

# **Institute of Actuaries Working- Party: Embedding Capital Models in the Business**

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## Introduction

The need to demonstrate that an insurer's capital modelling framework is embedded in the business, that is to say an integral part of the decision making processes across an insurer, is becoming an increasingly important topic for those working in the capital modelling field. This paper, prepared by the Embedding Capital Models in the Business Working Party, seeks to bring together ideas on this topic, provide a means of assessing the extent to which a company has embedded its capital model and suggest steps insurers could take to make models more embedded.

The paper is split into a number of sections:

- 1. Concepts.** The first section of the paper sets out the motivation behind its preparation, before moving on to an approach developed by the working party for assessing the degree to which a capital model is embedded and outlining why this is a difficult case for insurers to tackle in practice.
- 2. Assessment framework.** The second section of the paper starts with a suggested process for getting embedded before turning to a series of score-cards. These are intended as a means of assessing the extent to which the model is integrated within other business processes. For each segment of the business, the paper provides descriptions of what would be expected in a company achieving a particular level of embedding. Finally, there is a self-scoring matrix consolidating the points in section 2.
- 3. Summaries and actions.** The final part of the paper contains a number of suggestions for possible ways in which the embedding score could be improved in business segments, along with some examples of approaches trying to embed a model into their business. It is hoped that this section will provide readers with a useful toolkit for increasing the "embeddedness" of their capital model in their insurance business. It is hoped that readers can suggest other examples and build on those presented here.

## Acknowledgements

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## Part 1 – Concepts

### 1.1 Motivation

Many insurers, in the UK and overseas, have spent considerable amounts of time and effort in developing increasingly sophisticated capital models. As mentioned in the introduction, embedding these models into an insurer's business is rising up the agenda of those involved in this activity. This is important for two reasons:

- First, with the significant cost of developing and maintaining a capital model, companies are seeking to achieve real business benefits from the model. In practice this means that they are seeking to understand better the capital implications of business decisions – strategic (such as in the context of an M&A), operational (for example in the management of aggregates or setting pricing guidelines) or many other areas of the business.

As an example, a number of companies are starting to think about using their capital model to allocate capital. This should enable companies to achieve significant advances in performance improving the achieved return on equity. At this stage, the experience of the working party is that the routine and robust use of capital models in this area is still in its infancy; with time and better establishment of capital models however, we should see the benefits to the business being achieved.

- Second, regulators and other interested external parties (for example rating agencies) are demanding of companies that if they want their capital models to be given due weight, they must be seen to be truly representative of the company. The insurer must be able to demonstrate that it believes that this is so. This is not the faithful application of the output of a model in all corporate decisions, but rather the critical engagement of an insurer's management and staff with the varied facets of the model, so that it informs, influences and responds to their decisions.

In summary, capital models cannot be black boxes dusted down to work out a magic number, they must be an integral part of the business. To misquote an old adage: *A capital model that is just a capital model is not a capital model.*

When the working party started out preparing this paper, it was striking that this did not appear to be a topic on which a paper had been written. While in the UK the FSA has been pressing companies with its "use test", little detailed guidance appeared to be available for the practitioner. Many on the working party felt that while they could confidently state that they hadn't come across a model they would regard as fully embedded, doing any of the following would prove challenging:

- articulating in detail what would make a model fully embedded across the whole of a business;
- finding a language to compare two models and determine which was more embedded; or
- setting out a clear path for capital models they had participated in developing to make them embedded.

As a group, the working party felt that this was an area for development that as an established capital modelling community, general insurance actuaries could and should lead.

Failure to do so could result in the profession finding itself following methodologies set out by regulators or other professionals.

Therefore, the working party together set about preparing a paper to achieve the three things listed below using their shared experiences. Hopefully this contribution will help in closing the apparent gap in this field and promote the profession's profile in this area.

1. A framework for describing the degree to which a (non-life insurance) capital model is embedded in the business;
2. A set of descriptions for assessing how embedded a capital model is, that readers could possibly use to benchmark their own circumstances; and
3. A collection of ideas and suggestions (that with time may grow as experience of this area grows in the profession) for making a capital model more embedded.

### **1.2 What is meant in this paper by “Capital model”**

The working party felt that there is a wide spectrum of possible capital models that could be considered appropriate. Some may be highly complex, with a great deal of statistical and computational sophistication; others may be extremely simple. Some may be considered to be one “model”, others an array of computations carried out by the company. Indeed, some models may be considered to have fundamental flaws in the way in which they achieve their results, yet for the purposes of this paper they are still considered to fall within this class.

When the capital model of a company is referred to in this paper, all of the above forms of model are included in this description. All that is required by the use of this term is that the capital model provides a process by which a company can reach a quantitative estimate of the amount of capital needed for a particular purpose.

### **1.3 What this paper does not cover?**

Before setting out the framework, it is worth noting in passing two interesting, related and relevant topics that this paper does not cover:

- Why should capital models be embedded (other than briefly in the introduction)?
- Why should insurers have capital models?

The working party felt that were this paper to extend too far into these topics, it would likely become either extremely theoretical or unduly simplistic. Neither option appealed.

This paper is therefore purely about how to embed.

#### 1.4 A framework for considering “Embeddedness”

In considering the degree to which a capital model is embedded in the business, the working party defined seven core strands. Others may choose alternative groupings, or feel these omit major elements of insurance functions – the working party welcomes such suggestions for enhancements. This framework is proposed as an approach that readers could try; hopefully it will at least serve to move discussion forward.

The seven strands selected are:

- i. Strategy – the role of the board and senior management;
- ii. Operations – the execution of the firm’s strategy, and the day-to-day decisions made on the front-line of the insurer;
- iii. Planning – the process of establishing operating plans for the short to medium term, essentially relating to underwriting volumes and rates;
- iv. Assets – in this context the focus is on reinsurance, assets and credit risks;
- v. Liabilities – the focus here is insurance liabilities, particularly the claims reserving process. A natural extension to pension liabilities exists.
- vi. Systems and Controls – the framework for monitoring and managing the risks facing the business, including the incorporation and the assurance of the capital model itself;
- vii. Infrastructure – both technological and cultural: the management information systems, communication and language relating to capital.

Necessarily, given the title of this paper, the thoughts set out are capital model centred, and aspects that did not naturally appear to link to capital models have been excluded. As an example, the discussions of liabilities and assets have focussed on the main technical elements; however many other important balance sheet items are relevant. Other examples of where important company elements have been omitted are tax or human resources. Including aspects on these may assist the structure, but probably not detract from the central purpose of this paper.

The seven elements listed above will each attract responsibility from or ownership by one or more board members, for example:

- Chief executive officer – Strategy
- Chief operating / underwriting officer – Planning, Operations
- Chief financial officer / actuary – Assets, Liabilities
- Chief risk officer – Systems and controls
- Chief risk / information officer – Infrastructure

The working party felt that in these seven areas an embedding scorecard could effectively capture the extent to which a model was integrated with business processes. This is therefore the structure used throughout much of this paper.

Notably absent from the list of seven headings is underwriting and pricing. The working party debated this at some length but decided not to separate this out for the following reasons:

- Duplication  
Aspects of underwriting and pricing should be addressed in the other strands, most notably Planning and Operations.

- Process flow

Trying to construct a process where premium rates were driven by a particular organisation's capital model was seen to be putting the cart before the horse. Better to have appropriate systems and controls for underwriting decisions; consistent return on equity targets established; and strong management information to enable the consequences of pricing decisions to feed into the capital model so that it reflects reality as best it can.

In each of the following segments in Part 2, a similar format has been used:

- A short introduction and definition of the strand considered; and
- Categorisation statements, these set out levels of "embeddedness" for a business, describing the activities a company attaining that level might be performing. For each level, the company is assumed to have satisfied the points set out in the previous level.

These descriptions use between three and seven levels of attainment. An alternative breakdown is set out in appendix A, where a scorecard matrix using seven levels of attainment for all segments is applied. This has the advantage of equalising the graduation; however in places the approach has imposed some artificial distinctions that may be undesirable.

## 1.5 How this paper might be used in practice

The working party intended this paper to be a practical one and have tried to avoid theory as much as possible. With this in mind, the following steps could be followed to identify and improve on the current level of embeddedness:

*Step 1: Complete the self-assessment scorecard in Appendix A*

- a. Where are you now? Determine scores for each of the seven strands using the self-assessment questions or matrix.

*Step 2: Establish goals for the firm*

- a. Work out where your organisation would like to be over an appropriate time horizon (e.g. 1 / 3 / 5 / 10 years). Not everyone will agree with the "Ultimate" goals, and each will have conflicting priorities.
- b. Communicate the results in a diagram similar to the format set out in Appendix A
- c. Assign responsibilities using the broad board level allocations highlighted above

*Step 3: Develop a detailed action plan*

- a. Many of the improvement steps are evident from the nature of the target descriptions (e.g. moving a behaviour that is followed by some underwriting teams to all of them)
- b. In the appendices to this paper, are included various tools and examples that members of the working party have used or considered in trying to link capital models to the business and that readers may find useful.

## 1.6 What's so hard about all of this?

In theory, the embedding of a capital model into a business is straightforward: for example, a company could decide that once its capital model has been built, all that the company needs to do is to push the model's outputs down to business units, obtain their buy-in (albeit with some refinement of the model parameters) and begin the process of changing employee objectives to align with the model's output. This is all fine in theory, but our experience has shown that it is far from straightforward to achieve. So where does it go wrong?

First, the development of a **credible model** fit for this purpose is hard. Few who have gone through the gruelling process of introducing one would disagree. As actuaries, and as an industry, it should not be surprising that technical aspects have attracted most attention to date and where arguably most progress has been made. Critically, to embed these models, the technical hurdle is only one of several that need to be cleared.

The second hurdle is that the model needs to be sufficiently **relevant to current business decisions**. This means using up to date information so as to be still relevant when results are produced. Just as reserve studies and pricing reviews need to take into account as up to date information as possible, so do capital models. In section 2.1, a process for doing this is explored further. The approach used will need to recognise the underlying policy exposures and changing claims environment in a timely fashion. In some markets or at times of year, this might change fast and a highly dynamic framework could be necessary.

Third, following on from this need for timeliness, is the **quality of input management information** feeding into the capital model. As stated in the previous paragraph, it will not be possible to make decisions using a capital model reflecting changing business dynamics any faster than the input information is ready. In addition, the reliability of the capital estimates will be undermined if the underlying data feeds are inadequate. The potential scope of this challenge should not be underestimated, as this could require an information infrastructure well beyond what many companies have already found hard to achieve.

Fourth, the model must be **aligned with business processes**. While this sounds obvious enough, it could represent a significant challenge to organisations that have developed capital models to address regulatory needs in the first instance; this has often channelled thinking along the lines of prudential risk groups rather than the risks inherent in business decision.

