Practical Implementation Challenges of Internal Models under Solvency II

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on behalf of

The Faculty of Actuaries Solvency & Capital Management Research Group

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1 Introduction and objective of paper

1.1.1 Solvency II is an EU Directive due to be implemented in 2012 which will result in a fundamental change to the capital adequacy regime for the European insurance industry. It aims to establish a revised set of EU-wide capital requirements and risk management standards that will replace the current Solvency I requirements, resulting in a much greater alignment of capital and risk.

1.1.2 One important aspect of the new solvency regime is the fact that companies are able to use an "internal model" to calculate their solvency capital. The key focus of this paper is on the practical implementation challenges of internal models for offices seeking internal model approval.

1.1.3 This paper has been produced on behalf of the Faculty of Actuaries Solvency and Capital Management Research Group. The group consists of UK life insurance actuaries with both consulting and insurance company experience, and as a result, this paper primarily examines internal models from a life perspective (although Solvency II applies to both life and non-life insurers and reinsurers). Throughout this paper, we use the terms "company" and "firm" to mean all types of insurers and reinsurers to whom Solvency II applies.

1.1.4 In August 2009 we carried out a survey of UK life insurers on the practical implementation challenges of the use of internal models. This survey is referred to throughout this paper as "the Survey".

1.1.5 The views in this paper represent those of the authors and are not necessarily shared by their respective employers.

1.1.6 We have assumed throughout this paper that readers have a limited knowledge of Solvency II internal model requirements.

1.1.7 An Executive Summary of the paper is provided in Chapter 2. Chapter 3 provides some background to Solvency II and an introduction to internal models. In Chapters 4 to 9 we look at each of the six standards in turn which must be met to obtain internal model approval. We also provide a glossary of commonly used terms and acronyms in Chapter 10.

2 Executive summary

2.1 INTRODUCTION

2.1.1 This paper looks at the practical implementation challenges of internal models under Solvency II. Our emphasis is on the practical rather than the theoretical challenges. For each of the six regulatory standards which must be met for an internal model to be approved, we look at what the standard is; what it means in practice; what practical challenges are involved in meeting the standard; and include some suggestions on how these challenges may be overcome.

2.1.2 It is easy to get distracted by the detailed requirements of each of the standards. In this section we therefore first take a step back and look from a wider perspective, before looking at each of the standards in turn.

2.2 GENERAL POINTS

2.2.1 The first practical consideration around Solvency II is the scale of the project: it is arguably the biggest change to insurance solvency regulation for a number of decades. Even in the UK which is generally acknowledged to have one of the most advanced solvency regimes in the EU, the change will be significant.

2.2.2 As well as the size of the Solvency II project, its timing also presents challenges, as it is likely to overlap with some other significant projects for firms including implementation of the FSA's Retail Distribution Review and Phase 2 of the International Financial Reporting Standards project.

2.2.3 We believe that resourcing will be a key pressure point for firms, and this is something that has been reinforced by responses to our Survey which indicate that almost all firms are expecting to increase the size of their teams. Although on the face of it three years may seem a long time, the amount of implementation work required is such that this will create real practical issues, especially when coupled with the fact that there are a number of intermediate requirements which need to be completed prior to the final implementation date of October 2012 (such as the FSA's Pre-Application Process).

2.2.4 Although the term "internal model" is not explicitly defined in the Directive or draft implementing measures, it is clear that it is a much wider concept than the calculation engine that many would traditionally associate with the term. It effectively covers the whole framework of assessing the firm's capital requirements, and the controls around the inputs and outputs from this framework. Preliminary indications suggest that around 100 firms in the UK are planning to seek approval to make use of an internal model to calculate their capital requirements (rather than using the standard formula approach).

2.2.5 In terms of internal model preparedness, the Survey highlighted that many firms are still at the early stages of project planning. Project planning is complicated by the fact that final guidance for material aspects is not yet available, and some guidance will not be available for quite some time.

2.2.6 The whole internal model framework needs to be set up in a consistent manner, and an underlying theme of the guidance is that there should be an environment of continuous improvement. We believe that time spent up front on setting up good governance systems and controls for the internal

model should reap significant rewards later in the process. This governance should also cover the storage and management of documentation, data and assumptions, volumes of which are likely to be material. This is likely to be a key source of evidence for supervisors during the model approval process.

2.3 STANDARD 1: USE TEST

2.3.1 In our Survey, a number of companies stated that they viewed this standard and the documentation standard as two of the key challenges they faced in achieving internal model approval.

2.3.2 To be able to pass the Use Test, a firm will need to have more than just a good internal model: they will need to be able to demonstrate that the model is actually used for decision-making purposes.

2.3.3 To achieve this, the model will need to be embedded within the business as part of a strong risk culture. We believe that early engagement of senior management will be critical to the success of this.

2.4 STANDARD 2: STATISTICAL QUALITY

2.4.1 The statistical quality standards relate to the quality of the data, assumptions and methodology, and how they are used.

2.4.2 The requirements, as currently drafted in CP56, are onerous and will potentially result in a spurious level of accuracy, especially the requirement to have a full probability distribution forecast for the capital requirements. This is a point that a number of firms have raised during the CEIOPS consultation process, and many feel that the final requirements will be a little less strict than those stated in the current draft.

2.4.3 Diversification effects will be allowed for within the internal model as part of the process of aggregation of risks. Correlation matrices are the most popular method of risk aggregation, and are used by most UK companies in their Individual Capital Assessments (ICA). Such diversification effects can be substantial, and need to be appropriately considered as part of the construction of the internal model. The appropriate allowance for diversification will typically rely heavily on expert judgement, and we believe that this will be an area that will be challenging to justify, especially given that the correlations between risks are in practice likely to be dynamic in nature rather than static. It could arguably be one of the significant potential flaws in the Solvency II regime that while individual risks may with some confidence be fitted to appropriate Probability Distribution Forecasts, that these will then be aggregated using correlations that firms (and CEIOPS) find almost impossible to give a full and comprehensive justification to.

2.4.4 A significant volume of data will be required to be able to satisfy the statistical quality standards, and this data will be much more than companies will have used in the past, both in breadth and in depth. The level of analysis of the data will also be more intensive than under the previous regime.

2.5 STANDARD 3: CALIBRATION

2.5.1 The calibration standard requires that firms ensure that their internal model can produce output equivalent to a 99.5% confidence level on a value-at-risk measure (VaR) over one year, which is the calibration underlying the standard formula approach.

2.5.2 Our Survey suggests that the vast majority of companies are planning to calibrate their model at 99.5% VaR over one year, rather than use a different risk measure or a different period.

2.6 STANDARD 4: PROFIT AND LOSS ATTRIBUTION

2.6.1 This standard requires firms to regularly review the causes and sources of profit and losses by business unit and risk category.

2.6.2 A decision on the definition of profit and the level of tolerance of untraced profits and losses should be made early in the planning process as this will have an impact on the specification of the model. This will impact the work required and the granularity of the profit and loss analysis.

2.6.3 One of the main practical challenges will be installing data systems to provide the data required at a sufficient level of granularity to allow a detailed analysis.

2.7 STANDARD 5: VALIDATION

2.7.1 This standard requires that all aspects of the internal model should be appropriately validated on a regular basis to provide confidence over the results.

2.7.2 This standard will require a very significant improvement in the scope, quality and granularity of current validation processes, and validation checks will be required at all levels of the internal model process. Consequently, a considerable amount of work will be required by most firms to satisfy the standard, and it is likely that dedicated resource will need to be put in place to continue to satisfy the standard on an on-going basis post-implementation.

2.8 STANDARD 6: DOCUMENTATION

2.8.1 The documentation standard requires a detailed outline of the theory, assumptions and operation of the model. Sufficient documentation is also required to satisfy the supervisory authorities that all of the other standards are met, so this standard actually encompasses all of the six standards.

2.8.2 In our Survey, a number of firms felt that this was likely to be the most challenging standard to achieve, and that the level required was materially in excess of their current level of documentation.

2.8.3 We believe that early engagement of the Board and senior management is a critical feature of achieving the required documentation standards, as this will ensure that documentation receives appropriate attention in terms of project and resource planning.

2.8.4 Good model governance and effective version control of documentation will be very important to meet the required standard.

2.8.5 Documentation is also a moving target in that it constantly needs to be refreshed and kept up to date, which presents a number of practical challenges.

2.8.6 It should be noted that the level of documentation required will differ depending on the user, ranging from the most granular level (e.g. model specification) to higher level summaries (e.g. overview of model for the Board). This means that more than one level of documentation will be required, and all of the levels will need to be consistent.

2.9 CONCLUSIONS

2.9.1 The amount of work and effort required to achieve internal model approval will be significant, and should not be underestimated. The standards that must be met are set at a higher level than current industry best practice.

2.9.2 Early engagement, support and understanding of the Board and senior management, effective project and resource planning, and a culture which embraces risk management are some of the characteristics that are likely to help companies successfully achieve internal model approval.

3 Overview of Solvency II and internal models

3.1 THE LEGISLATIVE PROCESS FOR SOLVENCY II AND TIMELINE

3.1.1 Solvency II is being created in accordance with the EU four-level legislative process known as the Lamfalussy process. The 4 levels are:

- **Level 1 – Framework Principles**: This involves the European Commission developing a European legislative instrument that sets out essential framework principles. The Level 1 Directive text was adopted by the European Parliament on 22 April 2009 and was endorsed by the Council of Ministers on 5 May 2009. We will refer to this as "the Framework Directive", "the Directive" and "the Level 1 text" throughout this paper.
- **Level 2 – Implementing Measures**: This involves developing more detailed implementing measures, prepared by the European Commission following advice from the Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS). These implementing measures aim to provide sufficient extra detail around the Level 1 principles to enable companies to implement the principles within their operations. CEIOPS is composed of representatives of national supervisors (such as the FSA). In July 2009, CEIOPS issued the second set of draft technical advice on "Level 2" implementing measures for consultation. These followed the first set of consultation papers issued in March this year. A final set of consultation on implementing measures is expected to be issued around 2 November 2009. Taken together these are referred to as the "consultation papers" or "CPs" within this paper. In particular, CP56 covers the tests and standards for internal model approval. Level 2 implementing measures are referred to as "Level 2 text" in this paper.
- **Level 3 – Guidance**: CEIOPS works on joint interpretation recommendations, consistent guidelines and common standards to encourage convergence of supervisory practice across all EU national supervisors. Additionally, CEIOPS undertakes peer reviews and compares supervisory practice to ensure consistent implementation and application.

- **Level 4 – Enforcement**: This involves the European Commission reviewing Solvency II implementation in each Member State, and taking enforcement action against any States who have not implemented it appropriately.

3.1.2 The Directive now includes a 'go live' implementation date of 31 October 2012. The high level timeline of known activities leading up to Solvency II implementation included in the FSA's Feedback statement FS 09/01 is reproduced in Figure 1 below.

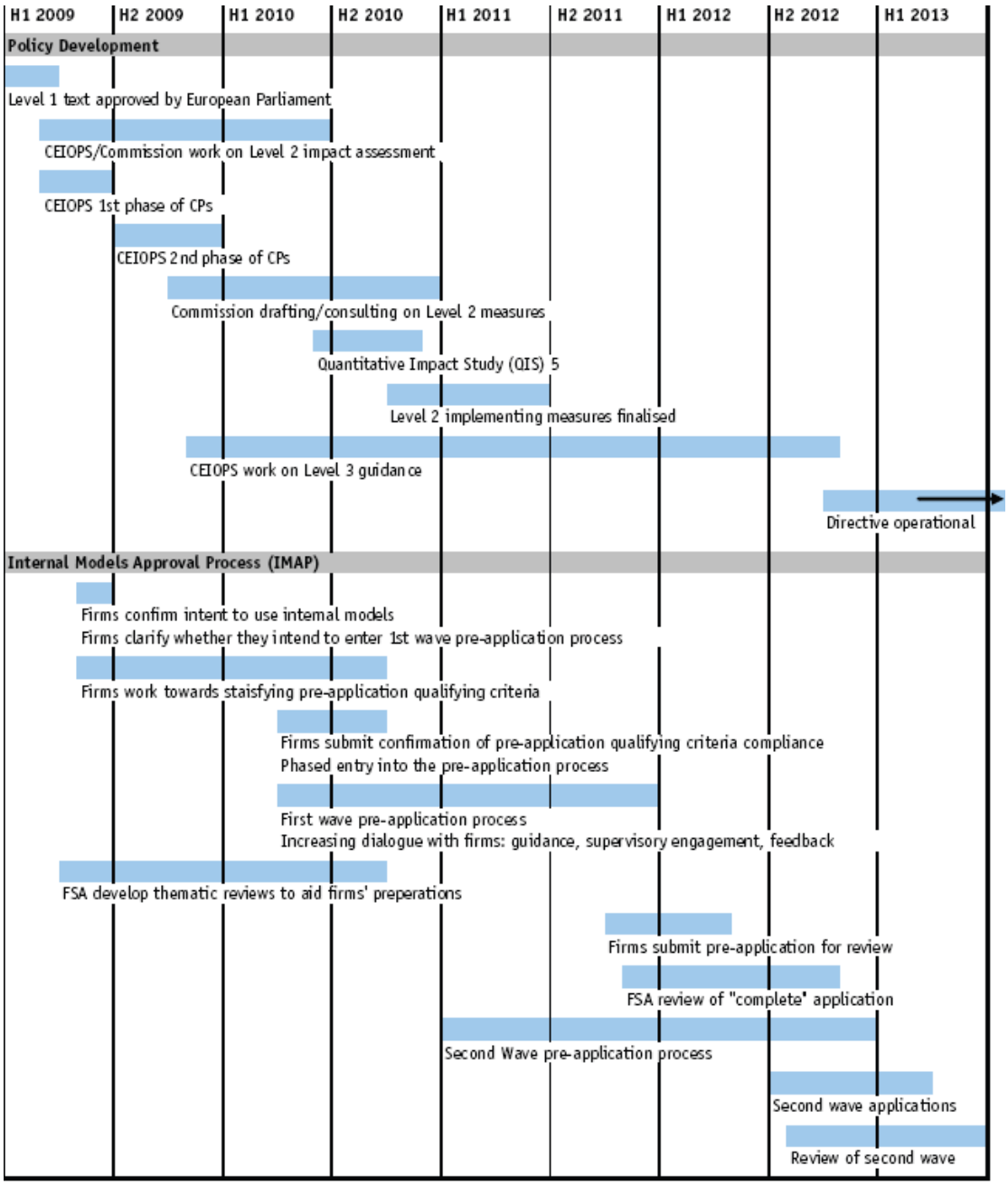


Figure 1: FSA timeline of known activities leading up to Solvency II implementation from FSA Feedback Statement FS 09/01.

3.2 CORE ELEMENTS OF SOLVENCY II REQUIREMENTS

3.2.1 Solvency II adopts a three pillar approach which is similar to the Basel II Accord requirements for the Banking industry. Figure 2 below shows the key elements of each of the pillars.

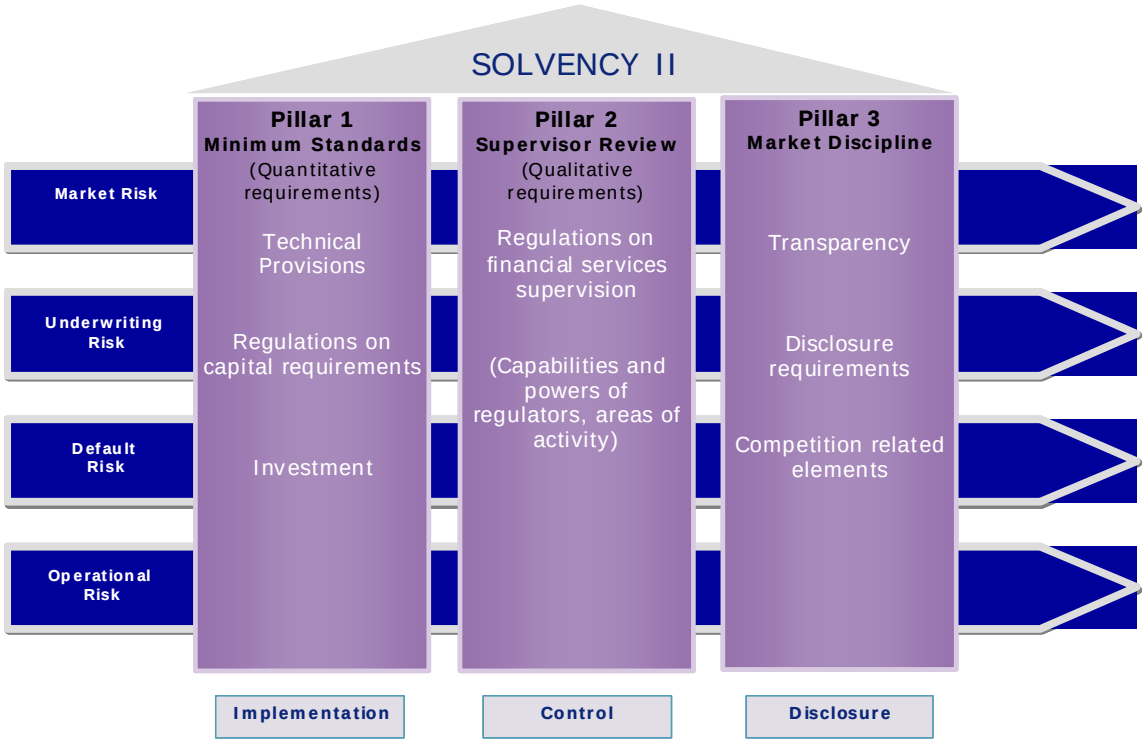


Figure 2: Solvency II three pillar approach.

3.2.2 **Pillar 1** contains the requirements for demonstrating adequate financial resources. It applies to all firms and considers key quantitative requirements, including the calculation of technical provisions and the rules relating to the calculation of the solvency capital requirements.

3.2.3 Under the Directive, there are actually two solvency requirements – the Minimum Capital requirement (MCR) and the Solvency Capital Requirement (SCR). The SCR is the target level of capital which companies are required to hold. The MCR represents the absolute minimum level of capital required, and if a company's available capital is below this level, it will trigger severe regulatory intervention including the likelihood of withdrawal of authorisation. If the available capital lies between the SCR and MCR, the supervisor will also intervene, although the level of intervention will be less severe (e.g. the supervisor may require the company to put in place a credible recovery plan). The concept behind having two measures of solvency margin is to provide an early warning system to the supervisory authorities of potential problems at a company which gives them enough time to act before the company becomes insolvent.

3.2.4 For the SCR, the company calculates its capital requirements for various risk types e.g. market risk, default risk, life underwriting risk, etc. Each risk type is split into sub-modules, for example life underwriting includes mortality, longevity, lapse, etc. The complete list of risk types are set out in Annex IV of the Framework Directive. The objective of the SCR is to

calculate the required capital for each risk that is consistent with a 99.5% confidence interval over a one year period.

3.2.5 **Pillar 2** contains the requirement to demonstrate an adequate system of governance. It includes the need to have an effective risk management system and prospective risk identification through the requirement for each company to carry out an Own Risk and Solvency Assessment (ORSA). It also contains the Supervisory Review Process (SRP) which is the overall process conducted by the supervisory authority in reviewing each company's approach to risk management, capital allocation and solvency assessment, ensuring compliance with the Directive requirements and identifying those with financial and / or organisational weaknesses which could potentially lead to higher risks to policyholders.

3.2.6 **Pillar 3** contains the public disclosure and regulatory reporting requirements and is concerned with enhancing disclosure requirements in order to increase market transparency and discipline.

3.3 CURRENT APPROACH TO SOLVENCY WITHIN THE UK

3.3.1 The current EU Solvency I regime has very simplistic formula-based capital requirements which are a function of reserves and sum at risk. These requirements give no credit to insurers for understanding and actively managing their risks, and do not achieve a good alignment of capital required against the underlying risks. There is also no requirement for a market consistent valuation of the liabilities, but rather liabilities are calculated with a prudential margin built into the key assumptions.

