two (or more) risk sub-modules within the same risk module jointly



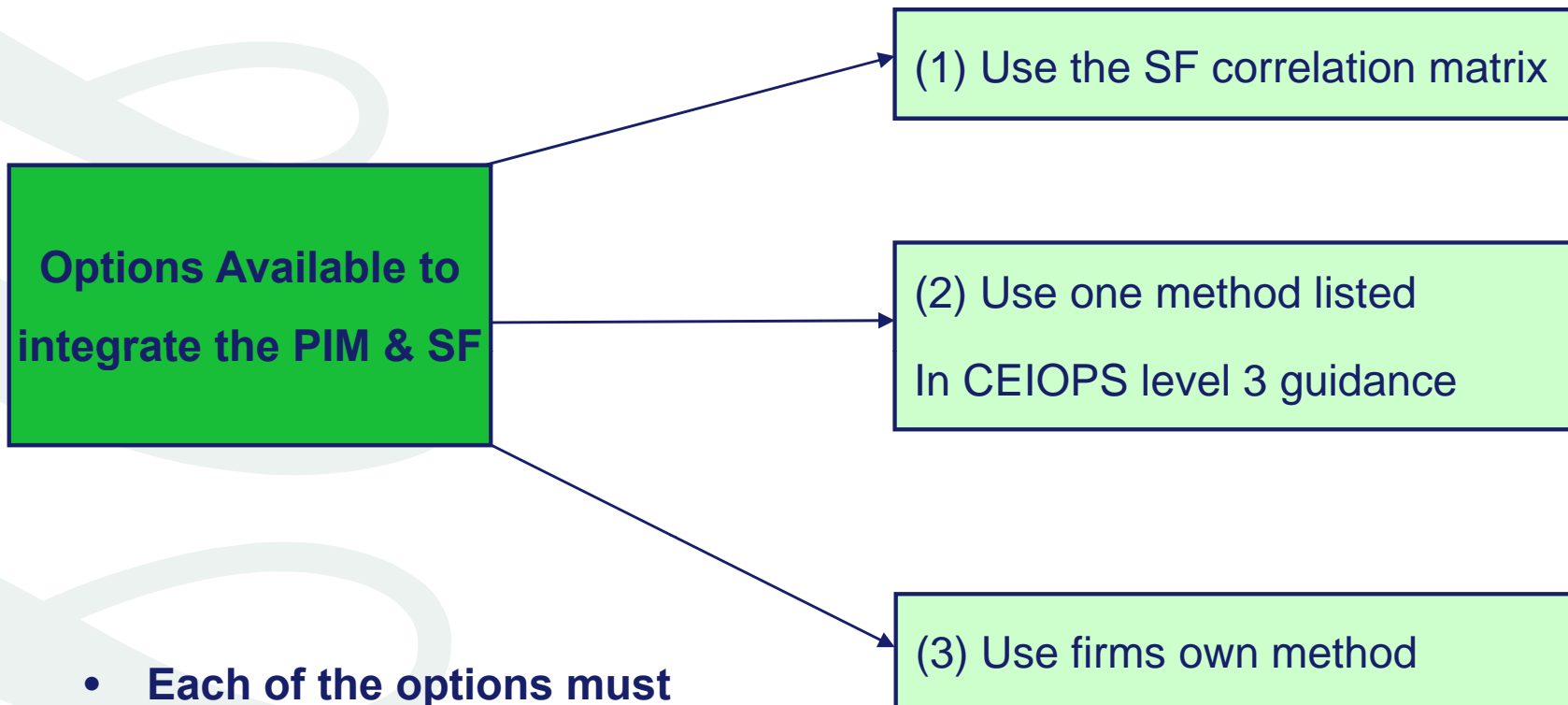
Example 4 - Modelling two (or more) risk sub-modules from different risk modules jointly



Example 5 - Modelling two (or more) risk sub-modules from different risk modules jointly

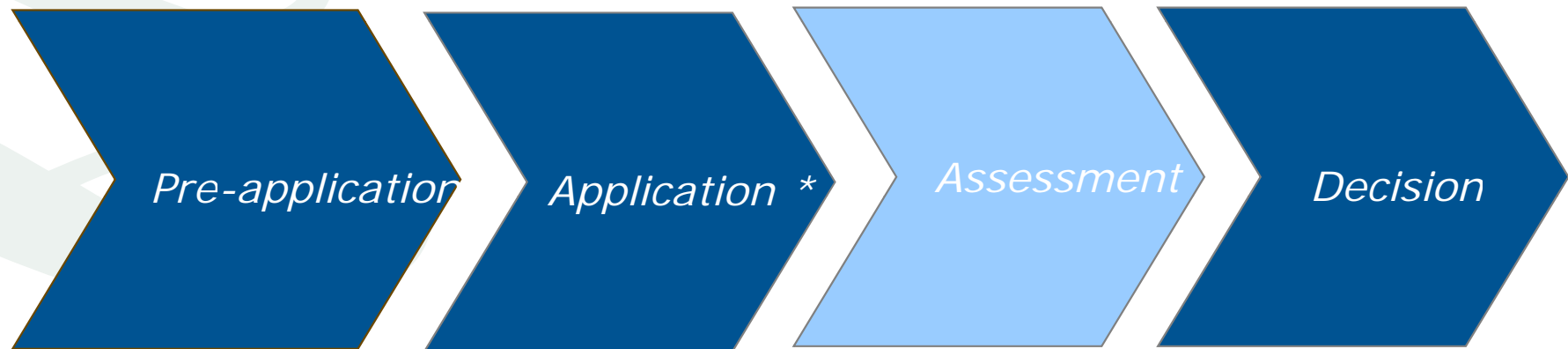


Integrating the results of the PIM with the standard formula



- **Each of the options must meet:**
 - Appropriateness and
 - Feasibility tests

The Approval Process



* Includes the policy for model changes

Assessment

- Supervisors may require additional information
- The assessment may be iterative with feedback to undertakings resulting in modifications to the IM
- The supervisors are expected to assess:
 - ✓ Scope and model coverage
 - ✓ Methodology and documentation
 - ✓ Data quality
 - ✓ Quantitative and qualitative procedures
 - ✓ Technological environment
- The assessment may include desk-based review, on-site inspections, requests for further information and other contacts