Fifth, the model must produce **output in a format that is readily understood** by non-capital modellers. Insurance businesses are monitored using established financial statements – capital models that do not link up by generating output in this form may fail to provide the necessary ability to link up with established planning, monitoring and reporting processes.

Sixth, the capital model needs **reporting detail that is sufficiently granular** to enable analysis and communication of variability (and hence capital use) at an operational level for a spectrum of business elements. Reporting at this low level and aggregated levels can introduce a considerable data management burden where simulation modelling approaches are used. Failure to do this will limit the ease with which operational level objectives (such as underwriting, pricing, reinsurance etc) can be linked back to the overall business objectives.

Finally, the capital model and the process surrounding it need to be **trusted at all levels of the business** to ensure their buy-in. Some of the previous points have addressed the need for the model to reflect the business as a necessary condition for this trust; however, there is also an important process angle to address as well. Firms have well established processes to quality assure many aspects of the way a business is run, for example the Sarbanes-Oxley acts imposition of additional rigours around financial reporting. Given how critical capital models are set to become in the oversight and management of insurance business,



frameworks to ensure the integrity of the model (through internal audit checks of models and processes) is a final key element to instilling trust in the capital models.

The working party did not feel these seven challenges were likely to be easy for organisations to crack quickly, cutting as they do across disciplines and business areas. What will be apparent from the detail in Part 2 of this paper, is how often they recur.

## Part 2 – Assessment framework

### 2.1 Strategy

Board and senior management

#### Overview

In a sense, the use of capital models to inform strategic decisions by the board of directors of a company is the ultimate test of how well embedded risk/capital modelling is within an insurance entity. If the model can gain acceptance amongst the Board members to the extent that they are prepared to use it in making the key decisions by which they will be judged a success or failure then it must have gained all the required buy-in from the senior management. It is likely, therefore, that in terms of acceptance, and “embedding” (as measured possibly by extent of use), the model will be further advanced in other fields of use than in this one.

The types of strategic initiatives that may be undertaken by a company will in this context probably fall into two categories – those for which capital is a major determinant to their success, and those for which capital is not.

#### Category 1

The first category will include the following examples:

- Acquisition of/Merger with another Company

There clearly are capital issues here; a key determinant of the attractiveness of the strategy will be the extent to which economies of scale can be derived from the new, larger, entity. One area in which these economies can be generated is that of capital, in particular, a merged entity will in most cases benefit from a greater degree of diversification benefit than two stand alone entities.

- Restructuring of Group

This could involve either merging of entities within a group – and so pooling of capital resources – or segregating of entities maybe with the aim of ring-fencing certain liabilities, or possibly to better work within certain regulatory environments.

- Reinsurance Strategies

Reinsurance issues can fall into either the “board level strategic” or the “operation-tactical” spheres. In this context we refer to major initiatives, for example

- Establishment of significant fronting arrangements – either ceding outwards of an existing book of business, or writing an inwards account as an income boost
- Changes in the emphasis of existing programmes – e.g. use of working covers where none have been used before, or cancelling of major proportional treaties.

In certain cases, these will entail initiatives in areas other than reinsurance.

## Category 2

There will be other strategic issues considered by management for which capital is less relevant. For example:

- Outsourcing of certain functions
- Branding and marketing initiatives
- Establishment of new distribution channels

The discussion below focuses on the first category above.

There are probably three levels of “embeddedness” of a capital model that might be seen in this case.

### Stage 1 – No Use of Capital Modelling.

- Management anticipates intuitively that there will be a benefit, but makes no attempt to quantify internally, rather allows rating agencies to drive the agenda by seeking to understand how much capital they will require.
- Board and senior management have an awareness of capital concepts

### Stage 2 – Intermediate Use Capital Modelling

- Concern will still focus on regulatory and rating agency requirements; use of capital model might be a re-running of the ICA for the new merged entity, and presentation of this to regulators and rating agencies.
- Capital issues are considered when the company makes decisions, but in a standalone fashion and with no meaningful reference to results of capital models. For example, such a company may have a capital model to determine an appropriate level of capital under the UK ICAS regime, but would not use this model (or indeed the key parameters and assumptions underlying it) for any other decision-making purpose.
- Some board and senior management have an understanding of capital concepts

### Stage 3 – Embedded Capital Modelling

- Management will wish to understand the regulatory/rating agency issues, and also the position of shareholders, looking at probability of ruin from shareholder perspective, and so the capital required to preserve the same risk appetite (or indeed to satisfy a new risk appetite).
- Management may also be concerned about the impact of the transaction on the risk-return profile to shareholders – i.e. considering much less extreme points on the distribution. Answering these questions will require significant use of the internal capital modelling capabilities.

In essence, the difference between these three situations reflects management’s attitude to capital and risk:

- In the first, capital is a cost to be determined by external parties.
- In the second, it is a cost to be determined by external parties, but management is seeking to take an active role in anticipating and also influencing the views of the external parties.

- In the third, in addition to seeking to influence the external parties, management is clearly concerned about the impact on the risk/reward profile of the entity, and consequently the shareholders, after the transaction.

A link exists between the levels of embeddedness between the strategic decisions above and the day-to-day management of the business outlined in the operations section below. The ability of a company to make senior-level strategic decisions using the capital model relies on progress of embedding the model in the other business processes discussed further in this paper. The link exists because of the board's role in monitoring the operational performance of the business and taking strategic decisions in response. The board's understanding of the structure and implementation of its capital model will drive and in turn be driven by the embeddedness of the capital model in the operational processes and decisions.

On the one hand, the business as a whole will struggle to embed its capital model if the board is not sufficiently engaged with the model, visibly driving business performance targets and metrics based on it. Conversely, the board may lack the confidence to impose a capital model on a business where they do not feel it accurately represents the underlying processes. Cutting through this circle and achieving change is therefore a critical step to be taken in making progress towards an embedded position.

## 2.2 Operations

### Integration of Decisions to Business Areas

#### Overview

In the preceding section, we considered the embedding of capital modelling within a strategic context, at Board and Senior Management level. In this section we consider the process of embedding at the Business Area level, both from a strategic and an operational viewpoint.

#### Development stages

##### Stage 1 – no link with the business

- Capital modelling & capital management sits centrally within finance/actuarial/management areas of the organisation; there is little “reach-out” to and involvement from individual business areas
- Business areas may not have an awareness of what capital modelling work is being done centrally
- Limited input from business areas into parameterisation of model
- Capital modelling results at a whole organisation level, no allocation of capital to individual business areas
- Business area performance measurement without reference to return on capital type measures
- Capital costs are not explicitly incorporated in pricing decisions

##### Stage 2 – partial link with the business

- Communication and presentation of capital modelling work is made to business areas
- Business areas give feedback on key assumptions within the model and understand how these are used in the model
- Allocation of capital to business areas is developed
- Some involvement of business areas in setting or challenging capital model assumptions or results
- Capital models used to inform a limited range of business area decisions

##### Stage 3 - model ownership within the business

- Business areas provide key assumptions and parameters for the model
- Business areas understand and agree capital setting methodology
- Business areas sign-off on assumptions, extreme event scenarios
- Discussion on allocation of capital to business areas
- Capital models used to inform decisions making in the business areas
- Capital model partially used in calculation for pricing decisions, aggregation monitoring and other day-to-day processes

##### Stage 4 – model fully embedded in the business

- Business areas have a good understanding of the capital modelling work done within the organisation
- Methodology and results of capital allocation are signed off by business areas
- Difference in risk appetite between business areas/organisation as a whole have been addressed
- Capital costs incorporated into pricing decisions
- Capital-based performance measurement of business areas' performance
- Remuneration/Bonuses with business areas are based on return on capital

## 2.3 Planning

Business planning processes and their integration with capital / risk frameworks

### Overview

This section considers the interaction and reliances between the capital model and the business plan.

At first we consider the different levels of interaction available between the business plan and the capital model. The extent to which capital considerations feature in the key decisions made as part of the business planning process will often be indicative of the overall level of sophistication of the planning process itself. Indeed, the consideration of certain factors as part of the planning process is a prerequisite to the development of a capital model on a consistent basis. Because of this, the discussion below considers the business planning process quite broadly, rather than purely focusing on the capital modelling.

Section 3.1.4 gives an example questionnaire used to assist in gathering information on underwriting uncertainty from underwriters, claims or senior management. A framework to guide users on how to move from one level to the next level is set out in section 3.2.2.

### Business plan process development stages:

#### Stage 1 – simple ground-up plans

Business plans at this stage are relatively simple and not subject to rigorous analysis. They are produced by individual teams and built up to form a view of the expected overall company performance.

- Plans are produced at a granular level and aggregated. This is generally the number that will make the final plan – there is little challenge
- Income projections are effectively best case scenarios. While some individual teams may meet their plans, not all will, meaning that the overall actual business written will invariably be less than the sum of the individual plans. These projections are built with gut feel “I want to write £Xm because I believe this is a stretching target for the team”. The premium is not built up from the basis “what did I write this year and what is changing going forward”
- The loss ratios are the same as those that will be held for the reserves initially (i.e. they include reserve risk margins and do not reflect the true ‘expected’ level of profitability), perhaps adjusted for expected rate movements in the plan year.
- Investment income and expenses projected at a group level and then allocated to different lines on a simplistic basis e.g. proportion of premium written.
- Simple inclusion of catastrophe risk appetite (other risk areas are not considered) – driven by external agencies i.e. Lloyd’s, FSA and rating agencies
- Final plan numbers forms the basis of the capital modelling inputs. The limitations in the output of the business planning process impose limits on what can actually be achieved in terms of capital modelling. For example, the impact of changes to reinsurance programmes cannot be assessed.

#### Stage 2 – detailed ground-up plans

At this level the business plan contains detail information, but this information is not utilised in a robust manner:

- Detailed financial information is produced, bridging last year’s business written to next years plan. This would allow for:

- Renewal rates
  - Exposure changes (e.g. line size change) on renewal business
  - Amount of new business
  - Premium Rate changes
  - Net inflation (i.e. underlying claims inflation less inflation in the exposure measure)
  - Exchange rate changes
  - Reinsurance split by type and expected recovery rates
  - Investment income
  - Expenses
- Financial information is however produced on a revenue basis. Projections are usually based on last year's revenue performance and expected changes from that position. Allowance is not made for the different mix/age of business contained in the financial results when projecting from this basis.
  - All estimates that are shown are best estimates and may not necessarily be the same as that shown in the reserves
  - There is a degree of actual vs. expected analysis. What was the plan last year? How have we performed compared to that plan?
  - The actual plan submitted is still not that robust. Plan assumptions are adjusted at the final stages to produce the results required by the department, rather than the assumptions producing the plan.
  - Plans are produced at a granular level and aggregated. This is generally the number that will make the final plan – there is little challenge
  - Income projections are still best case scenarios. While some individual teams may meet their plans, not all will, meaning that the overall actual business written will invariably be less than the sum of the individual plans
  - Final plan forms the input to the capital modelling process. The information produced permits some more explicit modelling of changes to the risk profile that may be part of the business plan than would be the case in stage 1.