3.3.2 In the UK, the FSA addressed some of these issues in December 2004 with the formal introduction of a two pillar approach to regulatory reporting. Under Pillar 1 of this approach, there is a requirement for a "twin peaks" calculation for companies with large with profits funds. In the twin peaks calculation, the company must first calculate its reserves using the traditional "Peak 1" Solvency I reserving requirements, and then calculate the "Peak 2" realistic position for the business (including cost of guarantees, etc). If this proves to be more onerous, then additional capital requirements need to be set aside.

3.3.3 Under Pillar 1 the inclusion of Own Funds (very broadly the capital resources available to the company in excess of the liabilities) is limited to tangible assets and subordinated debt.

3.3.4 Under Pillar 2 of the FSA approach there is a requirement for companies to submit an Individual Capital Assessment (ICA) in respect of their business which requires companies to assess their own risks and report results confidentially to FSA. These additional requirements beyond Solvency I are often referred to as "gold plating", and are one of the reasons why Solvency I capital requirements diverge across different Member States. Solvency II aims to achieve consistency across all Member States by ensuring all Member States follow the one Directive and do not add any gold plating provisions.

3.3.5 The structure for Own Funds under Pillar 2 includes estimates of future profits and will be more consistent with Solvency II requirements, although the current outline of tiering rules for quality of capital may make the position more onerous under Solvency II.

3.4 WHAT ARE INTERNAL MODELS AND HOW DO THEY FIT INTO SOLVENCY II?

3.4.1 The Framework Directive gives insurers the option to use internal models to determine their Solvency Capital Requirement (SCR) under Pillar 1 to reflect the specific risks the organisation faces rather than using the standard formula approach. A company may choose to use the internal model approach or, in certain unusual circumstances, the supervisor may require the company to use an internal model.

3.4.2 Neither the Framework Directive itself nor the Level 2 consultation papers define what is meant by an internal model. As part of the Survey we asked the question "What is your firm's working definition of an internal model?". There were a range of responses including: "*still to be determined*", "*a model which meets the Solvency II Directive requirements*" and "*Our interpretation is that this encompasses the entire capital management risk framework. This includes the calculation engine, documentation, model & assumption validation and the embedding of the framework across the business in day to day work.*"

3.4.3 The Groupe Consultatif / CEA Solvency II Glossary (2007) defines an internal model as follows:

> *"[A] risk management system of an insurer for the analysis of the overall risk situation of the insurance undertaking, to quantify risks and/or to determine the capital requirement on the basis of the company specific risk profile.*
>
> *Within the Solvency II framework an internal model is intended to fully or partially replace the standard formula for the calculation of the Solvency Capital Requirement. Both quantitative and qualitative requirements will be set by the regulator and explicit approval has to be granted by the supervisor."*

3.4.4 The Directive also requires companies to gain supervisory approval in order to use the internal model approach for the calculation of their SCR, and it sets six standards that must be met to secure that approval. These standards are:

1. Use test.
2. Statistical quality standards.
3. Calibration standards.
4. Profit and loss attribution.
5. Validation standards.
6. Documentation standards.

3.4.5 In addition to these six standards, the Directive also states in Article 110(5) that *"Supervisory authorities shall give approval to the [internal model] application only if they are satisfied that the systems of the … undertaking for identifying, measuring, monitoring, managing and reporting risk are adequate"*. This requires the internal model to be well integrated with the risk management systems, and for there to be robust governance controls around it. These requirements are sometimes informally referred to as "Test Zero".

3.4.6 In practice, for a UK insurer this means that the FSA must approve the internal model before an insurer can use it for SCR calculations. The standards that must be satisfied make it clear that the internal model is much wider than the capital calculation model used to calculate the solvency capital. The internal model also incorporates how output is "used" in day to day decision making and the risk management framework. Each of the six standards is covered in more detail in Chapters 4 to 9 of this paper.

3.4.7 In addition to Pillar 1, the internal model is also relevant to the ORSA under Pillar 2. Irrespective of whether a firm chooses the internal model route or standard formula approach under Pillar 1, it is required to produce an ORSA under Pillar 2. Again an internal model may be used for the ORSA calculation, but it is not a requirement to use an internal model. However, if an internal model has been approved for calculating the SCR, it is likely that the same internal model would be expected to be used for the ORSA calculation (to satisfy the use test and also from an efficiency perspective).

3.4.8 The Framework Directive also refers to partial internal models. A partial internal model can refer to use of an internal model approach for part of the business rather than the whole insurance business or it can refer to using an internal model for some but not all risk types. Partial internal models are to be subject to further consultation by CEIOPS in November 2009, and will not be discussed further in this paper.

3.5 PROS AND CONS OF USING INTERNAL MODELS

3.5.1 Given that in order to use internal models significant costs will be involved in the approval process, why would a company want to use an internal model? There are many potential drivers for using an internal model, and we provide some examples below.

3.5.2 The key driver is that if a company uses an internal model to run its business, it is more likely to have a better appreciation of the risks it is running which in turn should result in better risk management and more efficient allocation of capital. It would seem reasonable for such a company to be given credit for this through lower capital requirements. It is however not guaranteed that the capital requirements will be lower. In the Survey we asked companies how much of an approximate increase/reduction in free capital they were expecting compared to use of standard formula approach. The response was fairly evenly matched between those who thought it would increase and those who thought it would decrease, but the majority were unsure.

3.5.3 The information from the internal model can and should be used in product pricing which could give the company a competitive advantage over companies not using the internal model route in that they have a better understanding of the risks and their impact and can take this into account in pricing decisions.

3.5.4 There could also be pressure from the market and rating agencies for companies to adopt an internal model approach (rating agencies views on a company's appreciation of its risks are likely have an impact on the cost of raising capital, etc.).

3.5.5 It should be noted that even within the standard formula approach, models are required to calculate the capital requirements for the various risk modules that are then aggregated in the standard formula.

3.5.6 The cost involved in gaining internal model approval is likely to be the key reason why some companies (especially the smaller companies) may choose to use the standard formula approach.

3.6 APPROVALS PROCESS

3.6.1 Internal model approval will be a significant challenge for companies. In the UK, the FSA has set up a Pre-Application Process ("PAP") (pre-approval) for internal model approval outlined in DP08/4. The first wave of this process requires firms to demonstrate compliance with the PAP entry criteria between Q2 and Q4 2010 with the process itself commencing immediately afterwards. In the Survey, 65% of companies stated their intention to participate in the first wave, and indications suggest that around 100 companies have expressed an intention of participating in the first wave. There will be a second wave in 2011, but the FSA has warned that companies in the second wave may not have their internal models approved by the Solvency II implementation date of 31 October 2012. To participate in the PAP, the company is required to demonstrate compliance with the PAP entry criteria. 79% of companies in the survey were quite confident or very confident they would comply with these criteria.

3.6.2 CEIOPS consultation paper CP37 sets out how the internal model approval is expected to work in practice and goes some way to supporting the FSA's position, proposing a model pre-approval process across all of Europe.

3.6.3 The Directive and CP56 set out the principles for internal model approval. As previously mentioned, there are six standards which must be met for internal model approval:

- **Use test**: The use of the internal model should be central to business decision-making.
- **Statistical quality standards**: Appropriate statistical quality standards should be applied to all aspects of the internal model.
- **Calibration standards**: The internal model should be calibrated to the equivalent of a 99.5% confidence level over one year.
- **Profit and loss attribution**: A profit and loss attribution across major business units must be carried out at least annually to help validate the internal model.
- **Validation standards**: All aspects of the internal model should be appropriately validated to provide confidence over the results.
- **Documentation standards**: The internal model should be adequately documented.

Each of these is covered in more detail in chapters 4 to 9.

3.6.4 Internal model approval will also be a significant challenge for the FSA and it will have to manage the peak load resourcing issue caused by lots of companies requiring their internal models to be approved around the same time.

3.6.5 The FSA are currently in the first stage of a two stage process of producing Thematic Reviews on aspects of internal models. Stage 1 is planned for publication in September 2009, and is effectively a stock-taking exercise of the FSA's understanding of current industry practice relating to internal models. It will be published as four reports on the broad areas identified for review. These four broad areas will be further split into sub-sections of the issues to be focussed on. These are shown in Table 1.

Report	**Subject to be reviewed**
Qualitative Standards	• Demonstrating the use-test • Risk governance • Model governance • Senior management understanding. • Management actions.
Quantitative Standards	• Operational risk • Dependency structures • Model calibration • Modelling cat risk • Market and credit risk • Technical provisions
Model validation	• Validation (model input and output credibility and feed into decision making) • Compliance with other directive tests
Data and ensuring stability	• Compliance with data requirements

Table 1: Summary of the topics covered in Stage 1 of the FSA's thematic review reports relating to internal models (to be issued in September 2009). Source: FSA Feedback Statement 09/1.

3.6.6 Stage 2 will be a detailed look at the topics involving internal FSA experts and a selection of firms. This is currently planned for publication in Q3 2010.

3.7 BUILDING INTERNAL MODELS

3.7.1 The timescales to build an internal model and get it approved under Solvency II are demanding. As noted in section 3.6, the FSA require companies to demonstrate compliance with their PAP criteria for the first wave of internal model pre-approval between Q2 and Q4 2010.

3.7.2 The resources required and costs to build an internal model could be onerous. Companies should be planning and preparing for this now if they do intend to go down the internal model route. For UK companies, ICA models are a good starting point but the FSA has made it clear on many occasions that these are only a starting point.

3.7.3 There are several key stages in building internal models, and include aspects such as:

- **Model specification and use**: Companies need to decide on what metrics they require the internal model to produce and how frequently.
- **Upgrading existing models**: The ICA and other models can be used as a starting point, but they will need to be significantly upgraded to ensure they meet the approval standards and to ensure they can produce the required output in the required timescales.
- **Model governance**: Responsibilities, internal controls and a change control process need to be specified.
- **Embedding**: The internal model must be integrated into risk and capital management and used in making business decisions.

3.7.4 The concept of a market consistent valuation of assets and liabilities is becoming increasingly important in reporting (e.g. the recent introduction of Market Consistent Embedded Value (MCEV) reporting). From an efficiency perspective, it would make sense if the internal model was also used in producing these reporting measures. At the very least, International Financial Reporting Standards (IFRS) and MCEV reporting should be consistent with the internal model calculations. In the Survey, we asked whether companies were planning on using their Solvency II calculation model for MCEV and IFRS reporting. As can be seen from Figure 3, over 70% were planning to use it for MCEV reporting, and over half were planning to use it for IFRS reporting (with many still undecided on IFRS reporting which is probably due to the lack of clarity on the future direction of IFRS Phase 2).

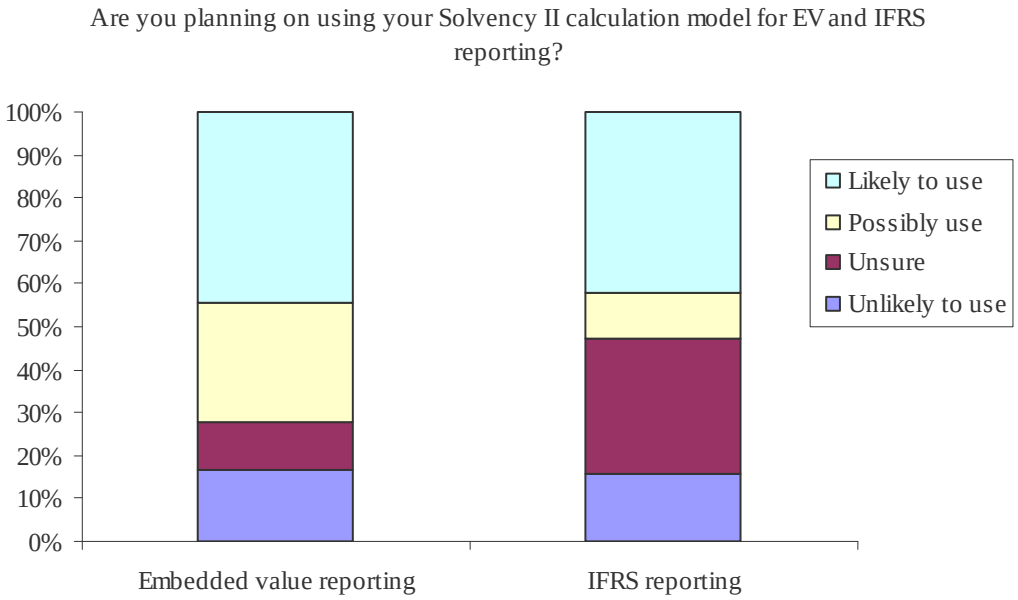


Figure 3: Responses to Survey regarding wider uses of internal models.

3.8 MAINTAINING INTERNAL MODELS

3.8.1 The ongoing governance of internal models is very important. Supervisors don't just want to make sure that the model meets the required standards at the point of approval, but they will need confidence that the model will continue to meet the required standards on an ongoing basis. This will require a formal change control process to be specified for the internal model, covering aspects such as:

- The scope of the model change policy.
- Definitions of categories of model change. This should be split into minor and major but sub-divisions within these categories could also be defined.
- Rules for determining what category a model change falls into.
- Reporting requirements for different categories. Major changes will need to be communicated in advance of implementation with sufficient information to allow the Board to sign off the changes. Minor changes will need to be reported on a less frequent basis.
- Sign-off procedures for each category of model change.

3.8.2 Companies will also need to consider the appropriate department structure for ongoing maintenance and use of the internal model. Solvency II is generally being tackled as a separate project within companies but ultimately it will need to be integrated into existing processes and departments.

3.9 USING APPROXIMATIONS TO INCREASE SPEED

3.9.1 One of the challenges of using internal models within Solvency II is how to satisfy the "Use Test" requirement that the output from the model is used in business decisions. If the model takes a month or more to run, it is unlikely to be useful in this context. In practice, various approximating techniques will need to be used to update the results of the last full run of the model sufficiently quickly so that they are of use in day to day decision making.

3.9.2 An example of one such technique that is likely to be used by a number of firms is that of replicating portfolios.

3.9.2.1 A replicating portfolio is a portfolio of assets whose behaviour under stress matches that of the insurance liabilities as closely as possible. If a replicating portfolio can be found then liabilities can theoretically be re-valued and projected quickly and easily.

3.9.2.2 Replicating portfolios are generally constructed in one of two ways:

- Market value approach. The assets are fitted to the market value of liabilities under current conditions and under a variety of instantaneous stresses.
- Cashflow approach. The assets are fitted to the liability cashflows in a range of scenarios (typically the stochastic scenarios from realistic solvency calculations).

Under both approaches, it is necessary to calibrate to liability values that have already been calculated i.e. the internal model needs to have been run first and then the replicating portfolio fitted to it. This replicating portfolio can then be used to approximate future changes to the liabilities.

3.9.2.3 It is worth noting that replicating portfolios generally only cover market risks. Other risks in the internal model (e.g. longevity, operational) will need to be allowed for separately. It is also not clear that replicating portfolios will capture all the characteristics of the liabilities under every possible scenario, particularly in complex with-profits funds. This means that calculating the capital requirement is likely to require more than just the use of the replicating portfolio technique. However, replicating portfolios do provide a quick way to estimate the value of the liabilities under a market stress which mean they are likely to be useful for producing approximate answers from the internal model to assist in management decisions.

3.9.2.4 Many other techniques exist for estimating / fitting surfaces to results although the extent to which these will be used will likely be limited by whether their use is accepted as standard market practice.

4 Use Test

4.1 WHAT IS IT?

4.1.1 The Use Test is a qualitative, principles-based assessment of the embeddedness of an internal model in a firm's business. It is the first of the six tests that a firm must satisfy if approval to use an internal model to calculate the Solvency Capital Requirement (SCR) is to be granted. While the Use Test remains one of the more ambiguous aspects of Solvency II, it is anticipated that considerable investment will be required from even the best-prepared UK firms to meet its requirements.

4.1.2 Article 118 in the Framework Directive sets out the requirements of the Use Test:

"Insurance and reinsurance undertakings shall demonstrate that the internal model is widely used in and plays an important role in the following:

(1) their system of governance, referred to in Articles 41 – 49, in particular

(a) their risk-management system as laid down in Article 43 and their decision- making processes;

(b) their economic and solvency capital assessment and allocation processes,

including the assessment referred to in Article 44.

In addition, insurance and reinsurance undertakings shall demonstrate that the frequency of calculation of the Solvency Capital Requirement using the internal model is consistent with the frequency with which they use their internal model for the other purposes covered by the first paragraph.

The administrative or management body shall be responsible for ensuring the on-going appropriateness of the design and operations of the internal model, and that the internal model continues to appropriately reflect the risk profile of the insurance and reinsurance undertakings concerned."

4.1.3 The key phrase in Article 118 is “widely used in and plays an important role in”. CEIOPS refers to this phrase throughout CP56. CEIOPS envisages that the Board and senior management are heavily invested in the success of the internal model and trust it sufficiently for it to play a key role in making important business decisions. CEIOPS does not intend that the internal model will be used to run the business, rather that the decision-making process will take account of the output of the internal model, while also acknowledging its limitations.

4.1.4 CEIOPS considered three approaches for the assessment of the Use Test, which included a prescribed list of uses and a case-by-case analysis but has settled on a principles-based approach with a series of nine principles that stem from a foundation principle.

4.1.5 The final paragraph of Article 118 touches on the governance of the internal model. The governance of the internal model forms part of the overall governance of the organisation and should include *inter alia* effective oversight by the Board and senior management of the internal model, review of the internal model (including robust challenge of the internal model output), and improvements to the internal model. The requirements around the governance of the internal model are prominent in CP56 and, reflecting their importance, some commentators have taken to referring to them as ‘Test Zero’, an additional test of the internal model.

4.2 WHAT DOES IT MEAN IN PRACTICE?

4.2.1 Despite the remaining ambiguity around the Use Test, CEIOPS has gone a long way to helping firms understand what the Use Test will mean for them in practice by setting out in CP56 the principles and possible uses of an internal model. With that in mind, in this section we look first at the principles set out in CP56 and then set out a comprehensive list of possible uses of internal models. Finally we assess the requirements around internal model governance.

4.2.2 **Foundation principle**: *“The undertaking's use of the internal model shall be sufficiently material to result in pressure to improve the quality of the internal model.”*

4.2.3 Through the foundation principle, CEIOPS sets the tone for the Use Test. The Use Test is not a one-off compliance issue; it is an ongoing and evolving requirement and it is clear that CEIOPS expects firms to strive to improve the quality of their internal models. If internal models are used as envisaged by CEIOPS, the motivation to implement improvements will come from within firms. A corollary of these improvements is that the Use Test ‘bar’ (while a qualitative standard) will continually be raised.

4.2.4 **Principle 1**: *“Senior management, including the administrative or management body, shall be able to demonstrate understanding of the internal model.”*

4.2.5 If the internal model is to be used by senior management then both they and the Board must have an appropriate understanding of the internal model in terms of its structure (e.g. the logic employed, statistical and business planning assumptions, how diversification effects arise); how it fits with their business model and risk management framework; and crucially also the limitations of the internal model and how these limitations are factored into the decision-making process.

4.2.6 While the internal model will be owned by the risk management function, Principle 1 puts the onus on the Board and senior management to acquire an understanding of the internal model and be able to demonstrate it to supervisors. In their assessment of compliance with the Use Test, CEIOPS expects supervisors to interview members of the Board and senior management and to seek evidence (e.g. through the minutes of Board meetings) that results from the internal model that will have a major impact on the firm have been reported to the Board and discussed by the Board.

4.2.7 **Principle 2**: *"The internal model shall fit the business model."*

4.2.8 CEIOPS' view is that to be useful, the internal model must be aligned with the firm's business and have picked up the FSA's comment in DP08/4 that "to embed the model into the business, it is first necessary to embed the business into the model."