Specificities for partial internal models (PIM)

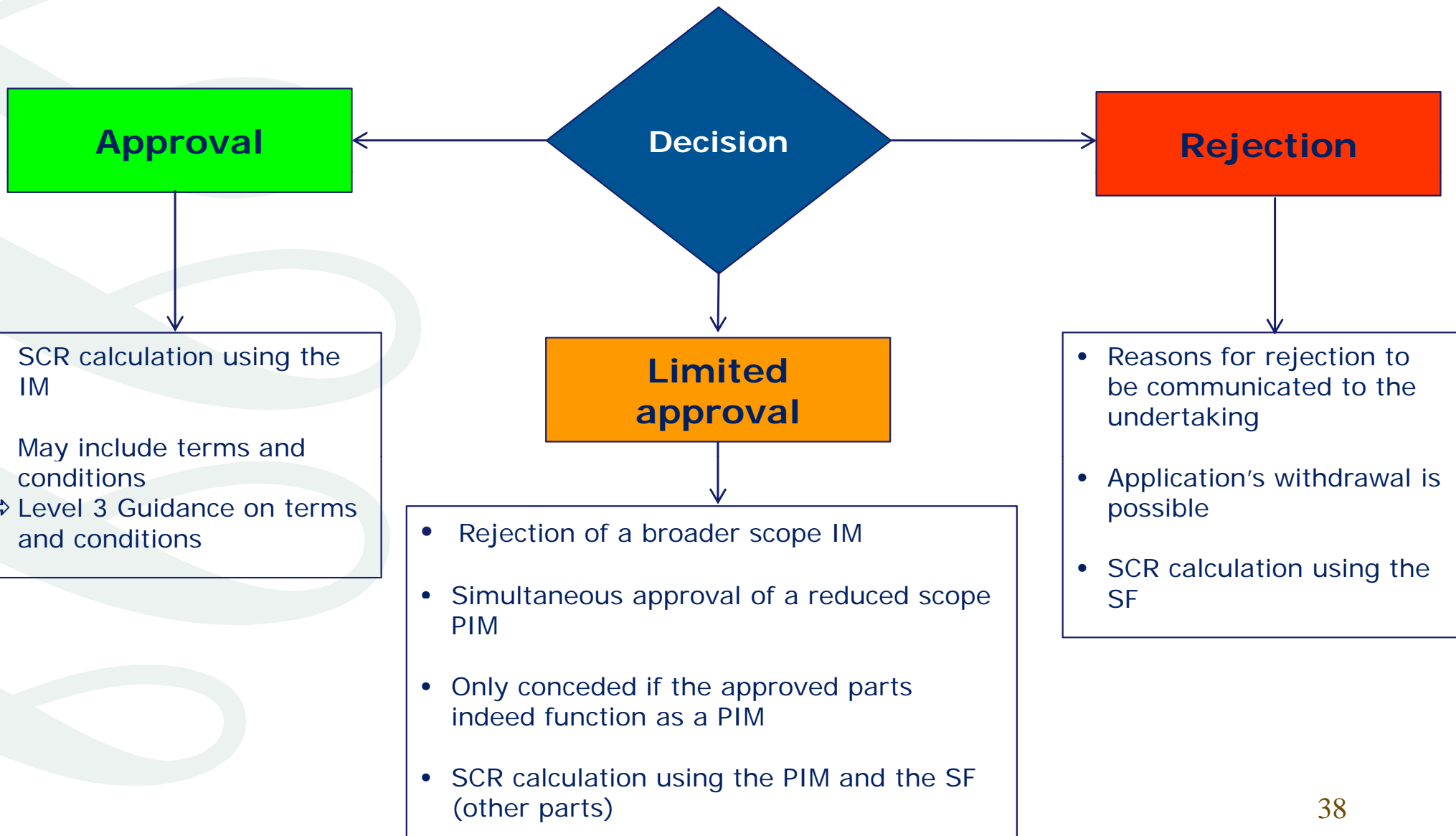
- Justification of the limited scope; better reflection of the risk profile than the standard formula (SF) and integration of the PIM's and SF's results

The Approval Process



* Includes the policy for model changes

Decision





What next?
Is that all?

On – Going Compliance



- **Firm's responsibility to implement a regular cycle of validation and monitor on-going compliance.**
- **Assessment of the internal model should include:**
 - Appropriateness of the design and operations of the internal model
 - Internal model continues to appropriately reflect the risk profile
 - Up keep of all tests and standards
- **Supervisors will review the outcomes of the firm's reviews to assess on-going compliance with the Internal Model requirements**

Reporting and Disclosure



- **Method for calculating the SCR**
- **Scope of the (Partial) Internal Model**
- **Internal Model governance and risk management arrangements**
- **Equivalent SCR for the firm if they were using the Standard Formula**
- **Validation analysis**
- **And more.....**

Summary

- Internal models are not only for large and sophisticated firms....
- However, to develop and maintain an internal model four main conditions need to be satisfied:
 - Good understanding of the business
 - Commitment of senior management
 - Knowledge, expertise to create and maintain model
 - Good, deep and rich data sets



Thank you!