### **Stage 3 – detailed robust point estimate plans**

Business plans contain detailed information and it is subject to rigorous challenge. The overall plan is analysed for consistency and reasonableness:

- The plan contains all the financial information described above however it is robust
- Financial information forming the basis of projection is separated into origin year. Plan is projected from the performance of the most recent origin year, taking into account trends in the business performance from the earlier origin years.
- The production of the first plan is iterative. Stages like those below are worked through:
  - i. Plans are produced from assumptions defined by the team; these are run through the capital model to give the team a view of the mean position defined by the assumptions as well as feel for the variability surrounding the assumptions. A summary document is produced setting out the key changes in the business is also produced
  - ii. Initial plan is submitted to Directors and business unit leaders. The plans are challenged e.g. too low loss ratios, the RI spend is too low or the level of new business is too high
  - iii. Revised plans are produced. Iteration 2/3 may occur multiple times
  - iv. The plan is formally signed off by the directors

- At this stage, the iterative approach allows for the first time for some output from the capital model to be taken into account in determining the adopted business plan.

#### **Stage 4 – detailed robust scenarios and optimisation**

At this stage, the initial detailed business plan is only the starting point of the business planning process. After the initial business plan for each individual business line has been produced, the level of profitability is reviewed and different scenarios that increase the overall profitability of the company are investigated. The final business plan is then adopted from these scenarios.

- The plans will include robust absolute profitably figures (as above) that can be used to target the more profitable classes, where there is scope for growth.
- Detailed contingency planning will be carried out. For example:
  - Reinsurance rates increase more than gross rates
  - There is a major natural catastrophe
  - A new division writes far more than expected
- For each plan where the profitability was higher than the target the question asked is “can more of this business be written and what would the implications of this be?” Business scenarios are proposed to take advantage of the market conditions.
- Capital will be set at a total level and allocated to individual business lines using the capital model. The allocated capital along with the expected profit allow a return on capital estimate to be calculated and this can be used in evaluating the benefits of the different plans.
- The key plausible short term plans would be summarised and the Directors choose the final plan from these scenarios. The extent to which the projected return on capital features as a determinant of the final plan will vary from:
  - Used as an indicator at the aggregate level, although not a key driver of the decision due to limited buy in on the part of management because of either poorly set out allocation methodology or lack of education / explanation
  - Used as a secondary determinant of the decision. Management accept that the capital allocation is fair, but are reluctant to use this as the primary driver of their business, favouring instead absolute profit per £ premium
  - Used as the main determinant. Return on capital by class is the primary measure of profitability that is used. Senior management accept that the capital allocations reflect a reasonable balance between the risk posed by the class of business and the diversification offered to the broader business entity.

#### **Stage 5 – detailed robust scenarios compared to Risk Appetite**

At this stage risk scenarios are incorporated into the business planning process. Given that capital allocation is a proxy for risk this section highlights the downside risk implied by the capital allocations (pre and post diversification) in each of the different business plan scenarios

- The downside risk in each business plan scenario (as implied by their capital allocation pre and post diversification) is set out so that there is a clear understanding of the risk reward profile of the business
- The business plans are compared to the risk in the past years business plan (and risk appetite) to see if the risk profile is changing
- This information will then supplement the return on capital measures developed in stage 4, and facilitate more detailed consideration of the risk profile in the adopting the business plan.



### **Stage 6 – multi year planning**

Building on the robust single year plans to produce plans over the insurance cycle. Where are we in the cycle? What returns do we have to make this year to make adequate returns over the whole cycle?

- Building simple multi-year plans under a range of insurance cycle assumptions:
  - Repeat historical cycles
  - The cycle implied by the share price
- Long term strategic decisions (e.g. business mix, RI levels and growth strategies) can then be compared for their total return implications

### **Stage 7 – optimise the control structure / business planning process and level of decentralisation**

Business planning operates most effectively within a clear business control structure. If this is ineffective this will make creating effective business planning difficult. The objectives of sub-units and the group centre will not necessarily coincide and clear structure to resolve these conflicts must be produced

- The control structure of the organisation has been formally agreed. This agreement would be set out for each level of the business planning process
- The capital allocations by team will have to be fully bought into
- Sub-units have total control over their operations as long as they operate within the overall capital/risk constraints as determined by the group centre. Many successful non-insurance operations operate within this structure
- Sub-units optimise within their own constraints as the group has done
- Sub-units present a business case to the group annually. This is similar to the way they would present to external investors as to why capital should be provided to their business
- Business performance is monitored in the way that aligns interest effectively with shareholder. For example analysing multi-year average profit can prevent over purchase of low level reinsurance
- The key business performance measure is formally agreed. E.g. cross cycle return on capital
- Employee remuneration is triggered by the same metrics that are used to monitor business performance

## 2.4 Assets

Reinsurance, asset and credit risk. A company may lie at different levels for each of these.

### Development stages:

#### Stage 1 – simple ground-up plans

Information taken into the capital modelling is at a straightforward level, and output is not sufficiently credible for feedback

- Simple reinsurance assumptions, consideration given to net underwriting ranges rather than explicit gross and reinsurance ranges
- Investment assets available in capital model may not cover the full range of asset types held. Simplifications may be required, such as treating property assets as equity.
- Credit risk may be ignored or based on simple deterministic percentage of outstanding debt

#### Stage 2 – More detailed modelling

More detailed information taken into the capital modelling, though output may still not be sufficiently credible for feedback

- More detailed modelling of reinsurance layers, including reinstatements and rate changes.
- A wider range of investment assets covered by model, though some more exotic assets may still need to be treated in a simplistic way.
- Credit risk incorporates outstanding debt split by credit ratings.

#### Stage 3 – Very detailed modelling

More detailed modelling of reinsurance programmes, but not robust

- Detailed modelling of reinsurance programmes, including:
  - layers
  - reinstatements and reinstatement premiums
  - Changes in the amount of new business
  - Rate changes
  - Net inflation (i.e. underlying claims inflation less inflation in the exposure measure)
  - Exchange rate changes
  - Reinsurance split by type and expected recovery rates
  - Investment income
  - Expenses
- Consideration of programmes shared across different classes, or across a larger insurance group
- Detailed economic scenario generation, including full range of asset types and currencies to suit the firm's actual asset holdings.
- For a multi-year model, linkage of economic inflation to claims inflation
- Each credit risk counterparty is modelled separately
- All the above are compared to history for reasonableness

#### Stage 4 – Feedback to decision making process

At this stage, the feedback loop is created where the business reviews and incorporates the output of the capital model into business decisions. The capital model is "owned" and understood by the business to create the feedback loop.

- Reinsurance modelling output bought into by reinsurance purchasing committee
- Reinsurance modelling output used to inform and support reinsurance purchasing decisions
- Asset modelling output compared with Investment committees outlook and the firm's best estimates used to inform the parameterisation of the capital model
- Asset modelling output used to investigate and support proposed changes in asset mix
- Feedback from reinsurance and investment committees incorporated into capital modelling framework to better reflect the business
- Credit risk modelling output used to inform the reinsurance committee's criteria on acceptable credit ratings for reinsurers. For non-reinsurance debts, the model's output is used to assess the firm's provision for bad debts from policyholders, intermediaries and other third parties.

## 2.5 Liabilities

### Claims and reserving

#### Overview

The purpose of this section is to outline the key stages of embedding reserve risk analysis into the business for ICA purposes. Each stage shows a description of the stage and the likely characteristics of development. Section 3.1.3 gives an example questionnaire used to assist in gathering information on reserve uncertainty from underwriters, claims or senior management. The working party anticipated that as this is an established actuarial area of work, this is likely to be the segment where many companies are most embedded.

#### Stage 1 – Reserve ranges set independently from reserving process

The initial stage of integration with the business is no, or very little, integration. At this stage the reserve variability is produced independently by the DFA team with minimal review by the business. The calculation of reserve variability is likely to use the same model for all areas of the business.

- the business provide best estimates to DFA team
- DFA team produce ranges using a standard reserve variability model
- very little or no review by reserving actuaries

#### Stage 2 – Review by the business

The next stage of integration starts with the same characteristics as Stage 1, with further integration through review by senior actuaries or appropriate reserving representatives from the business. This review process creates a feedback loop between the DFA team and the reserving actuaries, which may result in alternative models being used for producing reserve variabilities. Also the subjective expert judgements should better reflect the business.

- review by senior actuaries or appropriate reserving representatives from the business
- feedback loop may result in alternative models being used for reserve variability or adjustments to variabilities to better reflect the business
- move from reserves with implicit margins to reserves with explicit margins

#### Stage 3 – Embedded in reserving processes

At this stage the production of reserve ranges are incorporated in standard actuarial processes and the business “owns” the parameters. The DFA team act as independent reviewers of the process and the parameters.

- reserving actuaries produce reserve ranges
- parameters are “owned” by the business
- DFA actuaries review reserve ranges

#### Stage 4 – Quarterly impact review of changes in reserves

In this final stage of integration, the reserve ranges are produced and reviewed by the reserving actuaries and changes in reserve ranges are discussed with the reserving committee.

- reserve ranges are reviewed by the reserve committee
- reserve risk results become relevant when considering corporate reorganisation decisions

**Stage 5 – Future regulatory requirements**

Production and assessment of reserve ranges are fully integrated in the business with review by senior actuaries, DFA actuaries and the reserving committee. The reserve ranges are fully audited and comply with regulatory requirements (e.g. Solvency II risk margins).

- independently audited
- used to comply with regulatory requirements

**Other uses in the business**

In addition to integration of reserve risk analysis in the business, the DFA model may also be used for other purposes such as analysis of:

- Commutations; or
- Mergers and acquisitions

## 2.6 Systems and Controls

Integrating Regulation & Compliance with capital modelling and risk management framework

### Overview

This section considers the extent to which a model is operationally embedded within the risk management and compliance functions of a company and also the extent to which the modelling process is likely to satisfy regulatory requirements, including the use test.

Section 3.1.1 shows an example diagram which may be used to illustrate how and where capital models are integrated into the firm's entire risk management framework.

### Stage 1: Initial stage of capital modelling

At this stage there is limited formal documentation or procedures and no real links with the rest of the business.

- Documentation of capital modelling process may be inadequate to satisfy corporate governance standards
- No documented link between regulatory requirements for ICA and capital model calculations
- Internal Audit department have not reviewed capital modelling process
- No external review of ICA report, capital models and process
- Limited involvement of other departments in setting or challenging capital model assumptions or results
- Capital models used solely for ICA calculation
- FSA have not reviewed capital model and ICA calculation, or have significant questions about the model

### Stage 2: Basic Requirements met

At this stage progress has been made to ensure capital modelling meets the basic requirements of regulators and auditors.