4.2.9 A number of key areas for attention are highlighted by CEIOPS: the internal model should link to the technical provisions, which are the source of much of the risk in a firm; it should help with, and allow reconciliation between, internal and external reporting and allow for different accounting regimes; the internal model should be proportionate to the nature, scale and complexity of risks undertaken; it should be changed in response to changes in the business model (e.g. reorganisations, expansion into new locations or new lines of business); and results from the internal model need to be available at a sufficiently granular level to allow allocation of economic and regulatory capital.

4.2.10 **Principle 3**: *"The internal model shall cover sufficient risks to make it useful for risk management and decision-making."*

4.2.11 This is seen by CEIOPS as essential if the internal model (whether full or partial) is to be useful for the firm. The internal model must include an assessment of all material risks in a firm's risk register and must reflect the risk appetite of the business.

4.2.12 **Principle 4**: *"The internal model shall be widely integrated with the risk-management system."*

4.2.13 The firm must have in place effective processes and systems to manage risk and capital. To satisfy the Use Test, it is clear that CEIOPS expects the internal model to be fully embedded in the business; Principle 4 makes explicit the need for the internal model to be at the heart of the risk management function. For example, all risks identified by risk management system must be inputs into the internal model; outputs from the internal model must be used to set risk appetite, risk tolerance, trigger points and risk mitigation strategies; outputs must appear in reports to internal forums, such as the Board; and diversification benefits must be quantified and allocated as part of the capital allocation process.

4.2.14 **Principle 5**: *"The integration into the risk-management system shall be on a consistent basis for all uses."*

4.2.15 Principle 5 requires the internal model to be able to produce results on all bases of interest, which may include local GAAP, IFRS, Solvency II, economic capital and internal management accounting. The requirement to produce and reconcile results across a number of bases at a granular level is likely to be a significant challenge for most firms.

4.2.16 **Principle 6**. *"The internal model shall be used to support and verify decision-making in the undertaking."*

4.2.17 Article 118 requires the internal model to be used in decision-making processes (e.g. setting business or risk strategy, pricing products). By making the internal model key to the decision-making process, the Use Test provides the incentive for firms to keep the internal model and its parameters up to date (in line with the foundation principle).

4.2.18 Most firms are likely to find Principle 6 challenging to satisfy. It requires not only an understanding of the internal model and its limitations by the Board and senior management, but also a high level of trust in the internal model to ensure that the output from the model is systematically incorporated into the decision-making process. CEIOPS will look for evidence that the internal model and its results are regularly discussed within the firm. The evidence could take the form of reports or meeting minutes. These might demonstrate, for example, that "what if" scenarios - If new business for this line of business doubles, what is the impact on the capital? - were proposed, run through the internal model and the results analysed prior to a key decision being made. Other forms of evidence would be internal model output appearing on regular management information dashboards for the Board and senior management, being scrutinised by them and then fed into the decision-making process.

4.2.19 At this point, it is worth noting that the Use Test applies at all levels within a firm's organisational structure, not just at the level at which risk strategy and risk management are defined. Each function in the business is expected to understand how its decisions affect the risk and capital profile of the firm and is expected to contribute to the scope, design, operation and continuing development of the internal model.

4.2.20 **Principle 7**: *"The SCR shall be calculated at least annually from a full run of the internal model, and also when there is a significant change to the undertaking's risk profile, assumptions underlying the model and / or the methodology arising from decisions or business model changes, and whenever a recalculation is necessary to provide up-to-date information for decision making or any other use of the model, or to fulfil supervisory reporting requirements."*

4.2.21 CEIOPS' advice in CP56 is that supervisory authorities should decide on a case-by-case basis whether a firm needs to calculate the SCR using a full model run on a more frequent basis than annually. CEIOPS is also aware that the MCR must be calculated quarterly and that the proposed methodology requires a link to the SCR. Under the principle of proportionality, firms using an internal model shall apply a quarterly calculation that is sufficiently sophisticated to produce the quarterly SCR.

4.2.22 It is anticipated that most UK firms will have to develop the systems and processes around their internal model to ensure both that the SCR can be calculated within the year-end process (as to date the ICA has typically been done outwith the year-end period); and that the approach used to monitor the SCR between annual calculations is sufficient (e.g. the use of replicating portfolios, risk proxies or roll forwards). Large firms with complex businesses are expected to look to calculate the SCR more frequently than annually, while for smaller companies who still wish to run an internal model the requirement only to calculate the SCR annually will be a welcome relief.

4.2.23 **Principle 8**: *"The internal model shall be used to improve the undertaking's risk-management system."*

4.2.24 CEIOPS expects that by using the internal model, companies will gain more insight into their risks and hence be in a position to improve their risk management system. Suggested improvements include improving risk-mitigation techniques, clarifying the risk appetite of the firm, allowing more informed monitoring of risks and more risk-based decision making.

4.2.25 Principle 8 is consistent with CEIOPS' view that not only should the internal model sit at the heart of the business, and be used by the business, but that it and the risk management system are organic and should be developed and improved over time. If the internal model is truly being 'used', it is inevitable that possible improvements will be identified in the course of business. Any planned developments should be set out in a road map of future model developments. Firms may wish, for example, to implement more frequent 'hard-close' capital calculations, review assumptions more regularly or in response to specific events, or consider a wider range of emerging risks.

4.2.26 **Principle 9**: *"Undertakings should design the internal model in such a way that it facilitates analysis of business decisions."*

4.2.27 In CP56, CEIOPS helpfully lists a number of uses of the internal model that CEIOPS regards as good practice (e.g. rather than taking the results of the internal model as the final answer, firms should use the results to inform internal debate) but is otherwise fairly vague.

4.2.28 While CP56 does not prescribe a list of uses that an internal model must satisfy, CEIOPS have set out a list of uses that firms might consider when designing their internal model and submitting their application for approval. We felt it would be helpful for companies to have available a comprehensive list of possible uses of the internal model and have developed the following list, split by broad function, by drawing on a number of sources.

- **Risk management**: Quantifying and ranking risk; monitoring and managing the top risk exposures; developing and monitoring risk appetite; setting risk tolerance limits; ORSA preparation (stress and scenario testing, capital projection).
- **Capital management**: Calculating regulatory, rating agency and economic capital requirements at an appropriate level of granularity (business unit, line of business or homogeneous risk group); capital allocation by business unit and product; risk balancing (efficient use of capital); assessing efficiency of different capital structures; assessing capital raising options.
- **Strategy / planning**: Developing risk strategies; business planning; understanding the risks in the business plan and sensitivities to key assumptions; assessing the impact of potential mergers, acquisitions or disposals on the risk and capital profile of the business; portfolio transfer pricing; assessing the impact of different dividend and share buy-back policies; assessing customer benefits (e.g. setting bonus rates); setting return on capital targets for different business units, business lines and products; linking remuneration to profit and return on capital targets.

- **Product development**: Capital requirements and risks of new products; pricing of new and existing products; understanding the potential impact of new product developments; developing alternative business plan projections.
- **Risk mitigation**: Analysis, design and purchase of the reinsurance and financial hedging programmes.
- **Internal and external reporting**: Calculating technical provisions (including risk margins); production of key risk management information; risk based performance reporting using measures such as return on risk adjusted capital; market valuations for IFRS; reporting on MCEV / EV; reconciliation between the internal model and the technical implementation of management actions, e.g. for with-profit business; reconciliation between the internal model outputs and technical provisions and internal and external financial reporting.
- **Investment management**: Asset-liability management; assessing the impact of different strategic, tactical and operational investment decisions.
- **External communication**: Risk reporting to key stakeholders; communicating profit and return on capital targets.

4.2.29 In CP56, CEIOPS sets out its vision for the governance of an internal model. The vision comprises two levels of governance - high level and detailed – with a connecting feedback loop.

4.2.30 The Level 1 text makes it clear that, at a high level, governance is the responsibility of the Board and senior management. CEIOPS views the following areas as components of high-level governance:

- **Internal model approval**. Responsibility, from beginning to end, for the internal model approval process and the associated controls and documentation.
- **Roles and responsibilities**. Deciding on roles and responsibilities for the internal model governance. For example, an organisation may decide to establish an Internal Control Committee for the internal model.
- **Model change policy**. Responsibility for controls and documentation around the internal model change policy. Also responsibility for the process around applications for approval for major changes or extensions to the internal model.
- **Model strategy**. The firm needs to set up an internal framework to enable it to monitor the appropriateness of the model, and then to decide on the strategic direction of the model and hence any changes that are required. This will involve regular reports from the risk management function (via the feedback loop) about the performance of the internal model and areas for improvement.
- **Alignment to risk profile**. The internal model must reflect the risk profile of the firm. The internal model governance must therefore include a process by which the Board and senior management can review the alignment of the model with the risk profile and then act to change the internal model if necessary to ensure on-going alignment.

- **Timeliness of results**. The credit crisis has highlighted the need for timely calculation of results. The Board and senior management must ensure via the governance process that significant time lags between the calculation of model output and the use of the output for decision making purposes are avoided.
- **Sufficient, skilled resource**. The high-level governance process set up by the Board and senior management must ensure that there are sufficient resources to develop, monitor and maintain the internal model, and that the resources are appropriately skilled and experienced. It is sensible for firms to avoid relying excessively on a small number of experts.
- **Risk expert**. Where an approved internal model is being used, there must be at least one risk management expert in the company's senior management. In CP33, CEIOPS sets out its expectation that this will be the CRO where the firm is large or has a complex risk profile.
- **Ongoing compliance**. High-level governance must include the monitoring and reporting of on-going compliance with the requirements for internal model approval, so that the Board and senior management are able both to inform the supervisory authorities if the model ceases to comply and to assess the materiality of non-compliance.
- **Independent review**. The high-level internal model governance must ensure that there are adequate independent review procedures in place. The FSA raised a question around this issue in DP08/4. Firms' responses indicated that while they agreed that some independent challenge was necessary they were unsure as to whether this challenge could come from the internal audit function (who may lack the skills required) or would be better provided by an external party.

4.2.31 The detailed internal model governance requirements are the responsibility of the risk management function. Article 43 in the Level 1 text sets out responsibilities of the risk management function with regard to the internal model. CEIOPS expands on these responsibilities in CP56, and highlights the following aspects:

- **Design and implementation**. While the Board and senior management are responsible for setting the strategic direction of the model, the risk management function is responsible for the detailed design and implementation of the internal model.
- **Testing and validation**. The risk management function is responsible for the testing and validation of the internal model.
- **Documentation**. The risk management function must document the internal model and any changes to it.
- **Analysing and reporting on the performance of the internal model**. As mentioned above, the risk management function should report regularly to the Board and senior management on the performance of the internal model. The report should include an assessment of compliance with the internal model approval requirements and include a plan for restoration of compliance with the requirements where applicable.

- **Suggesting improvements to the internal model**. The risk management function must suggest areas for improvement to the internal model as part of its regular reporting to the Board and senior management and must report on the status of efforts to improve previously identified weaknesses. In particular, this will help the firm to satisfy one of the requirements of the Use Test: that the Board and senior management must understand the limitations of the internal model.

- **Liaise closely with users of the outputs of the internal model**. Interaction with the users of the output from the internal model is essential since they will have the greatest insight into the usefulness of the internal model and the risks they face. CEIOPS recognises that a key relationship is the one between the risk management and actuarial functions and recommends that firms develop a communication loop between these two functions.

4.2.32 CEIOPS also lists a number of areas where it feels the risk management function will need to manage the internal model. These include providing output at an appropriate level of detail to the decision makers in the firm; implementing changes to the model; providing information to enable reviews of the internal model and its controls; developing, implementing and documenting responsibilities for running and developing the model; managing relationships with providers of external data; and implementing the firm's policies relating to the internal model (e.g. data and validation policies).

4.2.33 CEIOPS considers a feedback loop between the two levels of governance to be essential. This will ensure that information flows from the risk management function to the Board and senior management (e.g. reports on the performance of the internal model and suggestions of improvements) and vice versa (e.g. on the strategy for developing the internal model).

4.3 WHAT ARE THE PRACTICAL CHALLENGES?

4.3.1 The Use Test presents a significant challenge for UK firms as it goes beyond the current ICAS requirements; even the best prepared UK firms are still some way short of the Use Test principles in at least some areas. In the recent internal models Survey that we conducted with the industry, a number of firms cited the Use Test as one of the greatest challenges facing them.

4.3.2 So what are the practical challenges? In this section, we set out five aspects of the Use Test that we feel firms will find particularly challenging.

4.3.3 Establishing a risk culture

4.3.3.1 Firms must transform themselves from insurance businesses into risk businesses. If firms are to fully embed internal models in their businesses, and thus satisfy Principles 4 and 6, risk must be in the organisation's DNA. This requires a change in the mindset of the organisation and is arguably harder to implement than any of the possible uses of an internal model set out above. The importance of a strong risk culture has been emphasised by Standard & Poor's in the criteria they use to evaluate insurers' ERM frameworks.

4.3.3.2 The change in mindset starts with the Board and senior management but ultimately must apply in all business units, in all territories and at all levels

within the organisation. If the Board and senior management think of strategy in terms of risk, regularly discuss risk appetite and have performance targets based on economic capital measures, then the use of the internal model is inevitable. Similarly if everyone in the organisation thinks about their job in terms of risk, it follows that they will talk credibly about how they manage risk in their roles. If the firm can develop a risk culture then it will be well on the way to satisfying the Use Test principles and governance requirements, and gaining internal model approval.

4.3.4 Improving and extending the use of the internal model

4.3.4.1 The results of recent industry studies, such as the CRO Forum's benchmarking study and CEIOPS' Internal Model Expert Group's Stock-taking report, indicate that most firms already use the output from an internal model to some extent but that all firms have work to do to satisfy the Use Test principles. Firms need to have an understanding of current industry best practice and emerging practice.

4.3.4.2 For example, firms should introduce quantitative risk appetite statements that focus on the time horizon of most interest (typically the period over which limited additional actions – e.g. capital raising, business unit disposal - can be taken, commonly a quarter or a year); the internal model should support the capital allocation process and should facilitate a more granular capital allocation (which would enable, for example, more informed product development activities); firms should adopt one performance measure that can be applied consistently across all of its business lines; the internal model should play a major role in the design and purchasing of reinsurance and hedging programmes; the internal model should be used to report in a consistent manner on all reporting bases of interest (e.g. local GAAP, Solvency II, internal accounting, embedded value, IFRS) and to assist senior management understanding by explaining differences in the results; the speed, quality and scope of MI at most firms needs to be improved; the internal model should be used to understand the portfolio of assets that most closely matches the liability, to set strategic asset allocations and to analyse the impact of investment managers' tactical asset allocations; internal models should be used to improve the quality of firms' external reporting, which should help to reverse the downward trend in the value of their franchises.

4.3.4.3 "Proportionality" is key to satisfying the Use Test and the FSA's expectations will be influenced by the nature, scale and complexity of a firm's business; nevertheless, smaller firms are likely to want to follow the lead of the larger players and take steps to improve and extend the use of their internal models.

4.3.5 Increasing internal model efficiency

4.3.5.1 To meet the requirements of Solvency II, firms will not only need to develop their existing ICA or internal economic capital models but also increase the efficiency of their model and the supporting processes. Simply to satisfy Principle 7, which requires reporting of the SCR annually at the year end, will require a considerable effort as currently a firm's ICA process can run over several months and typically takes place outwith the year-end period. In our Survey, 70% of firms responded that their ICA process currently takes at least 3 months. With the additional demands made of the internal model by the Use Test - including more frequent (potentially quarterly) SCR calculations for larger firms - and the expectation that internal model will continue to be developed, the challenge is even greater.

4.3.6 Building the case for compliance

4.3.6.1 As well as satisfying the Use Test principles, firms need to demonstrate compliance to the FSA. This is, in itself, a significant challenge and one that companies should address early. Firms should not wait for Level 3 standards and guidance – though undoubtedly they will help to remove the ambiguity around some aspects of the Use Test – but should begin building their case now.

4.3.6.2 Companies need to have a good understanding of what is an indicator of compliance. In CP56, CEIOPS makes the distinction between possible uses of the internal model that would i) indicate compliance with the Use Test and ii) indicate that the internal model is used well in a firm, but would not necessarily be an indicator of compliance with the Use Test. As an example, internal risk monitoring (through MI) would demonstrate compliance with the Use Test but Producing MI is not sufficient to be an indicator of compliance with the Use Test.

4.3.6.3 Documentation will clearly make up a large part of a firm's case for compliance with the Use Test. In particular, we expect the FSA to look for evidence in reports, such as the ORSA, Solvency and Financial Condition Report, business plan and risk management reports of internal model output, and in the minutes of Board or senior management meetings of the internal model, its output and its limitations being discussed, challenged and factored into the decision-making process. However, documentation alone will not be enough to demonstrate compliance with the Use Test, as CEIOPS expects supervisors to interview members of the Board and senior management to confirm they have an appropriate understanding of the internal model. CEIOPS has also suggested that firms should carry out a "Use Test self assessment", essentially a questionnaire which would be sent to all responsible persons that use the output of the internal model.

4.3.7 Use Test implementation planning

4.3.7.1 Over the period to implementation, Solvency II will be one of the most significant projects - if not the most significant – being undertaken by firms. It is a huge challenge for all firms, requiring considerable investment of time and resource. The Use Test is only one aspect of Solvency II, albeit one that is not only important in its own right but will be a focus of supervisory review.

4.3.7.2 We see the key challenges for firms, in terms of time, resource and scope, as being:

- Meeting the ambitious timescales set by the FSA within the 'first wave' model pre-approval process, which begins in Q2 2010.
- Lack of resource and fierce competition for the best resources. Securing additional resource with the right skill-set ahead of competitors is crucial. Managing temporary resource (consultants and contractors) carefully, as over-reliance on them may make it difficult for the firm to satisfy the Use Test.
- Agreeing a scope for the Use Test that is sufficient to satisfy the FSA yet achievable given resource and time constraints. Ensuring internal model developments do not take priority over Use Test developments. Prioritising Use Test developments alongside other urgent business issues, the majority of which are likely to be unrelated to Solvency II (e.g.

day to day business issues, the FSA's Retail Distribution Review, IFRS Phase 2, etc).

4.4 WHAT ARE OFFICES DOING TO SATISFY THE USE TEST?

4.4.1 In DP08/4, the FSA estimates that the UK industry is less than 50% of the way there in terms of readiness for the Use Test. Significant work therefore remains to be done if UK firms are to achieve internal model approval. In this section we highlight some of the results from the recent internal models Survey that we carried out.

4.4.2 Given the importance of the Use Test, the relatively short period until the opening of the 'first wave' and the pressure on resources, it is perhaps a concern that only 11 of the 20 respondents reported that work on the Use Test was underway (as shown in Figure 4). However, progress on the Use Test was better than on the other model approval tests, so it appears that firms do see the Use Test as a priority.

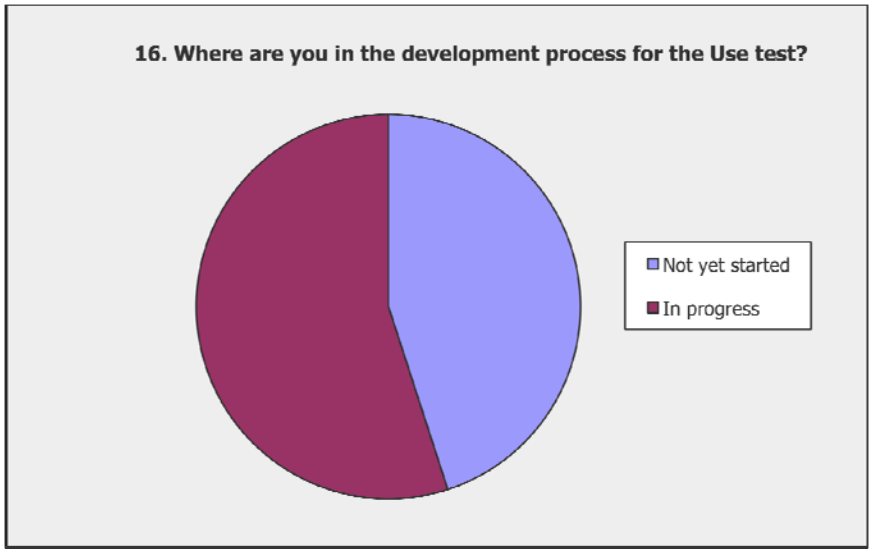


Figure 4: Responses to Survey regarding progress with Use Test

4.4.3 A key aspect of the Use Test is the need to embed the internal model in the business. Firms are factoring this into their approach to Solvency II by including key people from across the business in steering groups and setting up multi-functional project teams. For example, one respondent commented:

> *"Workstreams have been set up to include members from across the entire business. This provides an opportunity for the various business areas to be directly involved, especially in designing the model inputs and outputs required to make informed decisions."*

4.4.4 Firms are conscious that demonstrating that the internal model has been used in the decision-making process is likely to prove challenging and have given thought to how this aspect of the Use Test will be met. Understandably, most firms plan to provide the FSA with documentary evidence in the form of Board papers, minutes of meetings, short notes on decisions taken outside of formal meetings and MI packs showing key

metrics. There is an acknowledgement that documentation will almost certainly need to be more detailed than in the past, especially where a decision is taken contrary to that suggested by the output from the internal model. Meeting minutes, for example, will need to set out clearly the information presented in the meeting, the decisions made and the reasons for those decisions.