- Documentation of capital modelling process meets corporate governance standards
- Capital model calculations clearly matched to latest FSA rules and guidance on ICA requirements
- Internal Audit review of capital modelling process, using risk register as basis of audit plan
- External review of ICA report but limited in review of capital model and process

### Stage 3: Forging links with other departments

At this stage other departments are given more formal roles in setting assumptions and challenging results.

- Some involvement of other departments in setting or challenging capital model assumptions or results
- Capital models used to inform a limited range of business decisions in a few areas of the company
- FSA have reviewed and are satisfied with capital model and ICA calculation

**Stage 4: Model begins to be embedded**

At this stage links with other departments are extended and capital model begins to be integrated into the risk management framework.

- Regular review of latest FSA guidance to ensure continued compliance of capital model calculations
- Regular review of capital modelling methodologies to meet latest industry best practice
- Internal Audit review of capital model and process, using risk register in audit
- Detailed external review of capital model and processes
- Significant involvement of other departments and senior management in setting or challenging capital model assumptions or results
- Capital model is partially integrated within the risk management framework

**Stage 5: Model used to inform day to day business decisions**

At this stage the model is being used to inform some day to day business decisions, and there is a designated senior manager who will promote capital modelling at board level.

- Capital models used to inform business decisions in several areas of the company
- Internal Audit use capital modelling results to identify key risk areas across the business
- A designated senior manager has responsibility for championing capital modelling at Board level

**Stage 6: Model used extensively throughout the business.**

At this stage the model is being used in a wider range of areas throughout the business.

- Capital model is fully integrated within the risk management framework with links to risk register and key risk indicators
- Clear reporting and feedback lines ensure that appropriate areas of the business and senior management have the opportunity to set or challenge capital modelling assumptions and results
- Capital models used extensively within the business to inform a wide range of day-to-day business decisions in all applicable areas of the company
- FSA have reviewed and are satisfied with capital model and ICA calculation and agree that the use of capital models in the business satisfy the use test

**Stage 7: Model is fully embedded and adding value throughout the firm**

At this stage the model is fully embedded and is recognised as a standard tool for assisting in financial analysis and decision making throughout the business.

- Capital models used extensively within the business and the firm actively seeks to develop new ways to use the capital models.
- Capital modelling methodologies undergo continuous improvement to meet latest industry best practice

## 2.7 Infrastructure

Communication, Language and Management Information

### Overview

A business that has successfully embedded its capital model will have to have established the necessary infrastructure. Primarily, this means that it will need to have not only the ability for information from operating units to be readily available to the capital modelling team, but also for the output of the capital model flowing back to the operating units. In addition, there needs to be a frequency of discussion of capital concepts along with a language with which they are discussed. The exact needs will inevitably vary according to the nature of the business and how it is managed.

Some detailed examples of communication issues are provided in Section 3.1.2.

The following levels outline the infrastructure stages:

#### Stage 1 – Little or no infrastructure established

- No formal or consistent use or understanding of capital in business.
- Little or no consideration of capital issues in external communications.
- Little or no understanding of common technical terms and their implications for the way in which the business functions.
- Communication of capital topics does not arise.
- No MI system available to gather capital model inputs or distribute outputs.

#### Stage 2 – Basic levels of infrastructure, but of limited value to business

- Capital language used for technical applications
- Where used in communications with outside world, capital discussed in simplistic terms (e.g. business performance measured against net assets)
- Appreciation of definitions at board / senior management levels and in technical departments
- Where communication of capital related topics arises, it is normally one-way, from technical teams to other parts of the business. Any dialogue that does occur is often confused owing to inconsistent use of terminology.
- Communication of capital topics to business units is characterised as overly technical, and of limited use.
- MI available/prepared on an ad-hoc basis.

#### Stage 3 – Organisation starting to be able to articulate capital topics at senior level and in technical departments so that of value to business. Basic useful information exchange.

- Capital used as a framework for discussions at board / senior management level
- Regular use of capital in external communications by senior management but still at relatively simple level.
- Consistent view of definitions at board / senior management levels and in technical departments and what they mean for the company.
- Limited ongoing activity to monitor and measure capital usage and underlying assumptions. Basic management information available.
- Capital concepts often closely aligned to regulatory or rating agency capital needs only.
- Simple use of risk measures and articulation of risk appetite.



- Some two-way dialogue on capital issues between senior management and technical teams.
- Some routine MI collated and output disseminated but no established data capture systems.

**Stage 4 – Organisational competence in articulation of capital topics at senior levels. Initial use of capital-based language more generally. Established information exchange.**

- Capital used as language for decision making at board / senior management level consistent with and incorporating communications of technical studies performed
- External communications by senior management demonstrate appreciation of capital constraints of business and routine application of risk appetite decisions.
- Consistent application of technical terms across senior levels, technical departments and some business units.
- Regular monitoring and measurement of capital usage by board. Established management information available and used by board.
- Boards have language to carry out regular testing, review and challenge of assumptions underlying capital models used in business.
- Organisation starting to articulate more sophisticated risk measures and developing means of describing its risk appetite at global level and in some business units.
- Established data capture systems enabling capital modelling teams and senior management to monitor changes as needed.
- Established systems for capital model output to be efficiently disseminated to business units to enable its use in performance monitoring.

**Stage 5 – Organisational competence in articulation of capital topics throughout business. Dynamic feedback possible arising from robust information systems**

- Capital used as language for decision making at board / senior management level and at operational levels in business units.
- External communications demonstrate sophisticated appreciation of capital constraints of business, routine application of risk appetite decisions, application of differing measures / constraints for differing applications (e.g. when optimising regulatory/policyholder vs. shareholder trade-off).
- Consistent application of technical terms applied across business.
- Monitoring and measurement of capital part of day-to-day business unit management. Relevant management information available and used throughout business, customised to needs of business units.
- Business units engaged in process of establishing and challenging assumptions underlying capital models used in business.
- Established articulation of sophisticated risk measures and risk appetites across business units.
- Robust data capture and dissemination systems enabling company-wide capital position to be dynamically monitored and tactical or strategic decisions to be taken using up to date information.

## 2.8 Self scoring matrix

Introduction:

This matrix summarises the stages of embeddedness presented in the main sections of this paper. It can be used as a quick reference guide to judge how embedded your model is across the whole business.

Instructions:

For each column, assess firm's performance against the increasing levels indicated by the rows. Allocate a half score for partial compliance with the elements in the box. Some adaptation may be needed to (e.g. splitting r/i and investment scores).

- 1) At the same time, allocate a target score for where the firm would like to be in each strand within a given time period.
- 2) Plot the two sets of results using a spider diagram as indicated in the worked example below.

		<b>Strategy</b> Board – CEO	<b>Planning</b> COO / CUO	<b>Operations</b> COO / CUO	<b>Assets</b> CFO / Chief Actuary	<b>Liabilities</b> CFO / Chief Actuary	<b>Systems and Controls</b> CRO	<b>Infrastructure</b> CRO / CIO
Not embedded	Level 1 – No linkage with business	<ul style="list-style-type: none"> <li>Capital not really considered in business decisions</li> </ul>	<ul style="list-style-type: none"> <li>Simple granular ground-up plans</li> <li>Little challenge</li> <li>Global plan inconsistent with components</li> <li>Limited statistics considered</li> </ul>	<ul style="list-style-type: none"> <li>No consideration of capital in operating activities</li> </ul>	<ul style="list-style-type: none"> <li>Simple broad-based investment risk assumptions, little communication with investment team</li> <li>Little or no consideration of credit risk in model</li> <li>Simple reinsurance assumptions</li> </ul>	<ul style="list-style-type: none"> <li>No linkage – reserving assumptions (variability, run-off profile etc) set by capital modelling team with little contact with other relevant business units (either actuarial, claims or underwriting)</li> </ul>	<ul style="list-style-type: none"> <li>Documentation of capital model inadequate to satisfy corporate governance, internal or external review</li> <li>No link between capital model and other existing risk frameworks</li> </ul>	<ul style="list-style-type: none"> <li>No established language for capital in business.</li> <li>Little use of capital concepts in external communication</li> <li>Little appreciation of common capital concepts and their implications for the business.</li> <li>No MI on capital sources or uses for business.</li> </ul>
	Level 2 – Initial links, limited buy-in	<ul style="list-style-type: none"> <li>Awareness of concepts</li> <li>Capital issues considered, but in standalone fashion, disconnected from capital models</li> </ul>	<ul style="list-style-type: none"> <li>Detailed ground-up plans</li> <li>Bridging of plans from year-to-year</li> <li>Back-testing of plans against history / A vs. E analysis.</li> </ul>	<ul style="list-style-type: none"> <li>Awareness of concepts in core operating activities</li> <li>Global return on capital type measures set but not generally used across business.</li> </ul>	<ul style="list-style-type: none"> <li>More detailed modelling of investments, model discussed with investment team</li> <li>More detailed reinsurance modelling, some review and comment on net loss ratios by underwriting areas</li> <li>Simple consideration of current credit risk exposures e.g. by credit ratings</li> </ul>	<ul style="list-style-type: none"> <li>Assumptions lifted from analytic material prepared by actuarial teams, no real discussion of assumptions, sensitivities or limitations</li> <li>Limited involvement of claims and underwriting in actuarial parameters, particularly reserve uncertainty.</li> </ul>	<ul style="list-style-type: none"> <li>Internal and external review of capital model possible at high-level although limited carried out in practice.</li> <li>Some understanding of purpose of capital model in risk management framework of organisation, but no clear role or process defined.</li> </ul>	<ul style="list-style-type: none"> <li>Technical capital language established.</li> <li>Simplistic discussion of capital with outside world</li> <li>One-way capital communication from board or technical teams – little dialogue.</li> <li>MI prepared on ad-hoc basis</li> </ul>
	Level 3 – Partial buy-in and use	<ul style="list-style-type: none"> <li>Understanding of concepts by some of senior management / board / responsible persons</li> <li>Capital models considered for major decisions / transactions, but not in a day-to-day / business control setting</li> </ul>	<ul style="list-style-type: none"> <li>Detailed robust plans</li> <li>Challenge from above, iterative process to reach final plan</li> <li>Consistency of plan components with global plan</li> <li>Directors sign-off plan</li> </ul>	<ul style="list-style-type: none"> <li>Global RoC measures incorporated in pricing and other decisions in some areas, but limited operational involvement in establishing target or linkage of RoC to nature of risk taken on by operating decisions.</li> <li>Some reporting of RoC</li> </ul>	<ul style="list-style-type: none"> <li>Appreciation of asset model by management and investment team, consideration of high level capital requirements for market risk implied by model</li> <li>Limited use of credit risk output from model, comparison with bad debt provisions held</li> <li>Reinsurance modelling considered, but in parallel and for comparison with current decision-making processes</li> </ul>	<ul style="list-style-type: none"> <li>Assumptions used after some discussion with actuarial teams, but limited exploration of sensitivities and limitations (e.g. no real capture of events not captures by models)</li> <li>Some involvement of claims and underwriting in determining key parameters</li> </ul>	<ul style="list-style-type: none"> <li>Some ad-hoc review and challenge of capital model carried out.</li> <li>Initial establishment of role and basic process linking capital model to risk management framework.</li> <li>Reporting line for risk and capital modelling teams to board, but not integrated, nor directly represented at board level.</li> </ul>	<ul style="list-style-type: none"> <li>Capital language established at senior levels of firm.</li> <li>Some routine MI prepared, but no established data capture systems.</li> <li>Simple use of risk measures and articulation of risk appetite.</li> <li>Some dialogues on capital issues.</li> </ul>

		<b>Strategy</b> <b>Board – CEO</b>	<b>Planning</b> <b>COO / CUO</b>	<b>Operations</b> <b>COO / CUO</b>	<b>Assets</b> <b>CFO / Chief Actuary</b>	<b>Liabilities</b> <b>CFO / Chief Actuary</b>	<b>Systems and Controls</b> <b>CRO</b>	<b>Infrastructure</b> <b>CRO / CIO</b>
Embedded	Level 4 – Widespread buy-in and partial use	<ul style="list-style-type: none"> <li>Understanding of concepts by all of senior management / board / responsible persons</li> </ul>	<ul style="list-style-type: none"> <li>Optimised plans</li> <li>Alternative planning scenarios prepared and profit maximisation targeted</li> <li>Assumptions for scenarios considered aligned / reconciled with capital model</li> <li>RoC included in planning process, but not fully aligned view of senior management with operating levels</li> </ul>	<ul style="list-style-type: none"> <li>Global RoC measures incorporated into pricing decisions across business areas. Some operational involvement in target setting and adjusting of RoC target for differences in risk-type.</li> </ul>	<ul style="list-style-type: none"> <li>Investment team happy with modeling approach taken, results of model inform asset allocation decisions</li> <li>Approach to analysis of credit risk agreed by management, model output is discussed</li> <li>Reinsurance modelling sufficiently detailed and robust to use for high level decisions</li> </ul>	<ul style="list-style-type: none"> <li>Assumptions adopted (possibly with some modification for purpose) from relevant business unit models with appropriate adjustments for excluded elements.</li> <li>Widespread involvement of claims and underwriting in parameter setting and "ownership"</li> <li>Intermittent monitoring of changes in assumptions but limited control framework</li> </ul>	<ul style="list-style-type: none"> <li>Routine review of capital model carried out, but limited detailed challenge process established.</li> <li>Role and process linking capital model to risk management framework established. Key risks identified in insurers risk management plans correspond to similar elements in capital model where practical.</li> </ul>	<ul style="list-style-type: none"> <li>Capital language established throughout much of firm.</li> <li>Regular discussion of capital concepts with external stakeholders, but at relatively simple level.</li> <li>MI systems established to capture operating decisions for part of the business.</li> <li>Risk measures and alternative risk appetite scenarios discussed in quantitative setting and with reference to capital models at a high level.</li> </ul>
	Level 5 – Widespread use and initial feedback loop	<ul style="list-style-type: none"> <li>Capital models used in day-to-day / business control settings</li> <li>Information available for high-level challenge of key assumptions / model framework in some areas</li> </ul>	<ul style="list-style-type: none"> <li>Optimised plans developed and consider risk appetite of firm</li> <li>Plans considered in context of downside risk</li> <li>Changes in risk profile considered</li> </ul>	<ul style="list-style-type: none"> <li>Widespread application of RoC measures in pricing with underlying risk sensitivity.</li> <li>Some capture of risk aspects of operating decisions to feed into capital model</li> <li>Widespread reporting of RoC performance, but limited meaningful aggregation across business areas.</li> <li>Initial use of RoC as performance measure.</li> </ul>	<ul style="list-style-type: none"> <li>Investment team play greater role in calibration of model parameters</li> <li>More detailed review and use of Credit risk numbers to inform decisions</li> <li>Underwriters and Management look at effect of different reinsurance programmes, give feedback on net loss ratios</li> </ul>	<ul style="list-style-type: none"> <li>Assumptions consistent with those used for other business applications (e.g.: commutations, M&amp;As)</li> <li>Integration of business unit view of uncertainty assumptions with global view.</li> <li>Models used to meet (emerging) regulatory and accounting requirements.</li> <li>Frequent monitoring of changes in assumptions.</li> </ul>	<ul style="list-style-type: none"> <li>Detailed challenge of structure and parameterisation of capital model carried out as part of routine reviews.</li> <li>Model being continuously improved to meet industry best-practice.</li> <li>Key risks to insurer captured within capital model.</li> <li>Warning indicators triggered by capital model output enabling appropriate input into planning processes.</li> </ul>	<ul style="list-style-type: none"> <li>Regular discussion of capital concepts with external stakeholders, using increasingly sophisticated concepts.</li> <li>MI systems established to capture operating decisions for most of the business.</li> <li>Risk measures and alternative risk appetite scenarios discussed in quantitative setting and with reference to capital models, for some parts of the business.</li> <li>Discussion of business issues routinely includes capital considerations across the business.</li> </ul>
	Level 6 – Widespread use, partial feedback loop	<ul style="list-style-type: none"> <li>Capital models used in day-to-day / business control settings in dynamic fashion.</li> <li>Information available for detailed level challenge of key assumptions / model framework in most areas</li> <li>Model starting to be seen as quantitative side of business control framework</li> </ul>	<ul style="list-style-type: none"> <li>Multi-year planning process</li> <li>Plan looks forward across underwriting cycle</li> <li>Longer-term / strategic issues considered in plan optimisation</li> </ul>	<ul style="list-style-type: none"> <li>Widespread capture of risk aspects of operating decisions to feed into capital model</li> <li>General use of RoC as performance measure</li> <li>Initial ability to dynamically adjust RoC targets for changes in underlying operational decisions</li> </ul>	<ul style="list-style-type: none"> <li>Robust framework for review and calibration and use of asset model</li> <li>Detailed analysis of credit risk exposures, informs reinsurance committee decisions</li> <li>Detailed reinsurance model to assess performance of possible future reinsurance arrangements</li> </ul>	<ul style="list-style-type: none"> <li>Routine monitoring of assumptions, some challenge arising from implied capital use implications of output.</li> <li>Routine use of parameters in small transactions.</li> <li>Reserving risk results relevant when considering corporate reorganisation.</li> </ul>	<ul style="list-style-type: none"> <li>Reporting line for risk and capital modelling teams to board, integrated, with direct representation at board level.</li> <li>Board in position to control and change direction of capital model through risk management reporting process.</li> </ul>	<ul style="list-style-type: none"> <li>MI systems established to capture operating decisions across the business, enabling dynamic decision making, particularly at peak renewal seasons.</li> <li>Risk measures and alternative risk appetite scenarios discussed in quantitative setting and with reference to capital models, for most of the business.</li> <li>Discussion of business issues routinely includes capital considerations across the business.</li> </ul>

		<b>Strategy</b> Board – CEO	<b>Planning</b> COO / CUO	<b>Operations</b> COO / CUO	<b>Assets</b> CFO / Chief Actuary	<b>Liabilities</b> CFO / Chief Actuary	<b>Systems and Controls</b> CRO	<b>Infrastructure</b> CRO / CIO
Ultimate	Level 7 – Full use and feedback loop established	<ul style="list-style-type: none"> <li>Information available for detailed level challenge of key assumptions / model framework in all areas</li> <li>Model used as quantitative side of business control framework</li> </ul>	<ul style="list-style-type: none"> <li>Optimisation of control structure</li> <li>Agreement of capital allocations and targets agreed by business segment</li> <li>Control structure / delegation of authority levels agreed</li> <li>Frequency of plan review agreed and acted upon</li> </ul>	<ul style="list-style-type: none"> <li>Widespread use of dynamic control system providing real-time updates on risk levels and RoC performance across business.</li> </ul>	<ul style="list-style-type: none"> <li>Detailed investment module, regularly updated to current valuations and current market conditions. Inflation and other links to other risk areas. Model informs investment decisions</li> <li>Detailed analysis of credit risk exposures, regular update of current position and assumptions, key input into reinsurance committee decisions</li> <li>Detailed reinsurance model to assess performance of possible future reinsurance arrangements at all levels</li> </ul>	<ul style="list-style-type: none"> <li>Reserving risk results initiate and critical component of corporate reorganisation decisions.</li> <li>Routine challenge of assumptions used from business units and senior management.</li> </ul>	<ul style="list-style-type: none"> <li>Integrated approach established that can be rapidly and effectively deployed to new business areas to ensure quickly incorporated within overall business control framework.</li> </ul>	<ul style="list-style-type: none"> <li>Capital concepts (RoC, alternative capital measures, risk appetites) an integral part of structure of business.</li> <li>Robust MI framework enables capture of operational decisions and dynamic reporting framework that means that board can continuously optimise course followed.</li> </ul>

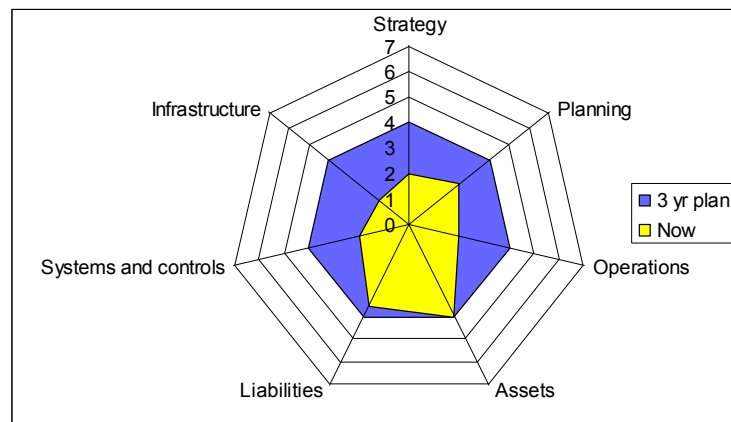
Worked example:

Strand	Now	3 year plan
Strategy	2	4
Planning	2.5	4
Operations	2	4
Assets	4	4
Liabilities	3.5	4
Systems and controls	2	4
Infrastructure	1.5	4

Here we see that the bulk of work required by this insurer to embed its capital model relates to its control environment and infrastructure areas, and resource should be allocated to these parts of the business

In terms of allocation of responsibility for segments:

- from 11 o'clock to 1 o'clock is responsibility of board and in particular CEO;
- from 1 o'clock to 4 o'clock is responsibility of chief underwriting or operations officers;
- from 4 o'clock to 8 o'clock is responsibility of finance director / CFO and chief actuary; and
- from 8 o'clock to 11 o'clock is responsibility of chief risk and IT officers.