4.4.5 Aside from documentation, respondents cited a number of other forms of evidence or initiatives that will help demonstrate the embeddedness of the internal model:

- Solvency II capital will be one of the key metrics that is used on a daily basis.
- Regular reporting of Solvency II risk maps.
- Incorporation of Solvency II capital projections in business plans.
- All potential business developments – new products launches or repricing / redesign of existing products - will include a formal assessment of the impact on risk and capital using specified stresses and metrics to assess their viability.
- Pricing decisions involve consideration of internal model results, in particular Solvency II capital.
- Training courses will be held across the company to embed the risk framework and understanding of the internal model.
- Managers will have a performance management framework that incorporates utilisation of capital.
- The internal model will be designed with a "what-if" capability that will allow managers to assess the impact of their decisions on capital usage.

4.4.6 Most firms were generally comfortable that the requirements of the Use Test would not hinder effective decision-making by management, however a few practical issues were flagged up by respondents, including the need to be pragmatic when using the internal model. For example: if a decision has to be made urgently, which precludes the use of the internal model, it is likely the decision will be made based on the expected outcome from the model which will be tested subsequently by running the model; the impact will then be analysed which will either confirm the decision or the business will have to react to the new information.

4.4.7 Respondents also stressed that they are aware of the danger of being too dogmatic as the internal model becomes more widely used; the importance of considering the needs of all areas of the business when designing the internal model to avoid resistance later on; that they accept there will be a need to justify key decisions made without consideration of results from the internal model; and that the FSA will need to accept the use of approximations where they are appropriate and running the internal model is impractical.

4.5 SOME PRACTICAL SUGGESTIONS

4.5.1 In this section we suggest five steps firms might take as they work towards satisfying the Use Test.

4.5.2 Incorporate Use Test in risk vision

4.5.2.1 A vision for risk within the firm is essential if the requirements of Solvency II are to be met. We believe that early engagement of the Board and senior management regarding the Use Test is critical. The Board and senior management should clearly define their vision for risk and communicate it to the business. The use of the internal model should be a key part of the vision.

4.5.3 Adopt a proactive approach to the Use Test

4.5.3.1 From the vision for how the internal model will be used will flow a number of objectives that must be included in the overall Solvency II implementation plan. Firms should be proactive in their approach to planning the work required to satisfy the Use Test: delegating responsibility for the Use Test clearly; ensuring buy-in from the Board and senior management early; scoping all planned developments fully; making realistic assessments of time and resource requirements; managing the work closely; ensuring progress is communicated regularly to senior management and the Board; and contributing to any consultations around the Use Test.

4.5.3.2 Difficult decisions will need to made on the road to internal model approval given the time and resource constraints likely to be faced by most firms. For example, firms will need to weigh up whether it is preferable to target a full or partial internal model given the timescales and other demands on the available resource.

4.5.4 Training sessions on the internal model

4.5.4.1 Board and senior management understanding and use of the internal model are key requirements of the Use Test and the FSA make it clear in FS 09/1 that the Board must trust the output from the internal model. A series of training sessions on the internal model – covering structure, inputs, output, uses and limitations – will need to be run for the Board and senior management.

4.5.4.2 The Use Test has implications for all areas in a firm. It would be advisable, therefore, to run appropriate training sessions for others in the organisation, in particular the risk, finance, actuarial, pricing, underwriting, capital management, investor relations and internal audit functions.

4.5.5 Early and open dialogue with stakeholders

4.5.5.1 The Use Test remains one of the more ambiguous aspects of Solvency II: the Level 2 implementing measures are not yet finalised, Level 3 standards and guidance have yet to be published and the final handbook requirements from the FSA are likely to appear late in 2012. Therefore it is critical that firms engage with the FSA (and the supervisors of other Group subsidiaries) regularly over the course of the model approval process. Firms should bear in mind that - just as they are - the regulator is learning more about the Use Test all the time. Early and open dialogue with the FSA will go some way to ensuring a ‘no surprises’ approach to the Use Test.

4.5.5.2 While the priority for firms will be achieving internal model approval, firms should adopt a similar approach with their other stakeholders – investors, analysts and rating agencies – to keep them abreast of Solvency II developments.

4.5.6 Keep up to speed with developments

4.5.6.1 The Use Test is a qualitative, principles-based and evolving standard. Firms should ensure they understand what represents current best and emerging practice in terms of the uses of an internal model by reading widely and participating in industry surveys and forums. Firms have an opportunity in the coming years to influence the Use Test and should contribute to CEIOPS and FSA consultations.

5 Statistical Quality Standards

5.1 OVERVIEW

5.1.1 The statistical quality standards applying to internal models form a diverse range of requirements covering all aspects of data, assumptions and methodology. At a very high level these are set out in Article 119 of the Solvency II directive. At a more detailed level, the draft advice on level 2 implementing measures relating to the standards are set out in the CEIOPS consultation paper on internal model standards (CP56).

5.1.2 The requirements coming from the CEIOPS advice appear to be quite onerous in places and firms may need to undertake significant work to meet the standards. Some elements of the requirements are not yet completely clear and CEIOPS arguably has further work to do in this area to create a completely unambiguous set of standards that have clear meaning from a practical implementation perspective.

5.1.3 The key areas covered by Statistical Quality Standards are:

- The Probability Distribution Forecast.
- Methodology and Assumptions.
- Data.
- Use of Expert Judgement.
- Risk Ranking.
- Model Coverage.
- Diversification.
- Recognition of Risk Mitigation.
- Guarantees and Options.
- Future Management Actions.

5.1.4 Some areas are more straightforward than others, in both being able to fully understand the requirement and being able to translate it into a real-world situation.

5.2 THE PROBABILITY DISTRIBUTION FORECAST (PDF)

5.2.1 Article 120 of the directive sets out that:

"Where practicable, insurance and reinsurance undertakings shall derive the Solvency Capital Requirement directly from the probability distribution forecast generated by the internal model of those undertakings, using the Value-at-Risk measure set out in Article 101(3)"

5.2.2 The concept of the Probability Distribution Forecast (PDF) is defined in Article 13 of the directive as:

"a mathematical function that assigns to an exhaustive set of mutually exclusive future events a probability of realisation"

5.2.3 At a theoretical level this appears to be very attractive: the internal model generating a distribution of capital requirements that arise from the combination of all risks that may affect the firm. The firm then selects the 99.5^{th} percentile from this distribution to arrive at the SCR, or other percentiles to arrive at other levels of economic capital depending on the purpose of the investigation.

5.2.4 Interpreted in this way, there are clearly significant challenges in meeting this requirement while fulfilling all of the statistical quality standards. In reality, we believe that a more practical interpretation may be needed.

5.2.5 CEIOPS advise that the concept of the PDF is not confined to the distribution of each of the risk factors (e.g. the range of different equity returns that may be achieved together with corresponding probabilities), but equally applies to the final outputs of the model such as profits and losses in monetary terms. The implication of this is that all methodology, data and assumptions that contribute to the model outputs are subject to the statistical quality requirements. Similarly CEIOPS advise that it is not just the calculation kernel/engine of the internal model that is subject to the standards but the whole calculation framework, including for example all the methods and techniques used to prepare input data or process output data.

5.2.6 The overall PDF will be dependant on the underlying distributions of the various risk factors considered within the internal model. These underlying distributions may be different depending on whether the overall PDF is at solo entity level or at group level. CEIOPS advise that the aim is to arrive at a PDF at the topmost (i.e. group) level, but where an internal model is used at an individual level, the PDF should be specific to that entity. There may be the possibility in theory therefore of having to apply different distributions for the same risk factor depending on whether that risk factor is being considered across the whole group or just at entity level. For example the lapse risk distribution at entity level could be based on that entity's own experience, and the lapse risk distribution at the group level could be based on the combined group experience. Should the group distribution be based on the aggregated lapse data for the group (to get a single group PDF) or a distribution formed by combining in some way the distributions for the individual entities (using correlation factors for example)? The practicalities of deriving individual entity distributions as well as combined group distributions could increase the amount of work for groups more used to applying a single ICA stress across all group entities.

5.2.7 The probability distributions that firms are able to derive are clearly going to vary across risk factors in terms of the number of data points available, or as CEIOPS puts it the 'richness' of the distribution. For example the better-established distributions are perhaps those related to investment market behaviour, as utilised by Economic Scenario Generators.

5.2.8 Clearly there are risk factors for which there is currently limited scope for building a full probability distribution function because it is simply not practical at the moment, either due to lack of data or workable statistical method. Some of the underwriting or operational risks would arguably fall into this category.

5.2.9 At the very least one would imagine that an acceptable PDF would have to consist of a mean value (aligned to the best estimate parameter used in the technical provisions) and a view as to the 99.5^{th} percentile of the distribution. The implication of the directive is that a significantly fuller distribution than this would ideally be in place. CEIOPS rightly point out that the overall PDF for the entity will only be as strong as the weakest of the individual risk PDFs as any individual shortcomings will be aggregated into the whole.

5.2.10 CEIOPS also point out that a PDF formed with fewer data points may need more intensive validation and stricter governance. While this may be right, it is obviously going to be harder to ensure that such a PDF can stand up to such scrutiny if the underlying data was sparse in the first place.

5.2.11 Given the potential benefits of better understanding the distributions of these risks, larger companies are likely to invest in research and development in this area. Such developments are likely to ultimately inform the supervisors' expectations and set the standard for continuing internal model approval. This could lead to challenges for smaller firms to keep up with developments, although it would be hoped that the supervisor will act proportionately and take account of the 'nature, scale and complexity' of such firms when considering their internal models.

5.2.12 Both CEIOPS and the FSA have commented on the need to avoid the potential systemic risks that could be introduced by the use of industry agreed methods and so there is a fine balancing act to be achieved between encouraging the roll out of the latest developments and allowing companies the freedom to implement their own methods.

5.2.13 CEIOPS have advised the following criteria for a limited PDF to be compliant with the statistical quality standards:

- It takes into account current knowledge and developments or has justification for rejecting these.
- Alternative methods (that would produce a fuller PDF) are either lacking or disproportionate with respect to the nature, scale and complexity of the firm's risks.
- Where generally accepted market practice has been established, the quality of the model meets or exceeds this.
- Any shortcomings with respect to the six key tests are compensated by additional (unspecified) measures.

5.2.14 While these requirements are onerous there does appear to be room for interpretation. Agreeing exactly what is 'generally accepted market practice' or what 'additional measures' are acceptable is likely to be the subject of much discussion between individual firms and the supervisory authorities. It is also possible that Level 3 guidance, which will eventually be published by CEIOPS, will give further help in this area.

5.2.15 In our recent Survey we asked those firms intent on developing an internal model the extent to which they believed it was possible to objectively define such probability distribution forecasts. The feeling was largely that this was going to be a very difficult area that will always rely to some extent on expert judgement. A small number of firms were slightly more optimistic, particularly in relation to what will be possible for some of the insurance risks.

5.2.16 From a practical perspective firms are likely to build on what they already have from their ICA work. In many cases this is likely to be points on a distribution for many risks rather than a full distribution. The hope must be that as data capture and analysis technology improves over time that distributions can be refined and made more robust. For smaller companies it would seem inevitable that some level of reliance on industry data will be needed despite the possibility of systemic risks. Similarly even for larger companies, where new products are being introduced or new risks identified, the data available to update or create new PDFs may require to be supplemented from outside of the company.

5.3 METHODOLOGY AND ASSUMPTIONS

5.3.1 The application of the statistical quality standards to all calculation methods and assumptions used in the internal model creates further challenge for firms. Certainly firms have always been required to document and explain their methodology and to justify their assumptions, but the internal model requirements take these requirements to a higher level than most firms may be used to.

5.3.2 Some of the requirements of the Directive are common sense. For example it would be hard to argue against the following:

- The methods used must be consistent with the methods used to calculate the technical provisions and consistent across any group internal model.
- Based upon current, credible information (though there may be some debate as to how current and how credible it is reasonable to expect).
- Based upon realistic and justifiable assumptions (although again, what is realistic may depend on your viewpoint).

5.3.3 A further requirement that is arguably a lot woollier is that the internal model is:

- Based on adequate, applicable and relevant actuarial and statistical techniques.

5.3.4 In their recent draft advice in CP56, CEIOPS have attempted to interpret this 'adequate, applicable and relevant' requirement as having the following meanings:

- **Applicable**: Firm has the necessary resources to implement, test and maintain the model.
- **Relevant**: Methods, inputs and outputs are relevant in the sense that they aid risk management and decision making within the firm.
- **Adequate**: This is broken down into multiple characteristics:
  - Appropriate: Methods suited to the modelling goals and to the nature of the firm in question. Shortcomings recognised and accounted for.
  - Up to date: Methods based on best evidence available, scrutinised repeatedly, modified or replaced as new information becomes available.
  - Detailed and parsimonious: Strikes the right balance between modelling the potentially unlimited complexity of the real world with the need to keep the model simple and manageable.
  - Transparent: Logical connections between inputs and outputs not lost, results intuitive, model does not become a black box.
  - Robust and sensitive: Results are stable but will react to changing conditions in the real world.

5.3.5 In discussing the principle of consistency between the internal model and the technical provisions, CEIOPS talks about contrasting the value of the technical provisions with the average internal model outcome or comparing the valuation of guarantees & options from the technical provisions to the corresponding valuations in the internal model. This is interesting because it implies that the internal model and the technical provision calculation can be two separate models.

5.3.6 In practice it is likely that, as with ICA processes, the actuarial models used to calculate the technical provisions will be run as part of the internal model to test how the value of liabilities moves under stress. It may be implied though that firms are able to use approximations in the internal model that do not require a full re-run of the technical provisions for every stage of the SCR calculation. An example could be the use of replicating portfolios.

5.3.7 Potential differences between the actuarial models used to calculate the technical provisions and the internal model used to calculate the SCR is perhaps an area for further research and discussion.

5.3.8 On how best to meet the statistical quality requirements for assumption setting, there was no clear common response from respondents to our Survey, other than being unsure and that the requirements look onerous. Suggestions that were mentioned included benchmarking of assumptions, improving the experience analysis systems and back-testing.

5.3.9 Practical suggestions for the best way to meet the standards on calculation methodology and assumptions would be as follows:

- Document all methodology and the reasoning behind it.
- Keep the methods constantly under review – update as new information comes to light or as industry practice develops.
- Ensure robust methods are in place for deriving assumptions (e.g. high quality experience analysis) so that there is documented justification for all assumptions used.
- Ensure the source information underlying these processes is fully checked to be as credible and complete as possible.
- Test the impact of alternative assumptions or methods and document this, especially where an assumption or method particularly influences the results or where judgement has been needed.

5.3.10 To a certain extent this should reflect what companies have always done or aspire to do, but ensuring that all the relevant justifications and documentation are firmly in place is still likely to present a challenge to many.

5.4 DATA

5.4.1 Actuarial models are of little value without data. Obvious examples of where data is important are:

- Policy data as at the valuation date to value the policyholder liabilities.
- Experience data, over a period of time, to arrive at best estimate assumptions. This may be extracted from a company's internal administration system or may include pooled industry or national data e.g. CMI mortality investigations.
- Asset data as at the valuation date to set valuation assumptions and determine the asset side of the balance sheet.
- Market data as at the valuation date to set valuation assumptions or calibrate an ESG. These values may vary depending on the data source.
- Historic market data covering varying time periods – used to inform 'real-world' calibrations.
- Historic loss data used to inform operational risk exposures.
- Historic demographic or expense data used to arrive at probability distributions for insurance risks.

5.4.2 The internal model statistical quality standards with regard to data should be interpreted to cover all of the above and more. CEIOPS sets out separate advice on Data Quality Standards for technical provisions, and these standards also apply to internal models. CEIOPS makes clear that the scope of the data quality standards goes beyond the data used purely in the calculation framework around the probability distribution forecast. Any data that influences the development, validation or operation of the internal model would best be considered to be in scope of this standard.

5.4.3 The Directive sets out the requirements at only the highest of levels, namely that the data should be:

- Accurate.
- Complete.
- Appropriate.

5.4.4 The extent to which data requires to be sufficiently accurate, complete or appropriate will vary depending on the way it is being used and for what purpose. CEIOPS have therefore recommended a principles based approach in which each company will be responsible for setting its own data quality policy, designed specifically to provide assurance of the accuracy, completeness and appropriateness of its data.

5.4.5 This data quality policy will have to be agreed with the supervisor as part of the internal model approval process and will then form the basis of the regulatory supervision of the data standards for the company. Similar to other aspects of the internal model, prior supervisory approval will be required for major changes to the data quality policy.

5.4.6 In reviewing data quality, CEIOPS suggests that companies should be able to demonstrate that:

- Data is free from material errors and omissions.
- Data is consistent in time so that model output refers to a point in time.
- Data comprehensively covers all business lines and all relevant model variables.
- No relevant data is excluded without justification.
- Data is sufficiently granular to support adequate actuarial and statistical techniques.
- Data is relevant to the business and portfolio of risks being analysed.
- Historical data used for prediction is a good guide to the future.

5.4.7 Some of these are easier to verify than others. Some are subjective and will require a judgement to be made. For example, is it ever possible to prove in advance that historical data will be a good guide to the future? The answer is probably no. From a practical point of view it will be important to ensure that the agreed data quality policy allows sufficient room for interpretation on some of these points. Focusing on the data related to the most significant risks would seem sensible. It may be that under the proportionality principle the data policy could allow a lower standard for data related to low ranking risks or small pockets of business that make very little overall contribution to the level of risk in the firm.

5.4.8 The frequency with which data should be updated is set in the directive to at least once per year. The draft Level 2 advice suggests that in keeping with the Use Test the frequency of update should be linked to the frequency of use, and even more frequently in stressed times.

5.4.9 In terms of what constitutes a data update, CEIOPS takes this to include an update to the probability distribution forecast. Most data updates will affect the PDF but in terms of the individual PDFs for individual risks it is hard to see that a data refresh will always be necessary on a greater frequency than annual. For example, would a mid-year data refresh be expected to lead to a material change in view about the 1 in 200 longevity stress? Such

distributions could be based on many years of data and so a few months extra information may not justify the cost of undertaking a full PDF refresh. For other distributions (e.g. equity returns) it is more conceivable that a mid year refresh could make a material difference especially following a significant market event. It would be hoped that a practical and pragmatic approach would be acceptable in terms of refresh frequency. At the very least it is likely that companies will need to specify their approach in their data quality policy and stick to it.

5.4.10 CEIOPS set out the minimum requirements for companies' data quality policy to be that the following are documented precisely together with allocation of responsibilities and frequency of application:

- Firm's concept of data quality and the actual implementation of this. It must be clear to the supervisor from this what standards will be applied in judging the quality of data.
- Detailed processes for checking and validating the data and action to be taken if data is not or does not continue to be accurate, complete and appropriate.
- Methodology to be followed in order to validate the use of expert judgement.
- Processes for updating data, with focus on data used in calculation of the PDF.
- Standards for frequency of data update, and triggers and timescales for unscheduled data updates.
- Circumstances in which data update does not necessarily require a re-run of the internal model to determine economic capital or recalculation of the SCR.
- Plans for future improvements of data quality or gathering process.