## Part 3 – Action plans

This section collates ideas on how to improve the degree to which a capital model is embedded in the business. Some ideas are presented based on successful approaches followed in practice by working party participants; others are suggestions for approaches that readers could develop in their own implementation. Inevitably, the right solution will be company specific. The working party feels that this is an area where further sharing of ideas will assist the profession's profile in this area.

### 3.1 – Capital Modelling: Building a Process

### 3.2 – Embedding tools and examples

- 3.2.1 Risk maps
- 3.2.2 Communication challenges
- 3.2.3 Reserve variability assumptions
- 3.2.4 Underwriting variability assumptions

### 3.3 – Action plans

- 3.3.1 Operations
- 3.3.2 Planning
- 3.3.3 Systems and controls
- 3.3.4 Infrastructure

### 3.4 – Stakeholders matrix

### 3.1 Capital Modelling: Building a Process

In order to Embed Capital Modelling into a business, the first stage is the creation of a process. This is similar, for example, to a reserving process, where on a quarterly basis the updated claims and premium information is considered and reserve levels revised.

Whether a capital model could be set-up in such a way that it could be considered a “live” model (i.e. one which updates as soon as risks are recorded on MI systems), is probably an ultimate goal for some companies, however, the first stage is realistically aiming for a regular update i.e. quarterly or possibly even monthly. If the capital model is updated and results presented on a quarterly basis, then this allows management to see the interaction of the changes in the business with the required capital levels.

Just as with the reserving process, it is extremely important for the capital assessment process to be efficient and auditable to maintain its credibility.

For the process to be established, consideration to the following needs to be given. This may require changes to the current capital model layout.

- **Model time horizon** – consideration needs to be given to the amount of new business to be modelled. Using a multi-year time-horizon makes it difficult to pin point the impact of small changes in current and near future assumptions (i.e. over the next underwriting year).
- **Model time period split** – consideration to the most suitable time period should be given. A quarterly model would tie into a quarterly reserving process most neatly, but will introduce significant tax and dividend complexities.
- **Degree of automation** - A clear process is needed to step from best estimate input data to the capital model. This is to allow easy, efficient and practical updating.
- **Clear and easily updateable analysis on range estimates used** (i.e. reserve ranges, loss ratio ranges). Where other actuarial teams prepare some of the capital model input parameters, they will need to ensure their output shows changes clearly and enables the reasons for these changes to be readily understood.
- **Timing of capital updating exercise** When should the model be updated? Should it be after completion of the reserving exercise, or tying into updated business forecasts? In addition, which ad-hoc situation (e.g. considering purchase of specific reinsurance) should be catered for?
- **Presentation** i.e. what results are presented? Should the process provide just the capital level, or a comparison to other capital measures such as rating agency and other factor based methods (e.g. ECR or even proposed SCR), return on capital measures, and even cash flow projections etc?
- **Audience** – at what level would these results be presented and to what decision making management or committee. For example, should model results form part of the Board Pack, or be focussed more towards executive management, reserve committee, risk committee etc? Possibly a capital committee should be created (analogous to existing reserve committees).

This establishment of a process does require a level of buy in from the business management, as in addition to the considerable amount of additional resource required, the review and use of the results will need to be decided and debated.

The creation of a process around the capital modelling will have a number of benefits:

- **Build understanding** – with each iteration, the process will be improved; additionally capital modelling will become more familiar and more understood by senior management and business audience.
- **Build confidence in the modelling** – monitoring the required capital on a more regular basis, tracking changes in the business, will by nature ensure more focus on sense checking and back testing the results from the model. Where issues are uncovered the model will be enhanced and modified to better model the business.
- **Build expertise** – the learning is principally in the “doing”, with capital modelling techniques evolving rapidly, a focus on a regular capital assessment exercise will assist a firm to remain at the forefront.
- **Regulatory Capital Assessment – ICA** – this will be a less significant event as much of the ICA will be already completed.

Once a process is established, the link to other processes i.e. reserving and planning, which fall under the “Embedding in the Business” is clearer. For example:

- **Reserving** – establishing a process with which the best estimate reserves in the capital model are updated with the quarterly reserving results, thus making a clear link for the reserve range and reserve risk capital from the capital modelling to the reserve process. Then subsequently linking the reserve range assessment within the reserving process is an essential embedding step.
- **Planning and forecast** –establishing a process with the plan levels and updated forecast levels being updated within the capital model, thus makes a clear link for the loss ranges, investment income ranges etc, from the capital model to the planning and forecasting. The monitoring of return on capital within the planning and forecasting is an obvious “embedding” step.

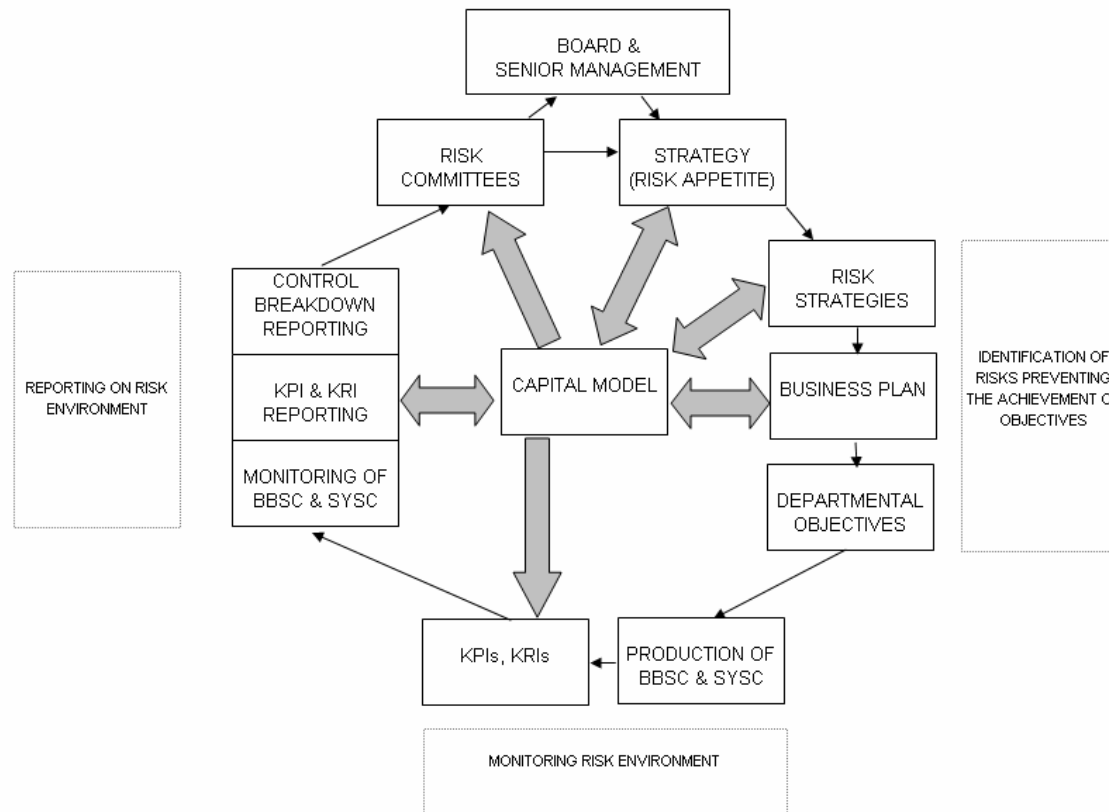
### 3.2 Embedding tools and examples

The working party members wanted to share some examples of the methods and ideas they had found useful in their own capital modelling work.

#### 3.2.1 Example risk map

Introduction:

Regulators will be interested in the way in which your capital model fits into the firm's overall risk management structure. The following type of diagram may be helpful in communicating this aspect of embeddedness.





### 3.2.2 Communication challenges

Introduction:

Good communication is key to helping others in your organisation understand capital modelling. The table below highlights a selection of words which may be more or less understandable by non-technical people. This appendix also includes some examples of clearer communication.

Do not use	Possible	Good
<p><b>DFA / ALM</b>  <b>Risk Measures</b>                      – VaR; percentile                      - TailVaR                      - Coherent Risk Measures  <b>Stochastic / Deterministic</b>  <b>Probability Distributions</b>  <b>Log Normal</b>  <b>Economic Scenario Generator</b>  <b>Factor based Models</b>  <b>Confidence Interval</b>  <b>Coefficient of Variation</b>  <b>Stochastic Reserving</b>  <b>Copula</b>  <b>Realistic Balance Sheet</b>  <b>Back testing</b>  <b>Parameter Uncertainty</b>  <b>Sensitivity Testing</b></p>	<p><b>Model</b>  <b>PSB Risk Categories</b>                      - Operational Risk                      - Group Risk (Fungibility)  <b>ICA / ICG / ECR</b>  <b>Correlation</b>  <b>Return Period</b>  <b>Curve fitting</b>                      - frequency: Poisson                      - Severity: Pareto  <b>Stress test</b>  <b>Monte Carlo Simulation</b>  <b>Volatility</b>  <b>Model error</b>  <b>ROC / Capital Allocation Methods</b>  <b>Rating Agency Methods</b>  <b>Solvency II</b></p>	<p><b>Capital</b>  <b>Risk</b>  <b>Planning &amp; Assumptions</b>  <b>Forecast or Projection</b>  <b>Reserving / PYD</b>  <b>P&amp;L / Balance Sheet</b>  <b>Likelihood</b>  <b>Underwriting Cycle</b>  <b>Trend / Claims &amp; Inflation</b>  <b>Asset types</b>  <b>Investments returns</b>  <b>Cash flow / Liquidity</b>  <b>Dependencies</b>  <b>Diversification</b>  <b>Scenario Test</b>  <b>Catastrophe models</b>  <b>Extreme Events / RDS's</b>  <b>Rating Agency Ratings</b></p>

**Task: Explain DFA without use of words from “Do Not Use” or “Possible”**

- DFA is a kind of flight simulator for decision makers in ins/reinsurance companies
- Allows them to investigate the potential impact of their decisions while still being on safe grounds
- Issues such as:
  - Capital management
  - Performance Measurement
  - Business Planning strategies
  - Reinsurance strategies
  - Investment strategies
- Banks use similar methods but call it “Balance Sheet Management”
- Life Insurance Companies call it “Asset Liability Modelling”
- DFA – as a “dynamic economy” – lots of continuously changing moving parts – dynamic financial analysis – aim capture moving parts of ins/reinsurance company
- Looking and analysing how the company’s financials would be impacted by moving parts
- Same structure/principle as plan - forecast the future
- Key differences:
  - Looking at results based on whole range of plan assumptions i.e. higher and lower than average
  - I.e. Losses may be forecast at 50% Loss Ratio, but need to consider likelihood that they are 30% or even 150%
- Results summarised in financial accounting layout - P&L/Balance Sheet
- Need to consider all range of all areas of uncertainty company exposed to
- Most important virtue is that all the dependencies between areas the company is exposed to can be allowed for
- Ideal for assessing level of capital to hold – as all aspects of company is taken into account



Compare risk vs. return

- **Task: Explain Risk Measure without use of words from “Do Not Use” or “Possible”**

- Is what it says it is... measures risk
- Risk = a possibility of incurring loss or misfortune
- First need to define what it is at Risk of not happening: I.e.
  - Risk of not making profits
  - Risk of not meeting the plan
  - Risk of losing sufficient money that you need to use your capital
  - ICA FSA definition – risk of losses from the whole business equivalent to a 1 in 200 year event
- The difficulty in assessing results from a DFA analysis is that you don't get one answer
- You get lots of results = the full range with likelihood of each
- Which one or ones should you look at?
- These will be your RISK MEASURES
- If the average is what you expect; then we want to measure the risk of being worse than what you expect:
- So how much worse?
- VaR or Value At Risk at the 99th level = the level you expect to be lower than 99% of the time or expect to be higher 1% of the time, or 1 once in 100 years, 1 in 100.
- VaR 90th level = level at which 90% of time outcome will be less than, 10% time will be higher than, or expect that result once in 10 years.
- Tail VaR at 95% level = looks at the average of the outcomes above the 95% level; different to the VaR 95% which just takes the value at the 95% level, ignore the values higher.

- **Task: Explain Copula without use of words from “Do Not Use” or “Possible”**
  - If claims behaviour in two classes of business seems to be related, we refer to this as dependency.
  - Dependency of the more likely events is measured by assessing the level of correlation between classes.
  - Copulas are a measure of dependency focusing on very unlikely events that affect several different classes of business; they try to capture the knock-on effects on other classes.
  - Why use copulas?
    - History and experience, and common sense tell us that there exist unlikely, but huge events that trigger claims in several classes.
    - For measuring solvency, it is exactly these extreme events that can materially affect the level of capital.
    - The usual measure of dependency – correlation – is not sophisticated enough to measure dependency of unlikely events.
    - So, simply using correlation will potentially understate the impact of the extreme events on the capital level.
  - However, use with care:
    - They will impact the level of required capital.
    - We have little historical data on these unlikely extreme events that we are trying to account for to analyse.
    - There are many different types of copulas with different varying impact; choose carefully!
    - This is a new area of mathematical development; there is a lot more work on testing and understanding to do.
  - Consider comparing impact to specific extreme scenario tests.

### 3.2.3 Reserve variability assumptions

Introduction:

When gathering information from other departments for use in a capital model, it is important to ask the questions in the right way. Below is an example of a questionnaire designed to elicit benchmark percentiles for reserving risk which worked very well at engaging people's interest, getting them thinking about uncertainty, and ultimately providing very useful assumptions for capital modelling.

#### Questionnaire on Syndicate 3000 Reserving Risk for ICA model 1993 to 2001 Policy Years - Excluding WTC and Bad Debt

You have the following information:

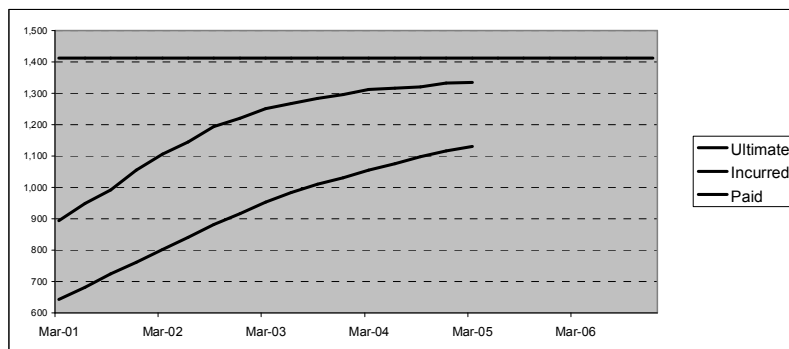
1) From the Q1, 2005 Actuarial IBNR Packs the reserves on the 1993 to 2001 Syndicates are as follows:

Syndicate	Gross Reserve	Net Reserve	Net Case	Net IBNR
	£m	£m	£m	£m
A	44	7	5	2
B	3	1	0	0
C	128	66	55	11
D	26	7	5	2
E	39	21	12	10
F	12	9	5	4
G	28	14	11	3
H	29	19	10	10
<b>Total</b>	<b>309</b>	<b>144</b>	<b>103</b>	<b>41</b>

2) Reserve Deterioration since June 2001 (ex WTC and 1009 LOD, 100% share)

Syndicate	Net Reserve Development					Total £m
	2001 £m	2002 £m	2003 £m	2004 £m	2005 £m	
A	actual movements deleted!					
B						
C						
D						
E						
F						
G						
H						
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	

3) The pattern of Paid and Incurred claim development on the whole block looks like this:



The Actuarial pick for the net reserves is £144m.

What do you think the chances are of the reserve run-off costing, at today's prices, the following amounts?

Give your answer as a percentage

Note that WTC is excluded

Note that the answers to A and B must add up to 100%!

- A More than £144m
- B Less than (or equal to) £144m
- C More than £150m
- D More than £155m
- E More than £165m
- F More than £180m
- G More than £195m
- H Less than £140m
- I Less than £125m

### 3.2.4 Underwriting variability assumptions

An important step when embedding a model in the business is to obtain feedback from the underwriters on the parameters used for future business. The questionnaire below was completed as part of meetings with each class underwriter, as well as by senior managers (to give a high level review of the business). This was used to improve the quality of the parameters and assist in gaining buy-in from the business.

**Example Class ABC**

Completed by: <DFA contact>

Agreed with: <Underwriter name>

Agreed date:

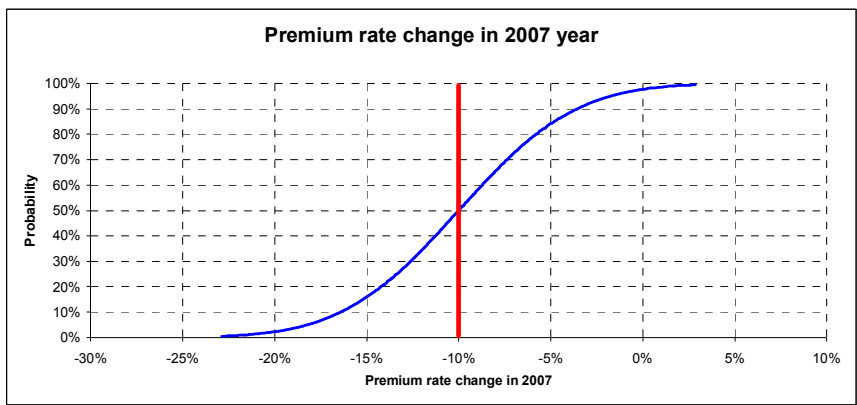
**Premium rate movements**

**Q1** The planned 2006-2007 premium rate change is -10.0%. Is this still your current best estimate? Yes / No  
 If not, what do you believe is the correct best estimate?  
 Please provide an explanation in the box below for the change.

**Q2** Do you think that half the time the 2006-2007 premium rate change is likely to be between -13.0% and -7.0% and half the time out of this range? Yes / No  
 If not, what do you believe is the correct 50% range of estimates?  
 Please provide an explanation in the box below for the change.

**Q3** Do you believe that once in every 100 years (ie worst case scenario) the 2006-2007 premium rate reduction could be 23.0% or more? Yes / No  
 If not, what do you believe is the correct 1 in 100 rate reduction?  
 Please provide an explanation in the box below for the change in the estimate.

**Q4** Do you believe that once in every 100 years (ie best case) the 2006-2007 premium rate rise could be 3.0% or more? Yes / No  
 If not, what do you believe is the correct 1 in 100 years rate rise?  
 Please provide an explanation in the box below for the change in the estimate.



**Gross premiums**

**Q1** The planned 2007 ultimate gross written premium is £100.0m. Is this still your current best estimate? Yes / No

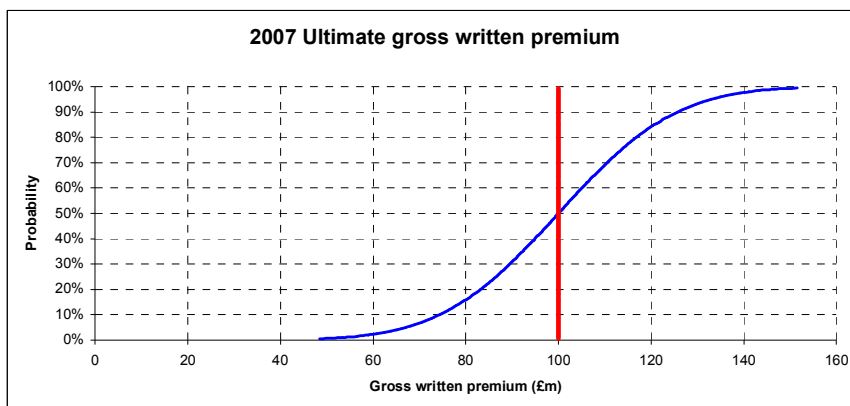
If not, what do you believe is the correct best estimate?  
Please provide an explanation in the box below for the change.

**Q2** Do you think that half the time the 2007 ultimate gross written premium is likely to be between £87.0m and £113.0m and half the time out of this range? Yes / No

If not, what do you believe is the correct 50% range of estimates?  
Please provide an explanation in the box below for the change.

**Q3** Do you believe that once in every 100 years (ie not very often) the 2007 ultimate gross written premium could exceed £152.0m? Yes / No

If not, what do you believe is the correct 1 in 100 years estimate?  
Please provide an explanation in the box below for the change.



**Gross loss ratios**

**Q1** The planned 2007 ultimate gross loss ratio is 75.0%. Is this still your current best estimate? Yes / No

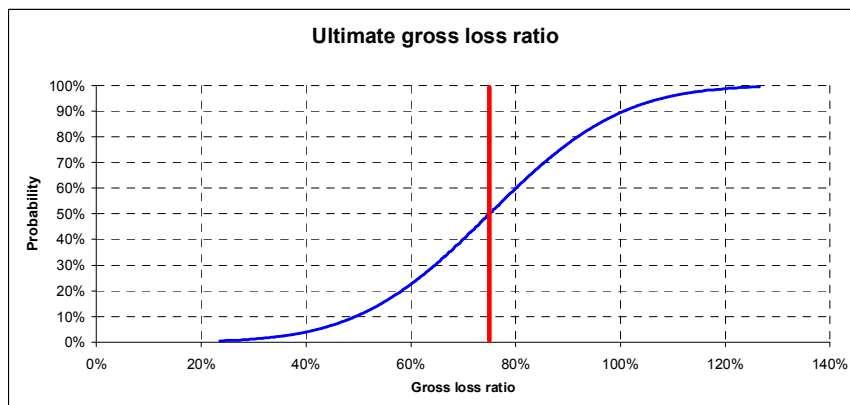
If not, what do you believe is the correct best estimate?  
Please provide an explanation in the box below for the change.