5.4.11 In our Survey, data quality was mentioned by some firms as being the single greatest challenge resulting from Solvency II. That said, there are many other firms who are not so concerned: 68% of firms intending to develop an internal model were either happy with their current data quality or felt than only a small improvement would be needed as illustrated in Figure 5. There is of course a possibility that some differences in the level of concern arise as the result of different interpretations of the requirements made by different companies.

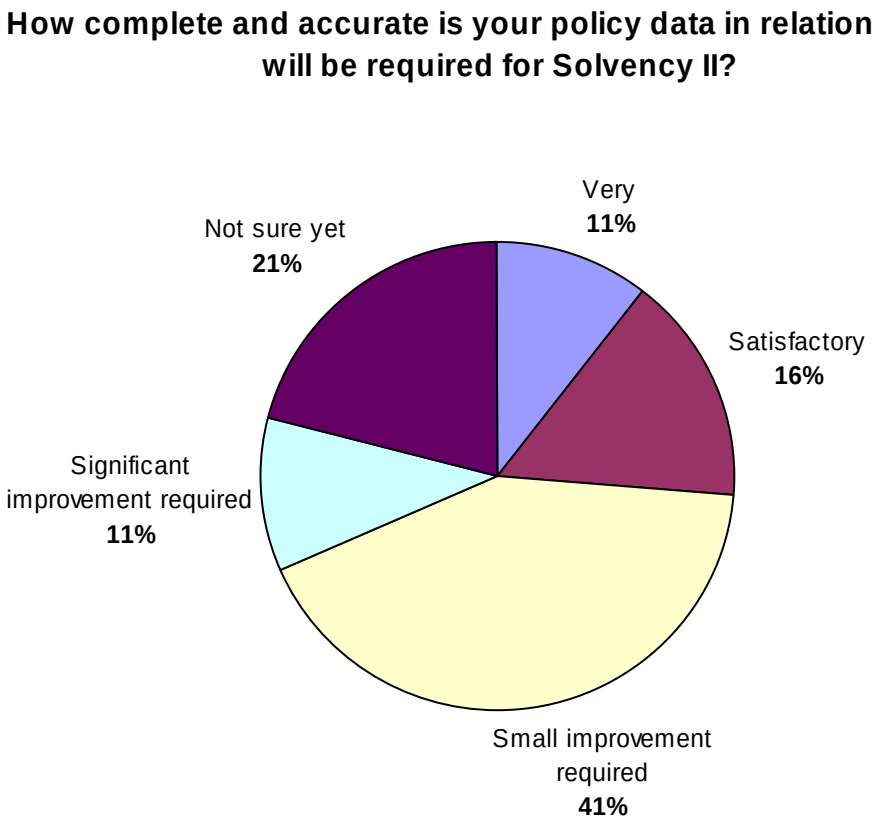


Figure 5: Responses to Survey regarding policy data.

5.5 USE OF EXPERT JUDGEMENT

5.5.1 When data is incomplete, unreliable or otherwise compromised, it is usual for companies to turn to expert judgement. For example, this might be done to arrive at an individual assumption or the 99.5th percentile of the distribution for some insurance risk where past data is unreliable or scarce. Within the UK context of the ICA, it has been a key tool in enabling firms to arrive at sensible numbers where the necessary back-up data simply doesn't exist.

5.5.2 The draft advice on statistical quality standards in relation to the use of such expert judgement places a potentially onerous requirement on firms, which could make the use of judgement difficult in some situations. It would be hoped that following feedback, CEIOPS might tone down the requirements contained in the draft advice. As it currently stands the advice is as follows:

- The use of expert judgement to substitute or complement data shall be well founded, explained and validated.
- Where data is available, expert judgement shall be reconciled to the data.

- Expert judgement is only admissible if derived using a scientific method and if it meets the following requirements:
    - Empirical testing: Expert judgement shall be falsifiable, refutable and testable.
    - Expert judgement shall be validated and documented.
    - Expert judgement shall have a known or potential error rate, and standards concerning the operation of its methodology shall exist and be maintained.

5.5.3 Judgement is about the forming of an opinion. This will be done through logical thought processes having looked at whatever evidence is available and will be influenced by the accumulated knowledge and experience of the person making the judgement.

5.5.4 To require the reasoning behind judgements to be explained and documented seems perfectly reasonable. To require that at a later date the judgement is tested against experience and if necessary refined would also be a reasonable requirement. However, to require that judgement is arrived at only by 'scientific method', that it is in some way validated at the time of the judgement and that it has an identifiable error rate is arguably not reasonable. To be able do this with any degree of certainty would imply that there is some reliable source of data to verify the judgement against, but if this were the case would there be any need for the judgement to be made in the first place?

5.5.5 Our Survey showed that those companies intending to develop internal models expect to continue to place a great deal of reliance on expert judgement. In areas such as arriving at probability distribution forecasts or correlation factors, expert judgement will continue to play a central role for many years to come. It is therefore all the more important that the rules around the extent to which judgement has to be arrived at or validated are realistic and workable in practice.

5.6 RISK RANKING

5.6.1 This requirement derives from the Article 119 of the directive as follows:

"the ability of the internal model to rank risk shall be sufficient to ensure that it is widely used in and plays an important role in the system of governance of insurance and reinsurance undertakings, in particular their risk-management system and decision-making processes, and capital allocation in accordance with Article 118."

5.6.2 In the Level 2 implementing advice, CEIOPS attempts to bring some clarity and sets out some requirements as follows:

- **Coverage**: Risk ranking ability should exist for all material risks covered by the internal model.
- **Resolution**: Differentiation between different risks and risk drivers sufficiently precise to allow appropriate management decisions to be taken.
- **Congruence**: Structure of different kinds of risk-ranking reflects structure of risks or risk categories and the risk management system.

- **Consistency**: Risks of a similar nature are ranked consistently throughout the firm and over time, and are consistent with capital allocation.

5.6.3 It will be up to each firm to design its own methodology for risk ranking.

5.6.4 In simple, practical terms, the risk ranking requirement could possibly be interpreted as the requirement to be able to compare the amount of risk associated with each risk category such that the firm can clearly identify which are the most important or severe risks, and therefore merit the greatest attention.

5.6.5 One simple method would be to compare the impact on each risk factor of a stress at a defined level of probability (either 99.5th percentile or other appropriate level for the firm's needs) and rank the financial impact. One area that could confuse the ability to do this in practice is the impacts of diversification within risk categories and across the firm as a whole. Where two risk factors move in opposite directions and so provide a natural hedge to each other they may merit a lower position in the risk ranking than implied by their stand alone level of risk.

5.6.6 This requirement is closely tied into the Use Test in that by having a method for consistently comparing and prioritising risks from the internal model, the company can allocate its time and resource for managing risk appropriately and allocate capital in a sensible way. The Profit & Loss attribution and the ORSA may also provide some validation of a list of risks ranked in order of severity. Where a risk is ranked at a low level this may help with proportionality arguments in relation to how that risk is treated in the internal model. Unfortunately to determine with good evidence that a particular risk is low ranking will require much of the internal modelling work to be done anyway.

5.7 MODEL COVERAGE

5.7.1 One of the requirements of the internal model is that it covers all material risks. At the initial approval stage the supervisor will assess whether the model coverage is sufficient. There is also an ongoing requirement that the model should continue to have adequate coverage. This should involve the firm defining trigger events that would initiate a new assessment of coverage within the internal model (e.g. a new product is launched).

5.7.2 In order to determine whether a risk should be considered material, the CEIOPS advice talks of a range of quantitative and qualitative measures. Examples include:

- Profits and losses not explained by existing risk categories.
- Sensitivity analysis, stress or scenario testing, testing against experience.
- Existence of dedicated risk management processes or mitigations.
- Identification of risks in the ORSA.
- Inclusion in the report from the risk management function to the board on material risks faced.

5.8 DIVERSIFICATION

5.8.1 The importance of correlations and diversification between risks is well known from ICA work where the impact of diversification benefits can dramatically reduce the overall capital requirement compared to the sum of the individual 1 in 200 stresses. Given the large impact that diversification effects can have, it is understandable that the statistical quality standards will apply here and that this will be an area of particular focus for the supervisor in approving internal models.

5.8.2 In its Level 2 implementing advice, CEIOPS acknowledges the enormous challenge in determining the diversification effects between risk categories, particularly where only key points on the probability distribution are known. This does not mean however that the statistical quality requirements will be any less onerous than elsewhere. There is clearly an expectation that expert judgement will continue to play a part but will only be acceptable if it meets the standards described earlier, which as already discussed are onerous and potentially unattainable as they currently stand.

5.8.3 It will be up to individual firms to determine their own risk categories. Diversification effects will take place between different risk categories but also within risk categories between different sub-categories of risk.

5.8.4 As a minimum, CEIOPS states that the system for measuring and recognising diversification effects:

- Identifies the key variables driving dependencies.
- Provides support for the existence of diversification effects.
- Fully justifies all underlying assumptions.
- Takes into account extreme scenarios and tail dependence.
- Has in place regular testing cycle including sensitivity and stress testing.
- Actively takes diversification effects into account in business decisions.
- Recognises any reductions in diversification from the impact of group activities when considering a Group Internal Model.

5.8.5 In our recent Survey we asked UK life companies intent on developing an internal model how they intend to aggregate risk categories. The use of correlation matrices was by far the most popular method, and this would certainly be in keeping with the approach that CEIOPS have used so far in the Quantitative Impact Studies (QIS) testing for the standard formula. A small number of companies indicated that they are looking at the possibility of using copulas (complex functions which allow the combination of single variable distributions into a joint distribution with a particular dependence structure). It is clear from CEIOPS' draft advice that the level of justification needed in setting individual correlation factors is going to be greater than firms are used to and concern about this was also evident from the survey responses. The overwhelming majority of firms who responded indicated that they would continue to rely extensively on expert judgement in setting these factors.

5.8.6 In FSA Feedback Statement 09/1 (May 2009) the FSA noted that respondents to their Solvency II discussion paper had shown overwhelming demand for more research to be carried out into the modelling of dependencies, including aggregation of risks and tail dependencies. Where suggestions were made of industry-accepted proxies, the FSA came out against this because of the possibility of systemic risk being introduced. This is understandable but does leave firms, especially smaller firms, with the difficulty of arriving at appropriate assumptions based on sparse historic data. CEIOPS does mention the use of scientific or other (presumably publicly available) sources and others such as the Standard Formula and other CEIOPS publications.

5.8.7 At the time of writing CEIOPS have not yet issued their draft Level 2 advice for diversification effects within the standard formula. In QIS4, the standard formula for dependencies involved the use of correlation matrices where all correlations were a multiple of 0.25. Given the onerous requirements being placed on firms using internal models it will be interesting to see the extent to which CEIOPS is able to justify the correlation factors it sets out for the standard formula and the data sources that are used to arrive at these.

5.8.8 It could arguably be one of the significant potential flaws in the Solvency II regime that while individual risks may with some confidence be fitted to appropriate PDFs, that these will then be aggregated using correlations that firms (and CEIOPS) find almost impossible to give a full and comprehensive justification to. The truth is that correlations between risks will constantly be changing and that there will never be one perfect assumption that precisely defines the relationship. That said, it would not be credible to have no allowance for diversification, particularly in light of the impact on firms' capital position that this would have. Given the size of the diversification effects that tend to be recognised currently by UK companies in their ICA calculations, this would appear to be a matter to which a great deal of further attention is merited.

5.9 RECOGNITION OF RISK MITIGATION

5.9.1 Risk mitigation techniques are widely used by firms to manage their financial stability or to keep down their capital requirements. Examples include:

- Reinsurance of mortality and longevity risks.
- Hedging of economic exposures using derivatives (e.g. guarantee costs).
- Collateralisation of derivative positions.

5.9.2 The statistical quality aspect around risk mitigation techniques arises out of the requirement to ensure that the internal model is not reflecting a risk mitigation technique that will not work in reality the way it is allowed for in the model. If it is to be reflected in the model then the technique needs to be shown to be robust enough that it will do what the model assumes it will do in all circumstances. The model also must show any additional risks that arise as a result of the existence of the risk mitigation technique itself, for example increased credit risk.

5.9.3 If the mitigation technique is not shown to be robust enough in reality then it will not be allowed to be reflected in the internal model. In their Level 2 advice, CEIOPS set out some principles that must be met:

- **Economic effect over legal form** – need to demonstrate that a risk transfer takes place from an economic perspective.
- **Legal certainty, effectiveness and continuing enforceability** – with processes and policies in place to ensure this remains the case over time.
- **Liquidity and ascertainability of value, including no double counting**. In the event of default or insolvency of the counterparty, the instrument should be capable of timely liquidation or retention.
- **Identification and assessment of secondary risks**, and reflection in the internal model, or processes and controls in place that ensure ongoing management of such secondary risks.
- **Direct, explicit, irrevocable and unconditional features** – the firm has a direct claim on the provider and the cover is clearly defined and incontrovertible. There should be no means for the counterparty to nullify or increase the cost of protection. Anything that would allow counterparty to delay payment to be fully taken into account.
- **Use of risk mitigation in internal model fully documented** and internal model capable of showing exposures gross and net of mitigation.

5.9.4 From a practical perspective, one area of difficulty with these requirements could be the use of derivative assets to offset guarantee costs. The effectiveness of these can vary significantly depending on various economic variables and even though in general they will provide a level of protection, this will not be perfect as it is impossible for example to hedge every possible variation in the yield curve. Companies would certainly want to reflect such protection in their internal models and so would need to find a way of meeting the above requirements. A qualitative solution, ensuring that very robust monitoring and management processes were continually in place, with processes to quickly re-align the hedges as required, would perhaps be one way to deal with this.

5.9.5 One of the challenges of a principles based approach is that it can lead to uncertainty in specific situations. The principles above could be applied to a reinsurance agreement where, for example, a recovery from a reinsurer should not be included in the internal model if there is a significant legal uncertainty over the payment. However, the interpretation of the legal position could potentially be quite subjective and may differ between the two counterparties.

5.9.6 Although not explicit in the Level 2 text, it would appear that the term “risk mitigation” actually refers to risk mitigation with a third party. There are lots of internal risk mitigation techniques that a company will have in place that will not have any legal contract, such as the matching of assets and liabilities, and not all of the above principles would make sense from this perspective.

5.10 GUARANTEES AND OPTIONS

5.10.1 The Directive places a lot of emphasis on ensuring that all options and guarantees are included in the internal model. The treatment in the internal model should be consistent with that used in the technical provisions.

5.10.2 CP56 mentions some requirements needed for accurate modelling including:

- Taking account of relevant risk factors e.g. implied volatilities. It also mentions factors such as unemployment levels or GDP, as changes in these could impact rates of exercise of options.
- Ensuring implied volatilities are for the appropriate underlying, strike and maturity.
- Taking account of discontinuities and non-linearities.
- Taking account of a mass option settlement caused by certain trigger events.
- Recognising liquidity risks arising from the exercise of an option or guarantee or the need to hedge the exposure, particularly at a time of illiquid markets.

5.10.3 From a practical point of view, many UK insurers managing with profit funds will be very accustomed to the need to value options and guarantees and are likely to have reasonably sophisticated stochastic models with which to do this. The requirements here may not therefore be overly demanding for some. Where firms intend to use replicating portfolios as a proxy for guarantee costs within the internal model, then they will need to ensure that such replicating portfolios reflect the dynamics of the options and guarantees with sufficient accuracy.

5.10.4 Many factors will affect the take up of options and guarantees and there must be practical limitation as to how many of these can be allowed for in the internal model. Attempting to define accurately the relationship between unemployment or GDP and option take up could be argued as creating a spurious level of accuracy. Thankfully this is only an example suggestion by CEIOPS rather than a requirement.

5.11 FUTURE MANAGEMENT ACTIONS

5.11.1 This covers the anticipated implementation of any decision that the insurer has the right to take. Again the concept will be familiar for anyone involved in modelling the capital requirements for with profit funds. It often relates to actions such as the company's ability to change the asset mix of a fund or take action to cut benefits in the event of an extreme loss in the fund.

5.11.2 From a practical point of view, there may be some degree of confusion as to what constitutes a management action compared to actions that would form part of the routine operation of an insurance company. Adjusting bonus rates in response to market changes would seem more routine and so arguably should be modelled as an automatic mechanism in the way a with-profits policy operates. However, the same could easily be argued for the application of a Market Value Adjustment and yet this is given by CEIOPS as an example of a management action.

5.11.3 The CEIOPS advice on this area centres on the following principles:

- Only management actions where the intention has been signed off by the board can be reflected in the internal model.
- Management actions reflected in the internal model should be carried out in practice if the specified trigger events occur.
- Any management actions that deviate from those included in the internal model require board approval before being implemented.
- Significant deviations from the modelled management actions should be referred to the supervisor, with the potential consequence that the model is deemed to no longer meet the internal model requirements.
- Further, if the supervisor decided that the SCR no longer represented the true underlying risk profile (e.g. built on management actions that were not applied in reality) then a capital add-on could be imposed.

5.11.4 There is some crossover with the risk mitigation techniques section discussed earlier. The example of assuming that a hedging strategy would continue to be dynamically managed over time could be seen as a future management action as well as part of the risk mitigation technique.

5.11.5 Many insurers will be used to allowing for future management actions in the event of certain future conditions when calculating their ICAs. They will not however be used to being held so closely to account for whether they do or don't implement those actions or others in the event that those conditions actually happen in reality.

5.11.6 In principle it seems reasonable that the internal model and future reality should tie up closely. Similarly for all of the statistical quality standards, the ideal situation will of course be that all internal models will meet these in full.

5.11.7 In practice however, significant amounts of pragmatism may be required: the real world is infinitely more complicated than any model is able to represent, no mater how sophisticated.

5.12 STATISTICAL QUALITY STANDARDS: SUMMARY

5.12.1 What is it and what does it mean in practice?

5.12.1.1 A comprehensive set of standards setting out the statistical and actuarial qualities required from the internal model. In particular the standards cover:

- **The Probability Distribution Forecast**: A statistical distribution of outcomes at both individual risk level and entity level that can be used to directly observe the SCR or other amounts of economic capital at different percentiles.
- **Methodology and assumptions**: Those used by the internal model have to meet a high standard including being based on adequate, applicable and relevant actuarial and statistical techniques.
- **Data**: This should be accurate, complete and appropriate and the company must set out for approval a very detailed data policy that will ensure this is the case.
- **Expert judgement**: As the advice currently stands, any judgement used must be documented, validated and only derived using a scientific method.

- **Risk ranking**: The internal model must be capable of ranking risk in order that a company can prioritise it's time between risks of different magnitudes.
- **Model coverage**: The model must cover all material risks and monitoring should be in place to pick up any new risks that should be added.
- **Diversification**: To be able to recognise diversification effects the internal model must, amongst other things, fully justify the underlying assumptions, taking into particular consideration extreme scenarios and tail dependence.
- **Risk Mitigation**: To be able to recognise in the internal model mitigation techniques that are in place, there are some detailed requirements that must be met to ensure that a true transfer of risk has taken place such as legal certainty, effectiveness and enforceability, direct, explicit, irrevocable and unconditional features.
- **Future Management Actions**: To be able to recognise management actions these must be signed off by the Board with the intention that they will be implemented in practice if the relevant circumstances arise. Where this does not occur, the ongoing approval of the internal model would be in question.

5.12.1.2 In general the statistical quality requirements mean in practice that firms require to adhere to a very high standard of justification for all input data and assumptions used in the internal model. This justification needs to demonstrate that the model reflects reality and must be very accurately documented.

5.12.1.3 In practice, CEIOPS acknowledge that some areas will be particularly difficult, for example the justification of diversification benefits, but in general the anticipation seems to be that best practice will emerge over time and companies will be expected to keep pace with this.

5.12.2 What are the practical challenges?

5.12.2.1 There are numerous practical challenges to be overcome. Many of these relate to the common theme of having reliable and complete data on which to base assumptions.

5.12.2.2 For example, arriving at a truly representative and accurate PDF for each risk will be virtually impossible if there is insufficient relevant historic data from which to build up such a distribution. Similarly, in arriving at correlations between risk categories, there will be very limited data from which to work and so expert judgement is likely to be needed. Expert judgement is however also subject to the need for validation and scientific method, which in practice may be impossible to achieve.

5.12.3 Some practical suggestions

5.12.3.1 CEIOPS is setting a high standard. This may be in the anticipation that enough firms will invest in the necessary research and development required to fully meet the standards and that this will then set best practice for others to follow.

5.12.3.2 From a practical point of view, firms have to start with what they already have from their ICA work. If data simply does not exist then it does not exist and at some point the FSA will have to decide what compromises and pragmatic approaches they will accept. It is doubtful whether any company currently has the capability to meet the standards across the board as they currently stand at 100% of the required level, but equally it is highly unlikely that FSA will simply reject all internal model applications.

5.12.3.3 Firms must make the effort to do the best with the information they have and set out as clearly as they can how they have gone about filling in the gaps. Firms seen to be making a significant effort towards meeting the standards using what they have are likely to get a more sympathetic hearing from the FSA during the pre-application phase, as well as individual guidance as to how they can make further improvements.

5.12.3.4 The use of industry forums or bodies to pool data and come up with industry accepted proxies would be another practical way forward where individual companies lack sufficient information. Areas such as correlations would seem to be prime examples of where this could be of benefit. The FSA and CEIOPS appear to have significant concerns about the introduction of systemic risks from such activities, but again some level of compromise may ultimately be needed.

6 Calibration Standards

6.1 WHAT ARE THEY?

6.1.1 Article 101 sets out the rules for calculating the Solvency Capital Requirement (SCR). Part of these rules relate to the calibration of the SCR such that it shall correspond to the Value at Risk (VaR) of the Basic Own Funds subject to a confidence level of 99.5% over a one-year period. Basic Own Funds are the excess of the value of assets over the liabilities plus any subordinated liabilities.

6.1.2 Article 120 sets out the Calibration Standards that companies must meet for internal model approval. These are:

1. Companies may use a different time period or risk measure to that in Article 101 as long as the result provides an equivalent level of protection.
2. Where practicable, companies shall derive the SCR directly from the probability distribution forecast (PDF) generated by the internal model, using the VaR measure set out in Article 101.
3. Where companies cannot derive the SCR directly, the supervisor may allow approximations to be used, if it can be demonstrated that policyholders are provided with a level of protection equivalent to that set-out in Article 101.
4. Supervisors may require companies to run their internal model on relevant benchmark portfolios and using assumptions based on external rather than internal data in order to verify the calibration of the internal model and to check that its specification is in line with generally accepted market practice.

6.2 WHAT DO THEY MEAN IN PRACTICE?

6.2.1 The Calibration Standards should be relatively straightforward if a company's VaR is 99.5% over a one-year period. However, if a company uses a different time horizon or risk measure, compliance with the Calibration Standards becomes more onerous.

6.2.2 The draft advice from CEIOPS on Level 2 Implementing Measures provides a more practical interpretation of Article 120. A summary of the advice given in Consultation Paper 56 is detailed below.

6.2.3 Using a different time period or risk measure

6.2.3.1 Different companies will have different risks and so the appropriate way to model these risks will vary, perhaps considerably, from company to company. Even within a company individual risks will be managed in distinct ways. Therefore, companies need to be able to model their capital requirements in a way that makes sense to their particular risks, even if this means using different time periods or risk measures for individual risks. This ability is a requirement for compliance with the Use Test.

6.2.3.2 However, there are practical considerations with using a time period or risk measure different to that set out in Article 101:

- The company will need to demonstrate an equivalent level of policyholder protection. Further information on demonstrating equivalence is given below.
- Aggregating risks within a company that has used different time periods/risk measures could raise questions as to the overall level of calibration. However, as long as equivalence has been demonstrated then perhaps there are no issues with aggregation.
- There is a risk that the level of economic capital, which equates to own funds, is lower than the SCR. In this case, a fundamental assumption driving the economic capital would be that the company could hold an insufficient amount of own funds to cover the SCR. This would not be consistent with the requirements of the SCR and so, would not comply with the Use Test.
- Any length of time horizon, i.e. shorter or longer than one year, could be used as long as it was appropriate to do so but would result in the company:
    - Demonstrating that the internal model takes into account the time effects of the risks;
    - Paying special attention to the choice of data used;
    - Demonstration that all significant risks over a 1-year period are properly managed; and
    - Justifying the choice, with regard to aspects such as the average duration of liabilities, of the business model and of the uncertainties with too far time horizons.

6.2.3.3 An important point to bear in mind is that the model would also be used to support decision-making within the business and, therefore, will be calibrated to a level, or range of levels, appropriate to the risk appetite. For example, in taking investment decisions or pricing new business, a 1 in 200 year event may not be appropriate, but instead perhaps generating 90% Earnings at Risk is a more appropriate risk measure. However, the implications for the SCR using a 99.5% VaR over one-year (or equivalent) would obviously need to be considered in the decision-making process.

6.2.4 Direct derivation of SCR from the PDF

6.2.4.1 It is CEIOPS' view that if two basic conditions are met then it should be practical to directly derive the SCR from the probability distribution forecast:

- Risks are assessed over a one-year period.
- The internal model directly generates the full PDF of the Basic Own Funds defined in Article 87 and this forecast meets the Statistical Quality Standards.

6.2.4.2 Examples where it is not practicable to derive the SCR directly (and so using approximations is allowable) are:

- If a time period other than a one-year horizon has been used.
- If the PDF is not calculated at the top level of aggregation, or if the methods for valuation are different to those prescribed for the SII balance sheet. E.g. different future premium taken into account, some assets marked to model rather than market, etc.
- If the PDF is restricted to some data points of the distribution of Basic Own Funds as valued in SII framework, and if the value of the distribution associated with the 99.5% quantile is unknown.

6.2.5 Demonstration of Equivalence

6.2.5.1 Demonstrating that the SCR gives an equivalent level of policyholder protection means a reconciliation to 99.5% VaR over 1-year is required. CEIOPS stresses the importance that this is not merely a reconciliation between two different models: one for regulatory requirements and one for economic capital, rather it is the process explaining the differences in the ways the same model is used and the rationale.

6.2.5.2 Equivalence should be demonstrated at least annually, but also when there are significant events or changes to the risk profile. The company shall:

- Explain how it rescales risks and justify that the bias introduced when doing so is immaterial.
- Explain the shortcuts used to reconcile the outputs of its internal model with the distribution of the basic own funds, if any.
- If using a longer time horizon, show due consideration of the solvency position at earlier time horizons.
- If using a different time horizon, justify the particular assumptions made in order to properly take into account the temporal dependency effects.

6.2.5.3 Approximations may significantly decrease the effort required to obtain the 99.5% VaR over 1-year, thus making it more practical to use different time periods/risk measures. Examples of approximations are:

- Assume the distribution of the basic own funds over 1-year is log-normal and has great confidence in the mean and the 99.5% quantile. Therefore, it is possible to estimate using analytical results.
- If the time period is less than 1-year, there are techniques that exist to generate a 1-year distribution.
- If the time period is longer than 1-year, these same techniques can be inverted.

6.2.5.4 There may be a high degree of uncertainty with using approximations and so compensation should be made by way of additional provisions. In particular, the assumptions should be thoroughly tested against alternative assumptions as part of the demonstration of compliance with Validation Standards.

6.2.5.5 Furthermore, the estimated SCR should be calculated in line with the requirements of the Statistical Quality Standards. However, there may be situations where there is absolutely no doubt that the economic capital calculated for internal purposes is higher than the SCR. In this circumstance, the supervisor may settle on an estimate which balances the two conflicting considerations, i.e. as much accuracy as possible without imposing costs to make it virtually impossible to use a different time horizon/risk measure.

6.2.5.6 Finally, there are some additional considerations in relation to demonstrating equivalence for groups:

- When a group model is used to assess the solo SCR, the provisions defined at solo level apply. The calculation should not directly, or indirectly, take into account any group diversification.
- For the group calculation, the principles in CP60 should be followed. In particular, no diversification benefits with financial regulated entities from other sectors shall be recognised.
- The amount of own funds must be determined after taking into account all the possible restrictions to the limited availability of own funds located in one specific undertaking.
- The SCR shall be calibrated in a way that it does not reflect any restriction about the ability of own funds located in a related undertaking to cover any kind of losses within the group.

6.2.6 Benchmark Portfolios

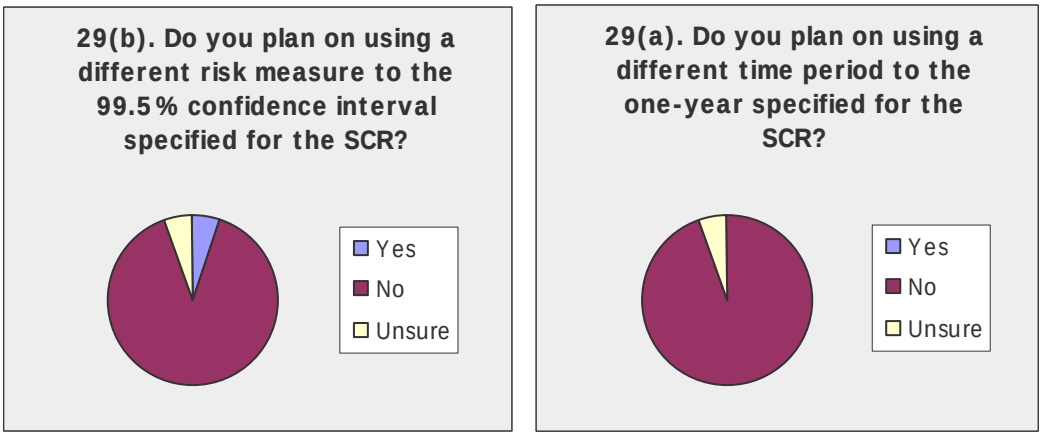
6.2.6.1 Supervisors can get companies to run their model using benchmark portfolios to verify their calibration. The problem with benchmark portfolios is that they have to be general enough to apply to all companies but have some specific characteristics to be adapted to individual risk profiles. It should be simple enough to apply to all but complex enough to identify weaknesses. Technical details regarding the benchmark will be part of later measures but CEIOPS recognises that it may be impossible to construct a single benchmark that will be appropriate for all companies; hence supervisors may be given some flexibility.

6.2.6.2 A request to run benchmark portfolios may take place whenever supervisors have concerns about the calibration either during approval or as part of the Supervisor Review Process. This can be an individual request or for the whole market (or segments of it). The company will need to justify the results and any deviations from the benchmark. The results of the benchmark test could result in the model being rejected or other actions.

6.2.6.3 As the details of the benchmark have not been specified yet, it is difficult to determine how onerous or otherwise the calibration verification would be; however, companies should bear this in mind when developing their models.

6.3 WHAT ARE COMPANIES DOING TO SATISFY THIS STANDARD?

6.3.1 The responses from our recent Survey of insurers on internal models are shown in Figures 6 and 7.



Figures 6 and 7: Responses to Survey regarding calibration plans.

- In relation to time horizon, all apart from one of the responders (who was unsure) are planning to adopt one-year. No company indicated that they were going to use a different time horizon.
- In relation to risk measure, 90% of responders intend to use a 99.5% VaR. One indicated that they were going to use a higher confidence level and one was unsure.
- A respondent to the survey also indicated that they will be assessing their capital requirements using a range of confidence levels, including 99.5% VaR over 1-year.

6.3.2 The results of the survey indicate that meeting the calibration standard should not pose any significant concerns for most companies as they do not plan on using a different time horizon or risk measure. For those that plan on using a different risk measure, a higher confidence level will be used. This should mean that approximations can be adopted to demonstrate equivalence as the capital held should be higher than that required by the SCR and the supervisor should be less concerned with the use of an estimate.

7 Profit and Loss Attribution

7.1 WHAT IS IT?

7.1.1 The Level 1 text regarding profit and loss attribution is (Article 121):

> *"Insurance and reinsurance undertakings shall review, at least annually, the causes and sources of profits and losses for each major business unit. They shall demonstrate how the categorisation of risk chosen in the internal model explains the causes and sources of profits and losses. The categorisation of risk and attribution of profits and losses shall reflect the risk profile of the insurance and reinsurance undertakings."*

7.1.2 CEIOPS Consultation Paper 56 (CP56) provides draft advice for the Level 2 text, expanding on some of the points. Before analysing the causes and sources of profit, it is important to first define what a profit is. Profit and loss could be defined in a number of ways, such as:

- Profit reported on an IFRS/local GAAP accounting basis.
- Change in the MCEV.
- Profits/losses based on a change in Basic Own Funds (on a Solvency II definition).
- Profits/losses based on an internal definition.

7.1.3 CEIOPS recommends an internal definition of profit as it feels that this would be more consistent with the requirements of the Use Test. A key requirement for any internal definition is that it is appropriate for the system of governance within a company. A company will also need to understand how the internal definition relates to the published profit and loss, and the causes of any differences.

7.1.4 A clear definition for a "major business unit" is not given in CP56. It only states that business units do not necessarily have to be legal entities and that further discussion of this will be addressed in a paper released later in 2009.

7.1.5 CP56 also states that the profit and loss attribution has to be transparent and used as a tool for validating the internal model and managing the business. Therefore the profit and loss attribution is important to show compliance with the Use Test.

7.2 WHAT DOES IT MEAN IN PRACTICE?

7.2.1 CEIOPS does not elaborate on what an internal definition of profit might look like. The definition is likely to be different for different companies and the elements included could include:

- Changes in the best estimate technical provisions.
- Changes in the risk margin.
- Changes in the SCR.
- Changes in the discounted value of future profits.
- Changes in the internally defined cost of capital.
- Changes in accounting provisions.
- Changes in basic own funds.

7.2.2 The risks modelled in the internal model should follow the causes and sources of profit and loss within the company. Not every potential or actual source of profit and loss will be modelled as a standalone risk in the internal model as the resulting model would become unduly complex. Qualitative statements explaining the unmodelled risks will need to be made. Any large unexplainable profit or loss should then be investigated, which would help identify weaknesses in the model as it would indicate that not all material risks were included in the model.

7.2.3 There is a large overlap between profit and loss attribution and backtesting as part of the validation standards. The work done to complete the two standards will be very similar, such as testing the results against experience and identifying weaknesses in the model. The difference will be on the focus and analysis of the results of the work. Profit and loss attribution will focus on risk recognition and backtesting will focus on the probability and severity of risks in practice compared to the model.

7.2.4 The results of the profit and loss attribution should provide information to assist in budgeting and forecasting which will help satisfy the Use Test. The profit and loss attribution should also be part of the control cycle.

7.2.5 The definition of profit used will be an important factor in determining the level of internal model development. Regardless of the definition used for profit and loss a company will need to understand the movements in the technical provisions and the SCR, which will define a base level of development needed. If the definition of profit differs from a simple movement in technical provisions and the SCR, this could require a significant amount of extra development.

7.2.6 The definition used for profit and loss will also need to be consistent with the definition used when quantifying the profit and loss for each PDF. CEIOPS states that any methodology that values the financial impact of future events is also subject to statistical quality requirements. Therefore the data, methods and assumptions used when quantifying the profit and loss are subject to full internal model standards. A detailed definition of profit will therefore require extra work to be done both in developing the model, but also satisfying the statistical quality requirements.

7.2.7 Model approval would also be in question if the definition of profit was set by the functional capabilities of the internal model, rather than the functional capability of the model being set by the definition of profit. If the model had limited capability then the analysis of profit may not be useful for managerial decisions, which would not fulfil Use Test requirements. Therefore, when planning the internal model development it would be valuable to agree an internal definition of profit early on in the planning process as the definition could help determine the scale of the work needed.

7.2.8 The Level 1 text requires the attribution to be carried out “at least annually”. To satisfy the Use Test a half-yearly or even quarterly attribution will probably be expected. Any internal model will need to be developed with the flexibility to allow a change in the length of analysis. It is not clear from CEIOPS what level of detail would be required for each time period to satisfy the requirements i.e. what approximations would be allowed in quarterly or monthly profit attributions if these were required for model approval. It is likely that each firm would need to specify any approximations made and justify why they are appropriate.

7.2.9 The standard way a company currently analyses profit is to project forward the business using expected assumptions and then move to actual experience for each cause or source of profit. This is a well-established method and would appear to still be a valid method under Solvency II.

7.3 WHAT ARE THE PRACTICAL CHALLENGES?

7.3.1 Many companies will already be analysing profit and loss along with an analysis of the change in surplus and the change in reserves. The output of this work will be used in control cycles and management decisions. So a basic process should already be in place for most companies and this would just need to be adjusted for Solvency II principles. In order to comply with the Use Test the existing process should form a good start position to build on.

7.3.2 One of the main practical challenges will be installing the data systems to provide the data required at a sufficient level of granularity to allow a detailed analysis. The data production process must also be efficient to allow the data to be produced in a timely and accurate manner. The data will also be required half-yearly or quarterly to allow frequent analysis of profit.

7.3.3 A full profit analysis requires data from several sources and so changing requirements or improving data quality will require interaction with several departments. As many companies now outsource the administration functions this may mean renegotiating service agreements. Examples include:

- Asset investment returns.
- Policy data, such as age, sex, etc.
- Movements in policy data, such as new business premiums and claims paid.
- Accounting items such as unallocated premiums, claims/compensation pending.
- Reserving and PDF assumptions.

7.3.4 Data could be a problem when back-testing the model to satisfy the validation standard. If data requirements are significantly different from what is currently used then it may not be possible to obtain the required data for prior time periods.

7.3.5 In the Survey, 41% of companies thought that a small improvement and 11% thought a significant improvement to policy data was needed for Solvency II and 26% also thought that the granularity of asset data needed to be improved.

7.3.6 The level of tolerance for untraced amounts could have an impact on the practical challenges. A more detailed attribution of profit requires a greater level of data and more complex modelling. The level of tolerance will need to be appropriate to the system of governance and proportional to the size of the operation.

7.3.7 Companies should consider how practical it is to analyse each element of the definition of profit. For example, analysing the change in best estimate technical provisions for each cause of profit is reasonable, but accurately calculating the risk margin or SCR many times is not likely to be practical. Companies will have to choose which parts of the profit analysis to calculate accurately, which to use approximations for and which ones to describe in a qualitative manner. This decision will also interact with the level of detail required and tolerance for untraced amounts.

7.3.8 It would be desirable if the results of the attribution were consistent with the value measures reported to shareholders, for example MCEV and IFRS. This could be difficult as the future direction of IFRS Phase 2 is still to be decided, and MCEV is still developing. The chosen definition of profit will be more effective if it can satisfy the needs of many stakeholders.

7.3.9 Companies should also consider how to account for high level or group sources of profit or loss such as correlation of risks and diversification benefits. A reduced correlation of risks or an increased diversification of business should increase future profits as the capital required by the company will fall and so the cost of holding the capital needed to ensure company solvency will reduce. A company will therefore need to think of how to allocate this profit.

7.3.10 A practical challenge always exists when considering the tax charge on profits. It is common to calculate profit first at a policy or product level, but tax is calculated at a company level and so a good internal model will be able to aggregate cash-flows from a product or policy level to a group level to enable company level tax calculations to be performed.

7.3.11 Attributing the total tax charge among the different business units could be quite arbitrary if the business units are more granular than a legal entity. The internal model will need to have a feedback loop down to a business unit level to calculate a net of tax profit for each business unit. There will therefore need to be careful consideration of the tax computation, especially if HMRC rules are not consistent with the Solvency II regime.

7.3.12 A further consideration for tax will occur when considering the order of profit analysis and profit analysis over a part year. Tax is only calculated once a year and the emergence of profit over a year or allocation of profit between risk types does not affect the calculation. Companies should give consideration as to whether the most accurate analysis of profit will be on a gross or net basis. Also, when performing an actual to expected analysis of profit, the order of the sources of profit and loss makes a difference to the end result. A company will need to consider the risk of consistently undervaluing or overvaluing a source of profit due to the order in which the analysis is carried out.

7.4 SOME PRACTICAL SUGGESTIONS

7.4.1 The definition of profit should be made early in the planning process as should a decision about the treatment of factors seen at a group level and tax. These decisions will assist with the model specification that in turn will aid the planning process. Other early decisions to be made include the level of granularity required and the tolerance for approximations and untraced amounts in the analysis.

7.4.2 Companies should also think about the data requirements needed for the analysis and start considering how the required data will be provided within the necessary timescales. This may require negotiations with both internal and external parties.

7.4.3 In the Survey, profit and loss attribution was not highlighted as a key area of concern. This may be due to companies expecting to just expand on existing profit reporting processes. However, a more detailed analysis of the requirements of the profit and loss attribution may reveal that this standard requires more attention than a simple expansion of the existing process.

8 Validation Standards

8.1 WHAT ARE THEY?

8.1.1 Validation is the term given to the process used by the firm to provide confidence over the results, design, workings and other elements of the internal model and thus provide evidence of its suitability for use.

8.1.2 The validation standards applying to internal models are set out in Article 122 of the Solvency II Directive, with CEIOPS providing draft advice on Level 2 implementing measures relating to them in section 8 of CP56.

8.1.3 The Level 1 text regarding validation is (Article 122):

> *"Insurance and reinsurance undertakings shall have a regular cycle of model validation which includes monitoring the performance of the internal model, reviewing the on-going appropriateness of its specification, and testing its results against experience.*
>
> *The model validation process shall include an effective statistical process for validating the internal model which enables the insurance and reinsurance undertakings to demonstrate to their supervisory authorities that the resulting capital requirements are appropriate.*
>
> *The statistical methods applied shall not only test the appropriateness of the probability distribution forecast compared to loss experience, but also to all material new data and information relating thereto.*
>
> *The model validation process shall include an analysis of the stability of the internal model and in particular the testing of the sensitivity of the results of the internal model to changes in key underlying assumptions. It shall also include an assessment of the accuracy, completeness and appropriateness of the data used by the internal model."*

8.1.4 The validation standards are expected to create a sound control environment, demonstrate the appropriateness of the model for its stated uses and ensure the supervisor has confidence that the level of regulatory capital is not materially mis-stated.

8.1.5 It should be highlighted that under Solvency II, the clear intention is that validation covers much more than the normal model and assumption checking that validation has traditionally been associated with. The validation standards apply to all elements of the modelling process including both the qualitative and the quantitative elements of the model.

8.1.6 CEIOPS recommends that validation should cover at the very least:

- Data.
- Methods.
- Assumptions.
- Expert Judgement.
- Documentation.
- Systems/IT.
- Model Governance.
- Use Test.
- Validation Policy itself.

8.2 VALIDATION PROCESS

8.2.1 CP56 pays particular focus to the ongoing programme of analysis and improvements in modelling that will be required under the validation strand of the standards. This concept is consistent with the actuarial control cycle, and is illustrated in Figure 8.

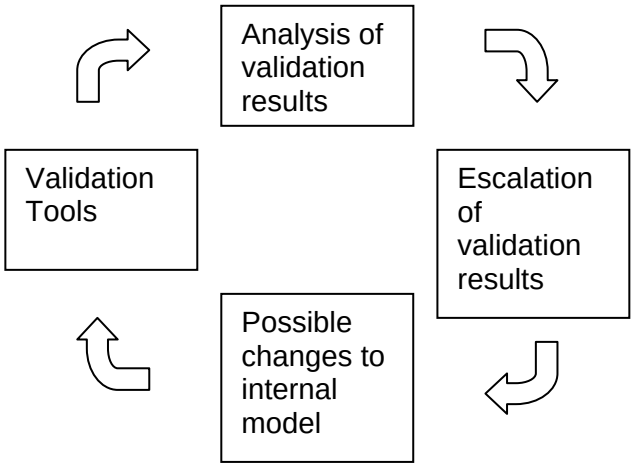


Figure 8: Validation control cycle from CEIOPS CP56.

8.2.2 The requirement under Article 122 for an on-going process of validation is reinforced by the requirements of the Use Test to ensure the ongoing appropriateness of the design and operation of the internal model.

8.2.3 New products, new structures and changes in the external environment as well as the rolling programme of validation and modelling improvements will mean that the validation process is an iterative process – the evolutionary nature of this highlights the requirement for excellent documentation and governance standards and a clear validation policy.

8.3 VALIDATION POLICY

8.3.1 CEIOPS recommends that each firm should have a documented Validation Policy that sets out how the internal model is validated and why it is appropriate. Policy documents set out principles and standards for mitigation of internal model risk. The key elements of validation policy that CEIOPS suggest are described below.

8.3.2 Purpose and scope of validation

8.3.2.1 The items to be covered by the validation should be listed and any elements of the internal model which are not covered by the validation policy should be clearly identified and justifications as to why they are not required should be provided.

8.3.2.2 The level of comfort sought by the validation policy should also clearly be stated.

8.3.3 Validation tools used

8.3.3.1 A list of validation tools used along with justification that they are appropriate and how the ensuing analysis is expected to highlight any issues. The level of comfort that is being sought by their use should also be clarified.

8.3.4 Frequency of validation process

8.3.4.1 The validation checks should be performed regularly at a frequency set down in the policy. Different validation checks may be performed at different frequencies e.g. a full suite of validation checks performed half-yearly with regular weekly/monthly Key Performance Indicators (KPIs) used for monitoring purposes.

8.3.4.2 It should also be noted that the CEIOPS text sets an expectation that as well as regular scheduled validation checks, ad hoc validation analyses are required should significant changes to the external environment (such as the market events of last year) occur. It is up to the firm to set out limits that would lead to these further ad-hoc investigations.

8.3.5 Governance of validation results

8.3.5.1 The responsibilities for performing the validation analyses and how those validation results are to be reported should be clearly stated.

8.3.5.2 The validation policy should identify how senior management are involved/informed of the validation process with the structure of the governance escalation procedures for signoff being clearly set out.

8.3.5.3 It is not just the validation sign-offs that need a good governance structure: should validation tests fail, well defined processes for how the results of failed validation tests will be used also need to be put in place.

8.3.6 Limitations and future developments

8.3.6.1 Any limitations in the validation process need to be clearly identified along with descriptions of how these are expected to be tackled in the future. This ongoing development of the process is expected to be well documented.

8.3.7 Documentation

8.3.7.1 As with all other elements of the internal model process, documentation requirements are key. The validation policy is required to be documented, with a requirement that the validation processes and responsibilities are understandable by a knowledgeable third party.

8.3.8 Independent review

8.3.8.1 An independent review of the validation policy is required. This may be performed internally or externally.

8.3.9 Validation report

8.3.9.1 It makes sense that in order to demonstrate compliance with the validation standard, a comprehensive validation report should be produced detailing:

1. All the validation checks completed.
2. Any investigations and results from failed validation checks.
3. Any gaps in the validation process or limitations with the internal model (along with the issues that these raise and the likely impact).
4. Schedule for improvements.
5. Appropriate governance items (sign-offs, etc.).

8.4 RESPONSIBILITIES

8.4.1 It is entirely the company's responsibility to validate the elements of the internal model (not the supervising authority).

8.4.2 There are several links between the company's governance process, internal audit and the validation requirements - clearly delineated responsibilities will need to be defined with the scope and limitations of any sign-offs being detailed. External reviews can be used but ultimately the Board will have sign-off of the validation process.

8.5 VALIDATION TOOLS

8.5.1 Several validation tools have been suggested, by CP56 and other recent papers on the subject (such as the "Actuarial Aspects of Internal Models for Solvency II" paper delivered to the Institute of Actuaries on 23 February 2009), and these are described below.

8.5.2 Data quality checks

8.5.2.1 These are checks on data collection, storage, cleaning process, and data processes (e.g. scaling, etc.). Elements of these types of checks are more consistent with the validation processes that we are currently used to (control total checks, check digits, etc.).

8.5.3 Analysis of assumption processes

8.5.3.1 The statistical validation of the model inputs and methodologies are closely aligned with the statistical quality standards and calibration standards covered earlier in the paper.

8.5.4 Sensitivity testing

8.5.4.1 The sensitivity of the internal models to changes in key assumptions/parameters should be tested to identify the key assumptions to which the model is most sensitive.

8.5.5 Stress and scenario testing

8.5.5.1 The internal model will be used to assess the impact on the business under a range of conditions and so needs to produce sensible results under a wide range of stresses and scenarios – the validity of the model under stress conditions needs to be verified with any limitations clearly understood and documented.

8.5.5.2 As well as more standard stress tests, the firm also needs to understand what conditions will cause their business model to fail and hence the internal model needs to be able to perform reverse stress testing.

8.5.6 Backtesting

8.5.6.1 One of the most onerous requirements will be for a full detailed analysis of change – reconciling the output from the model given actual experience compared with the actual current position of the various elements being modelled. Any discrepancies between the model forecasts and actual experience need to be identified and appropriately explained.

8.5.6.2 This covers two main elements:

- Using actual experience does the model accurately reflect the evolution of the business?
- An analysis of how actual experience has deviated from the internal model projections with appropriate justifications/analysis showing that these deviations do not invalidate the appropriateness of the model.

8.5.6.3 The stages of Back Testing identified by CEIOPS are:

- Define a trigger event (this being the actual realization of a loss that exceeded a pre determined limit).
- Identify the portfolio where the event was triggered.
- Analyse root causes of this event (e.g. market fall, etc.).
- Examine how this root cause is reflected in the internal model.
- Analyse the root causes of large movements in profits or losses which can provide useful indications of the continued validity of the stress test assumptions.

8.5.6.4 The FSA have highlighted in Feedback Statement FS09/1 that they believe back testing should go further. For example, reviewing “how likely the actual outcome had been perceived to have been given the assumptions taken at the start of the period“. This will allow the development of a better understanding of the risks that the company is writing.

8.5.6.5 It is not sufficient to simply adjust for any deviations that are identified by the backtesting process – a full analysis is required. This should cover the source of the risk, its severity, likelihood of re-occurrence and a recommendation for mitigating the problem.

8.5.7 Profit and loss attribution

8.5.7.1 These are checks on how the causes of actual profit and loss compare with risk drivers in model.

8.5.7.2 This is a standard in its own right but elements of this are consistent with backtesting and hence much of this can be performed at the same time.

8.5.8 Implementation checks

8.5.8.1 These cover aspects such as user acceptance testing, model specification checking and version control.

8.5.8.2 Validation of the model design and development process is required, with appropriate checking, reviewing and documentation being put in place.

8.5.9 Benchmarking

8.5.9.1 This is against consultancy firms' reports, regulatory capital models, rating agency models, industry models, etc., and is not to be confused with potential benchmarking requirements of the Calibration Standard.

8.5.9.2 Ensuring consistency with developing market practice (best practice) will provide additional comfort as to the appropriateness of internal model elements, although this needs to be backed up with the justification that it is appropriate for the particular firm.

8.5.10 Challenge

8.5.10.1 This involves conducting a review of the theoretical soundness of model assumptions, data, expert judgment, outputs functions and methodology.

8.5.10.2 Having a strong challenge process as part of the internal model review process is key to ensuring the reasonableness of the model. Ideally this challenge should be both internal and external with appropriate expertise being called upon to assess the appropriateness of each element.

8.6 WHAT DO THEY MEAN IN PRACTICE?

8.6.1 The main practical implication is that companies will have to significantly expand the scope and improve the quality, granularity and coverage of current validation processes.

8.6.2 In terms of man hours of effort, it is likely that validation will be one of the most onerous of the internal model standards for companies to deliver.

8.6.3 Kathryn Morgan (FSA representative on CEIOPS) highlighted in a recent Insurance Risk & Capital article that she believes there are two key things for insurers to remember:

- Supervisors will not be validating the models – "*The firms will be validating the models and we [FSA] will be assessing the quality of their validation.*"
- Validation is not a static process – "*Firms need to have a clear idea of what the results might be and what that might mean for future developments. They should get into a cycle of improvement.*"

8.6.4 She also confirmed that CEIOPS has recognised insurers' concerns over internal model issues – *"We'd like to give more advice on how the use test might be demonstrated and what kind of validation tools might be used by companies. We're currently in the planning stage and will start publishing that from January next year."*

8.7 WHAT ARE THE PRACTICAL CHALLENGES?

8.7.1 The volume of work required to put a complete internal model validation structure in place.

8.7.1.1 The obvious issue that most companies will have is the sheer volume of work that validation will require – both in terms of developing appropriate processes and managing the production processes once they are in place.

8.7.1.2 The likely competition for skilled resources that has already been highlighted in several sections of this paper will make this issue even more acute. Companies need to act now to ensure that appropriate core resources will be available for the internal model development and implementation.

8.7.2 Clear/complete specifications, structured/controlled testing.

8.7.2.1 More consistent with current validation processes, practical issues around model developments and appropriate testing (user acceptance testing, etc.) will need to be managed under this now much larger process.

8.7.3 Embedding validation checks at all levels of the internal model process

8.7.3.1 Traditionally validation checks have been associated with policy model developments and results checking but Solvency II extends validation across all areas of the internal model. In order to deliver appropriate validation comfort on an ongoing basis within appropriate deadlines, validation will have to be embedded into business as usual processes.

8.7.3.2 The Use Test section 4.2.28 highlighted the potential uses for the internal model within the business. The validation processes put in place will need to be appropriate to cover all of these and be able to react to the variety of timescales / levels of granularity that these uses will entail.

8.7.4 Scale of managing internal model process

8.7.4.1 It should be noted that the development of the validation process for implementation in time for 2012 is not where the practical challenge ends. Due to its scale, the management of the validation process once in production will be a major task requiring significant dedicated resource.

8.7.4.2 The necessity for consistency within all elements of the process means that documentation and communication will be key, with the validation policy documentation playing a pivotal role.

8.7.5 Evolution of Validation Framework

8.7.5.1 A major practical issue for all elements of internal models will be the evolving nature of the methods being applied under the framework. It is unlikely that there will be a consensus on what defines best practice within the industry (“best practice” will also differ between companies depending on the nature of the risks affecting them).

8.7.5.2 A partial convergence of this is likely to take several years (through benchmarking exercises, etc.). This means that processes such as validation are likely to go through very significant changes in the initial few years of Solvency II.

8.7.6 Setting limits

8.7.6.1 Companies will need to take special care when setting limits for validation checks. Due to the likely complexity of the internal model process, small deviations early in the process could be compounded and have a material impact on the results. Also, as the internal model is expected be used for different purposes, the limits should be set with the most detailed/onerous of these uses in mind.

8.7.6.2 The text does not clearly identify what limits should be considered appropriate when performing the validation tests, although the proportionality rule is highlighted.

8.7.7 Data requirements

8.7.7.1 As has already been highlighted in the Profit and Loss attribution section, a key challenge will be to be able to provide the data required at a sufficient level of granularity to allow a detailed analysis within the required timescales.

8.7.8 Partial Internal Models

8.7.8.1 Although guidance on partial internal models has not yet been issued, it is clear that the integration of these adds another complexity / dimension to the validation process.

8.8 WHAT ARE OFFICES DOING TO SATISFY THE STANDARDS?

8.8.1 It is clear that this element of the internal models' requirements is one of the least developed areas with 17 out of the 20 responses to the Survey indicating that they had not started developing their Solvency II validation standards processes, as illustrated in Figure 9.

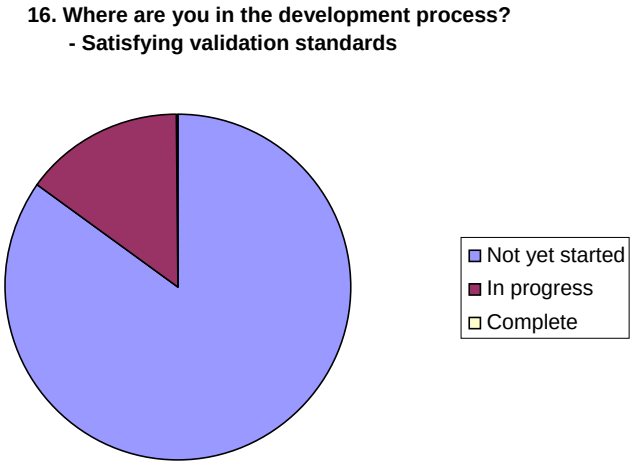


Figure 9: Responses to Survey regarding validation progress.

8.8.2 In the FSA's June 2008 analysis of QIS4 responses the FSA highlighted the significant deviation between companies' own opinions of readiness for implementing the validation standards compared with the FSA's opinion. An update on this in November last year suggested the FSA viewed validation standards as one of the least developed of all of the six internal model standards with the expected effort required to deliver the standard being one of the largest.

8.8.3 This suggests that companies have a very long way to go to implement comprehensive validation processes.

8.9 SOME PRACTICAL SUGGESTIONS

8.9.1 There are significant overlaps in the analysis required for the validation standards and other elements of the internal model and Solvency II reporting process, such as:

- Stress and scenario testing within the ORSA.
- Profit and loss attribution.
- Statistical quality standards.

8.9.2 Thus efficient management of the validation process should allow completion of these tasks at the same time.

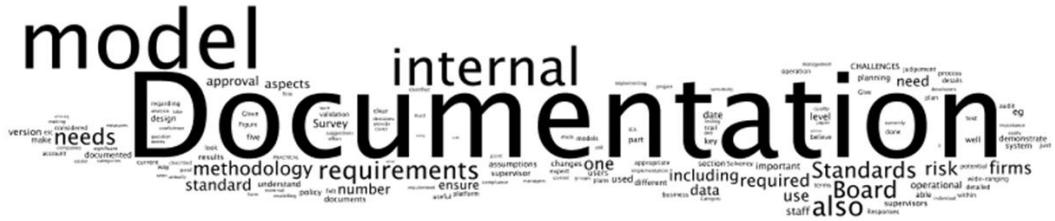
8.9.3 We would expect that there will be a significant number of benchmarking surveys performed by the actuarial consultancies throughout the period of internal model development as we progress towards Solvency II. These should provide a valuable resource for the development of validation tools and understanding of best practice.

8.9.4 CEIOPS has highlighted that they will be issuing further guidance on validation tools in January 2010, which should assist companies in moving towards a consistent validation framework.

8.9.5 In order to monitor the ongoing appropriateness of the internal models and effectiveness of the validation process, regular automated KPIs should be introduced and monitored to gain confidence in the checks.

8.9.6 Flexibility in underlying systems/validation tools will be key to delivering a comprehensive validation process that can evolve over time without requiring total redevelopment. Thus the granularity of data and level of available detail in the analysis should be set beyond the minimum levels identified by companies' Solvency II gap analyses.

9 Documentation Standards



9.1 INTRODUCTION

9.1.1 In this section we will explore the documentation standard. Although at first glance this standard may look innocuous, it is absolutely critical to gaining supervisory approval for use of the internal model. Without good documentation, the internal model will not be approved. As we will see, it is not a standalone requirement but actually encompasses all of the other five standards too.

9.2 WHAT ARE THEY?

9.2.1 Article 123 of the Directive sets out the requirements for the documentation standards. This requires that the documentation covers:

- The design and operational details of the internal model.
- How the internal model complies with the five other standards (use test, statistical quality standards, calibration standards, profit and loss attribution, and validation standards).
- A detailed outline of the theory, assumptions, and mathematical and empirical basis underlying the model.
- Any circumstances under which the internal model does not work effectively.
- All major changes to the internal model.

9.3 WHAT DO THEY MEAN IN PRACTICE?

9.3.1 To paraphrase the requirements, the documentation must show:

- What is done.
- Why it is done.
- How it is done.

9.3.2 Given the complexity of most internal models, it is easy to get distracted by the detail of the wide-ranging documentation requirements. We therefore first take a look at the key objectives of the documentation standard.

9.3.3 The documentation standard aims to:

- Give confidence to supervisors regarding appropriateness and reliability of the internal model.
- Give confidence to the Board that the model upon which it is basing its business decisions is sound.
- Mitigate key person risk.

9.3.4 The concept underlying the standard is that the documentation should be sufficiently detailed to allow a knowledgeable independent third party to be able to understand the reasoning, design and operational details of the internal model, and to be able to judge its reliability and appropriateness (including whether it complies with the requirements of the other five standards). In addition, there should be sufficient information on the framework, methodology, assumptions and the limits of the internal model that the knowledgeable third party could in principle construct an independent model producing consistent results given the same data and parameters.

9.4 DETAILED REQUIREMENTS

9.4.1 In this section of the paper, we will look at some of the aspects of documentation which need to be considered by firms. It should be noted that it is not an exhaustive list, but rather aims to give a flavour of the wide-ranging nature of the documentation requirements. It is worth pointing out that not all of the documentation requirements are set out in Article 123 and the related implementing measures; a number of the requirements are contained in the articles and implementing measures for the other five standards.

9.4.2 There are a number of different potential users of the documentation: the Board, the supervisor, risk managers, model developers, etc. It is important to ensure that the **level of documentation is appropriate to the audience**. For example, the level of detail for the Board would be very different than that for the person responsible for the design of a particular risk module. This means that there will need to be more than one level of documentation for the internal model.

9.4.3 As the internal model will be used for day-to-day decision-making purposes by the Board, and also to demonstrate the adequacy to the supervisor, the **documentation of the design and operational details needs to be comprehensive and up to date**. There also needs to be **strong governance systems** around the model such as documented policies, controls and procedures covering the management of the operational details of the internal model.

9.4.4 All **Board discussions relating to the internal model** including decisions made that take into account the results of the internal model, **should be minuted** as this helps demonstrate that the firm is meeting the requirements of the Use Test. The risk management function is responsible for the operation of the internal model, and they must prepare a regular report on the operation of the internal model for the Board. The documentation of the internal model should also **highlight weaknesses and limitations** of the model, and the Board needs to demonstrate awareness of these issues when it is making decisions (again through minutes of Board meetings).

9.4.5 To be able to generate results, an internal model needs input data, assumptions and a modelling methodology and operation. Each of these aspects requires full documentation to meet the approval requirements. We will examine each in turn.

9.4.6 **All data** used to generate the probability distribution forecast needs to be **identified, described, quality assessed and its use justified**, with a clear flow from the source of the data to exactly how it is used in the internal model. The database within which the data is stored also needs to be documented including security and maintenance aspects. A written **data policy** needs to be developed.

9.4.7 Similarly, **any assumptions** made within the internal model need to be **detailed and justified**, including how they are derived. There are special requirements for the documentation of **expert judgement** given the potential risk inherent in such judgement, covering aspects such as: why an expert judgement is required; how the expert judgement has been derived; how it has been validated; a sensitivity analysis of the impact of the assumption; and the name and qualifications of the expert.

9.4.8 In terms of the **mathematical methods** behind the modelling methodology, the theory and empirical basis needs to be **described, along with the rationale** for selecting that particular method (including what other alternatives were considered and why they were rejected). The description also needs to cover the risks captured and those not captured under the methodology, any approximations made, and the key assumptions.

9.4.9 Finally, the actual **operational process** for generating the outputs from the model needs to be **described**. The technology used for the internal model also has to be documented, including how both the input and output data is stored, along with confirmation of the security of the data, contingency plans and business recovery plans.

9.4.10 The documentation of the internal model is not just expected to cover one point in time, but it should also provide an **audit trail of the history of past model developments** to give an overview of the evolution of the model, including why the model is in its current form and what other approaches have been considered. One interesting question is whether firms need to recreate the development history of their internal models if the model already exists.

9.4.11 It is important that **model changes** are documented fully, and the documentation must demonstrate that the changes have been adequately tested and the impact of the changes has been assessed including any implications for the design and operation of the model, as well as an assessment of the continued compliance with the other five standards.

9.4.12 As mentioned in Chapter 8, validation forms an important part of the approval process. The **validation policy** needs to be documented, and the **methods and results of the validation** need to be recorded. This will include the results of sensitivity analyses, stress testing and scenario testing as well as reverse stress testing to identify potentially dangerous scenarios for the firm.

9.5 WHAT ARE THE PRACTICAL CHALLENGES?

9.5.1 In the recent Survey, a number of companies cited documentation as one of the key challenges for gaining approval of their internal models. As can be seen in Figures 10 and 11, firms are still at the preliminary stages of considering how to deal with the documentation requirements, and most feel that their current levels of documentation need to be improved significantly to meet the approval standard.

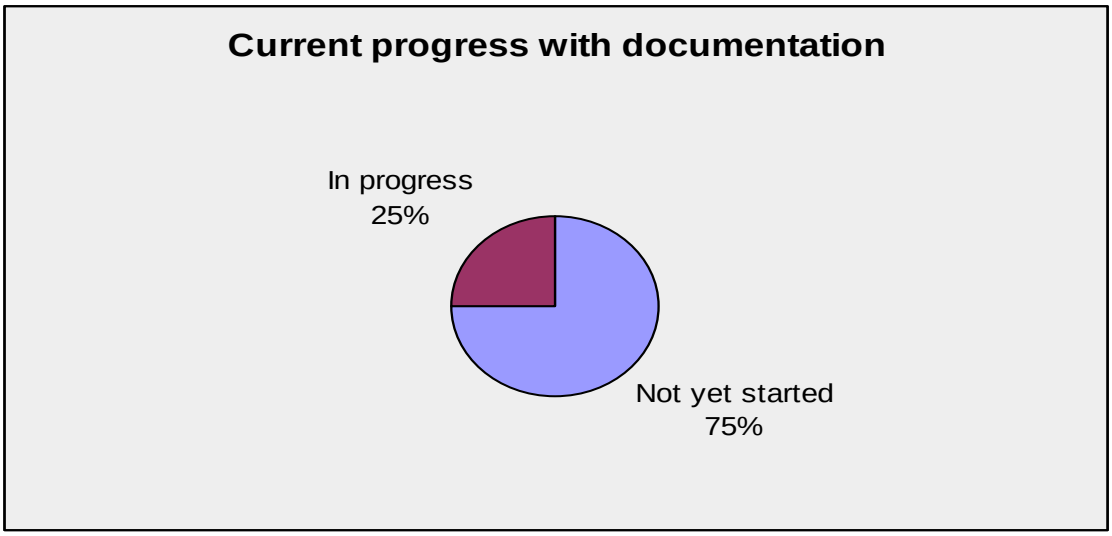
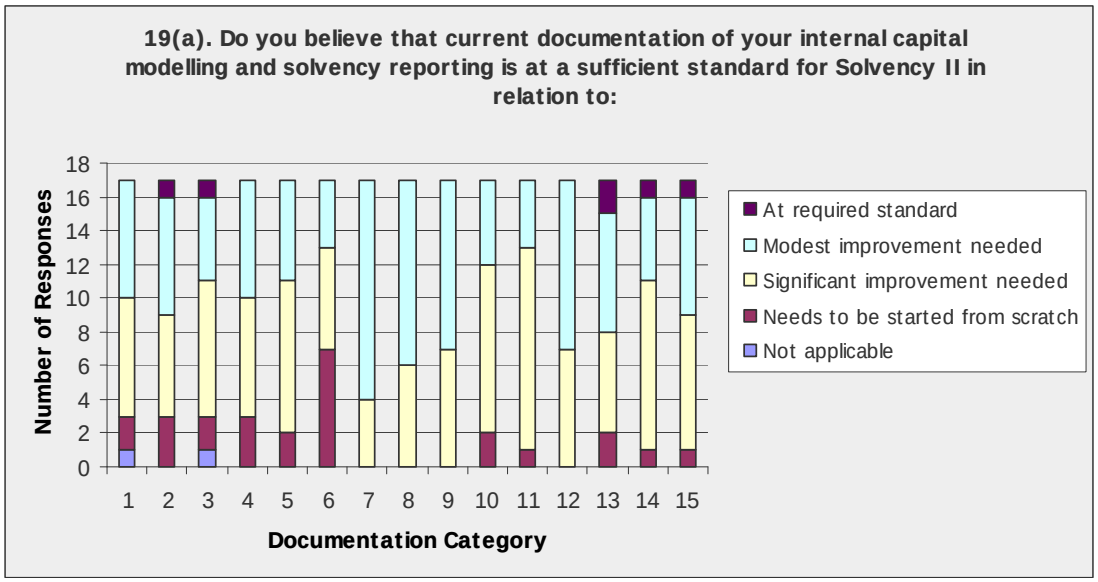


Figure 10: Responses to Survey regarding documentation progress.



Category	Category description
1	Data modelling system (e.g. DCS)
2	Core liability calculation system
3	Supporting spreadsheets for core calculations
4	Experience analysis system
5	Technical provisions Best Estimate methodology
6	Technical provisions Risk Margin methodology
7	ICA Insurance risk methodology
8	ICA Market risk methodology
9	ICA Operational risk methodology
10	Analysis of change methodology
11	Procedures and process instructions
12	Risk appetite
13	Pricing methodology
14	Solvency monitoring methodology
15	Use in board level decision making

Figure 11: Responses to Survey regarding documentation progress split by category.

9.5.2 One company summed it up well when they said: "*Our current documentation standards are high, but the approvals process appears to require much more than this*".

9.5.3 In response to the survey question: "How do you plan to reach the required standard?", the most common response was "*Lots of hard work*"! Firms are generally planning to cover this as one of the workstreams within their Solvency II implementation plan with the tasks being driven from gap analyses. A number of companies commented that their plans were still at a very early stage of development.

9.5.4 In the Survey we also asked if firms felt that the documentation for any external models that they use (e.g. ESG) currently meets the required standard. The majority felt they did not. To achieve the required standard, some firms felt that the external provider should make the necessary improvements, whereas most felt that a combination of effort would be required from both the external provider and from the firm itself.

9.5.5 In this section of the paper, we will examine some of the practical challenges, and in the following section we will provide some suggestions to help with the documentation requirements.

9.5.6 One of the initial challenges is how to ensure all staff understand the importance of documentation. Traditionally, many people probably regard documentation as a bureaucratic chore that takes them away from their main job, and this can have a number of undesirable impacts such as poor quality documentation that is out of date and little used by staff, increasing the potential for errors and single-point sensitivity risks.

9.5.7 The documentation requirements are wide-ranging, and the gap between current levels and the required level will be very significant for almost all companies. This means a lot of time and effort will be required to bridge the gap which has resourcing and project planning implications. It is also important to ensure that no material aspects are missed.

9.5.8 The complexity of the documentation is increased further when taking into account that it has to be appropriate for a number of different categories of user (e.g. for the Board and supervisor; individual risk managers; model developers, etc).

9.5.9 There are a number of aspects around documentation storage which need to be addressed, including the platform, how documentation is structured and how relevant documents can be identified and accessed.

9.5.10 Another challenge is the fact that it is always a moving target: how do you make sure that the documentation is kept up to date, and how do you make sure the documentation relates to the right version of the model? The whole issue of ensuring effective version control and providing an audit trail of the evolution of the model represents a significant challenge to the industry.

9.6 SOME PRACTICAL SUGGESTIONS

9.6.1 In this section we outline a number of suggestions on how to address some of the implementation challenges relating to the documentation requirements. We believe that one useful guiding principle is that anything that can be done to make it easier for the supervisor to review the internal model is ultimately likely to have a benefit and thus increase the likelihood of approval of the internal model.

9.6.2 With this in mind, we believe that there are some simple steps that can be taken to make life easier for the supervisor. For example, having a clear index of all internal model documentation (document name and location), as well as having a map connecting each of the regulatory requirements with the individual items of documentation supporting that requirement.

9.6.3 We would recommend early engagement with the Board as a critical feature to achieving the required documentation standards. The Board needs to understand the fundamental importance of documentation in terms of securing internal model approval, and its wide-ranging scope. This should then ensure that documentation receives sufficient prominence in project planning and consequent allocation of resources. The Board should also ensure that an effective communication programme is put in place so that all staff are aware of the importance of good documentation.

9.6.4 In terms of firms' Solvency II internal model implementation plans, the documentation aspects should be taken into account from the outset, and all of the various facets of documentation tasks need to be considered within the context of the overall project plan. Part of this will involve identifying all of the categories of documentation required. As previously mentioned, documentation covers all of the six approval standards (not just the documentation standard), so there are a wide range of documentation categories to consider.

9.6.5 It is important not to leave the documentation until the end: the CEIOPS consultation paper on implementing measures makes it clear that it expects the documentation to be up to date.

9.6.6 Staff should be encouraged to view documentation as something that is useful for both the business as a whole and for individual members of staff, and is not just a bureaucratic compliance point. One way of facilitating this is by making sure the documentation is written in a way that is actually useful to staff: if this is the case, the effort involved in putting it together becomes more bearable in that it isn't just a SII compliance exercise, but it is also seen to have useful business benefits. Consideration could also be given to incentivising staff in order to achieve alignment of interest e.g. take into account in performance planning system.

9.6.7 Although not a specific requirement under the regulations, we believe it would be helpful for firms to define a documentation policy at the outset, and ensure that all documentation meets this policy. We would envisage this policy also defining all of the different groups for whom the documentation will be targeted (e.g. the Board, regulatory supervisors, risk managers, model developers, etc), and the level of documentation which would be appropriate for each of these groups. This approach can be used to ensure consistency in the look and feel of the documentation, which should also improve efficiency in that if all documents have the same layout, it should be easier for a user to locate the information that they require. In terms of documentation for supervisors, it would probably be sensible to also provide supervisors with all other documentation as well so that the supervisors had a complete picture of all of the internal model documentation.

9.6.8 Once firms have identified all of the aspects of documentation required, they should establish what documentation currently exists and from this decide what currently meets the Solvency II documentation standards, what needs to be improved and what needs to be started from scratch.

9.6.9 We believe that strict version control of documentation will be very important to ensure that the documentation has a good audit trail of the model development and it is always clear to all users that they are using the most up to date version. A related point to this is that there should also be strict version control of internal model release, as the documentation should also contain the version number of the internal model to which it relates.

9.6.10 The documentation should be on a platform that is easily accessible by all of the stakeholder groups. This platform should be able to cope with all of the different kinds of documents which will form part of the documentation (e.g. Word, PowerPoint, Emails, etc). The documents should be easily updatable, but in a controlled way in which previous versions are retained for audit trail purposes, and there is appropriate review of any changes before new versions go live. If documents are not easily updated, then they are more likely to become out of date which could precipitate a lack of confidence in users.

9.6.11 Figure 12 summarises the survey responses to the question: “What medium are you planning to use for your documentation?”. As can be seen, at present a significant proportion of firms are still deciding on their approach. For those who stated that they plan to use a documentation management system, only one had actually decided on what platform to use.

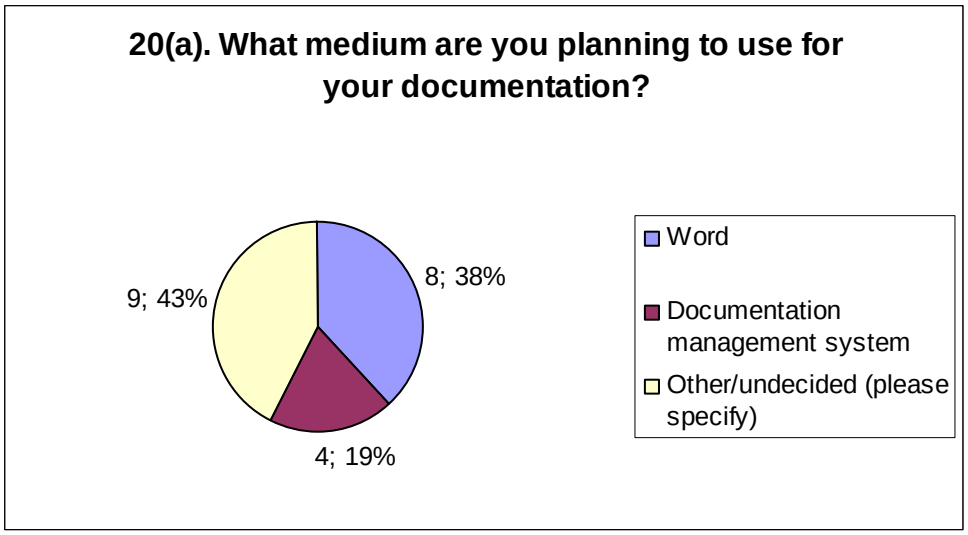


Figure 12: Responses to Survey regarding documentation medium.

9.6.12 As part of the Use Test, firms need to be able to demonstrate that the key users of the model (including the Board) understand the model and especially its limitations. One potential way of achieving this would be by providing training on the model which could be validated by a post-training test. The post-training tests could then form part of the documentation demonstrating that users understand the model.

10 Glossary of terms

Basic Own Funds: A term defined in Article 87 of the Solvency II Framework Directive as the excess of the value of assets over the liabilities, plus subordinated liabilities.

CEIOPS (Committee of European Insurance & Occupational Pensions Supervisors): Level 3 committee for the insurance and occupational pensions sectors under the Lamfalussy process, composed of high level representatives from the insurance and occupational pensions supervisory authorities of the European Union Member States.

GAAP (Generally Accepted Accounting Principles): The accounting standards which apply in a particular country (e.g. UK GAAP).

IAIS (International Association of Insurance Supervisors): Issues global insurance principles, standards and guidance papers, provides training and support on issues related to insurance supervision, and organises meetings and seminars for insurance supervisors. The IAIS was established in 1994 and now represents insurance regulators and supervisors of some 190 jurisdictions.

ICA (Individual Capital Assessment): A regulatory requirement set by the FSA for insurance companies within the UK under which each firm must carry out an assessment of the adequacy of its capital resources which is reported privately to and reviewed by the FSA.

ICAS (Individual Capital Adequacy Standards): The current capital adequacy requirements regime applicable to UK insurance firms under which they are required to carry out an ICA. This regime will be replaced when the Solvency II has been implemented on 31 October 2012.

IFRS (International Financial Reporting Standards): The standards which apply to figures reported in an insurer's Company Accounts.

Level 1 Text: The Solvency II Framework Directive. The name is derived from the Lamfalussy legislative process which is being used to develop the Solvency II legislation.

MCR (Minimum Capital Requirement): The absolute minimum level of capital an insurance company must hold in excess of its reserves under Solvency II.

MCEV (Market Consistent Embedded Value): A set of principles developed by a group of CFOs from a number of major European insurance companies for calculating the embedded value of an insurance company.

ORSA (Own Risk and Solvency Assessment): The entirety of the processes and procedures employed by an insurance company to identify, assess, monitor, manage and report the short and long term risks it faces or may face and to determine the own funds necessary to ensure that the company's overall solvency needs are met at all times.

PDF (Probability Distribution Forecast): Defined in Article 13 of the Solvency II Framework Directive as a mathematical function that assigns to an exhaustive set of mutually exclusive future events a probability of realisation.

QIS (Quantitative Impact Studies): Studies carried out by CEIOPS to test the financial impact and suitability of proposed Solvency II requirements on companies.

Risk Margin: A generic term, representing the value of the deviation risk of the actual outcome compared with the best estimate, expressed in terms of a defined risk measure. The term 'risk margin' in the context of Solvency II refers to the amount above the best estimate liability.

SCR (Solvency Capital Requirement): The target level of capital an insurance company must hold in excess of its reserves under Solvency II.

SFCR (Solvency and Financial Condition Report): A public report containing key quantitative and qualitative data required under Solvency II.

Standard Formula Approach: A non-entity specific risk-based approach to the calculation of an insurer's Solvency Capital Requirement under Solvency II, under which the calculations are based on a series of formulas covering each risk category. This is the default option for the calculation of an insurer's SCR, although an insurer can choose to calculate its SCR by using an internal model (subject to meeting the approval standards).

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