**Q2** Do you think that half the time the 2007 ultimate gross loss ratio is likely to be between 62.0% and 88.0% and half the time out of this range? Yes / No

If not, what do you believe is the correct 50% range of estimates?  
Please provide an explanation in the box below for the change.

**Q3** Do you believe that once in every 100 years (ie not very often) the 2007 ultimate gross loss ratio could exceed 127.0%? Yes / No

If not, what do you believe is the correct 1 in 100 years estimate?  
Please provide an explanation in the box below for the change.



**Reinsurance loss ratio**

**Q1** The average 2007 ultimate reinsurance loss ratio is 60.0%, do you believe this is the correct best estimate? Yes / No

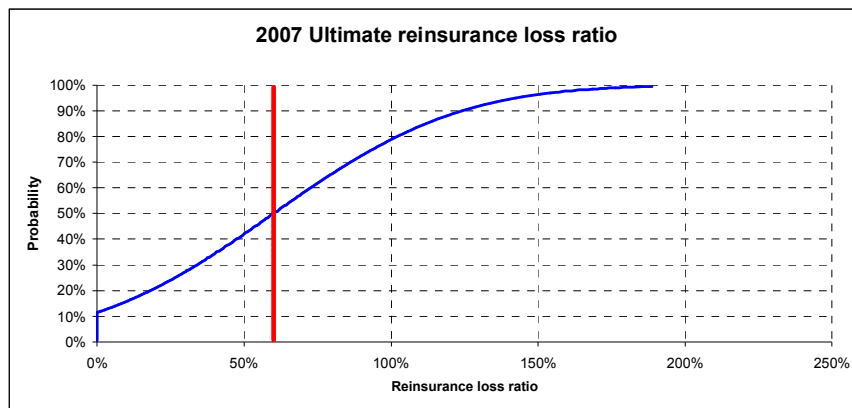
If not, what do you believe is the correct best estimate?  
Please provide an explanation in the box below for the change.

**Q2** Do you think that 12.0% of the time, during 2007, you will not recover on the reinsurance programme? Yes / No

If not, what percentage of the time will you not recover on your reinsurance program?  
Please provide an explanation in the box below for the change.

**Q3** Do you believe that once in every 100 years (ie not very often) the 2007 ultimate reinsurance loss ratio could exceed 189.0%? Yes / No

If not, what do you believe is the correct 1 in 100 years estimate?  
Please provide an explanation in the box below for the change.



**Net loss ratio**

**Q1** The average 2007 ultimate net loss ratio is 80.0%, do you believe this is the correct best estimate? Yes / No

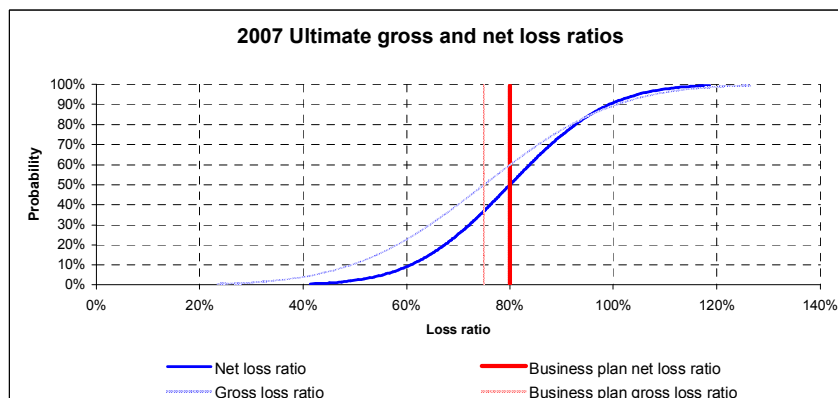
If not, what do you believe is the correct best estimate?  
Please provide an explanation in the box below for the change.

**Q2** Do you think that half the time the 2007 ultimate net loss ratio is likely to be between 70.0% and 90.0% and half the time out of this range? Yes / No

If not, what do you believe is the correct 50% range of estimates?  
Please provide an explanation in the box below for the change.

**Q3** Do you believe that once in every 100 years (ie not very often) the 2007 ultimate net loss ratio could exceed 120.0%? Yes / No

If not, what do you believe is the correct 1 in 100 years estimate?  
Please provide an explanation in the box below for the change.





### 3.3 Action Plans

Introduction:

This appendix sets out suggested steps for some of the embedding domains to move a firm up the ladder. Our aim in including this glossary of ideas is to assist firms in setting out plans to improve the degree to which their capital model can be considered embedded.

#### 3.3.1 Operations

**“Moving Up the Ladder”** Key themes and priorities to improve your position

From Stage 1 to Stage 2:

- Communication of capital modelling/ICA process to business areas
- Explain key data/assumptions required, ask for input into these
- Start to develop capital allocation to business area
- Identify “quick-win” areas where capital modelling can help inform decision making

From Stage 2 to Stage 3:

- Wider involvement of business areas in reviewing assumptions and results, moving on to setting assumptions for their business area
- Discussion with business areas on capital allocation to business area
- Increase of usage of capital model to help with business area decisions.

From Stage 3 to Stage 4:

- Management measures business area by return on capital measures
- Incorporate full reviews of assumptions and results within the business to facilitate challenge and feedback
- Identify the variety of opportunities within the business which could benefit from a capital modelling perspective
- Align remuneration/bonus structures to return on capital performance with buy-in from business areas.

#### 3.3.2 Planning

**Business plan process stepladder**

**To reach stage 2**

- Use a consistent business plan bridge template that is owned by the business.
  - This should include all the assumptions that are shown in section two that drive the final plan number
  - Gives each team a template, help them to fill it in, but it must be owned by the business
  - The plan should include at least three years business; last year, this year and next year. The current year will still be uncertain and the current view may differ from the most recent plan, it can be useful to gain two years bridge
  - Ensure that all the assumptions that are submitted in the plans e.g. level of new business are consistent with the history
- Calculate a robust ‘pure’ view of the business profitability

- The held reserve should contain a margin for uncertainty. In order to calculate true best estimate business plan loss ratios we need to understand (and have agreed with the business) the best estimate loss ratios
- This can be difficult for the catastrophe classes where loss ratios are often held at 70% until a catastrophe has occurred. Formally agreeing the true level of profitability is key to deciding if the risk reward profile of the catastrophe business is adequate. To do this a distribution needs to be agreed. This does not need to be complicated; e.g. NULR 1:10 = 200%, 3:10 = 100%, 6:10 = 30% → 68% NULR average
- Calculate a pure view of inflation. Is there an inflation hedge in the exposure measure this should be netted off when calculating loss ratios changes
- Allocate expenses and investment income and have it owned by team. This is crucial to go from loss ratios to profit
- Actual vs. expected. It can be useful to obtain as many historical business plans as possible and compare this to what actually occurs. This can be a useful driver to making teams produce more accurate estimates

### To reach stage 3

- A robust challenge process is useful.
  - Numerical plans are submitted by teams. Challenges are then written up by actuarial before the formal review
  - A formal sign-off similar to the reserve sign-off where two sides (i.e. teams and actuaries) present a case for what they believe the plans should be. No plan is signed off if it contains assumptions that do not 'smell right'

### To reach stage 4

- Contingency planning
  - Identify the key uncertainties in the business plan. E.g. volume or RI cost and produce plans under these scenarios. Is the profitability sufficient under these scenarios?
  - Senior management input will be required for some scenarios e.g. action after extreme natural catastrophe
- Opportunity planning
  - Identify the most profitable parts of the business and challenge whether they can increase

### To reach stage 5

- Set out all the key risk in the business in a single MI schedule (i.e. including reserve and attritional insurance risk). Once management has started to understand this output it can be compared to the expected profitability in the business plan

### To reach stage 6

- Multi year planning is not that difficult. The key assumption is to include a realistic market cycle assumption. These will vary by team and need to be owned by them.
  - Have each team produce a loss ratio and volume plan for their own and the business over the next cycle (i.e. 7-10 years)
  - Present these back to the teams and have them agree a consensus view for the business

- Use this to produce the profit target for next year. This will be either higher or lower than the long term average required depending on the position in the cycle
- Set out regularly the return that the business has made and whether it is on course to make its cross cycle targets. E.g. since 2002 the average return has been 20% with a long term target of 15% and so we believe we are on track to meet the cross cycle target

#### **To reach stage 7**

- Any suggestions?

#### **3.3.3 Systems and controls**

##### **From Stage 1 to Stage 3:**

- Ensuring adequate documentation of modelling process and procedures
- Undergo an internal audit of capital modelling work
- Ensure that key assumptions and results of the model are challenged by appropriate areas of the business

##### **From Stage 3 to Stage 5:**

- Regular review and update of model to meet industry best practice and regulatory requirements
- Wider involvement of business areas in reviewing assumptions and results
- Full external review of modelling work to give confidence that modelling is of a good standard and in line with market practice
- 

##### **From Stage 5 to Stage 7:**

- Continuous process of enhancement to capital models to keep up to date with evolving regulatory requirements and market best practice
- Incorporate full reviews of assumptions and results within the business to facilitate challenge and feedback
- Clear links between capital modelling work and overall risk management framework
- Identifying the variety of opportunities within the business which could benefit from a capital modelling perspective
- Have a senior manager who promotes the benefits of capital modelling at Board level

#### **C.4 Infrastructure**

- Establishment of language to use internally
- Development of meaningful MI on back of established capital modelling framework
- Progressive introduction of capital concepts into dialogue with external stakeholders.
- Roll-out of capital language to business units. Simple at first, then gradual introduction of sophistication.

Most of the steps for self-improvement in infrastructure are self-evident. They can, however prove challenging and costly to implement successfully in practice.

Language and communication:

- Examples of challenges and possible approaches to explaining difficult concepts are set out in section 3.1.2.

Management information:

- An example of an ad-hoc approach to underwriters' views of reserve variability is set out in section 3.1.3.
- To move to high levels, amore general MI framework will need designing with the insurer and its needs in mind. This could range from a simple spreadsheet-based approach for a single-site business with few business lines, to a sophisticated enterprise platform approach for large complex organisations.

### 3.4 Example Stakeholders Matrix – ICAS Business Responsibilities

Introduction:

This matrix had been produced for an earlier presentation on capital values prior to the production of this paper. It was used as a template for the working party to begin thinking about the various aspects of embeddedness.

Example Stakeholders Matrix – ICAS Business Responsibilities						
	“Company Level” Strategic	“Business Line” Strategic	Business Planning & Finance	Reinsurance, Credit & Asset	Regulation & Compliance	Reserving & Claims
ICAS/Capital Focus	<ul style="list-style-type: none"> <li>Overall Capital level &amp; measures</li> <li>ICAS/Capital uses in business i.e. Performance Measures, Reinsurance etc.</li> <li>Key Sensitivities</li> <li>Stress &amp; Scenario testing results</li> <li>Group Risk</li> <li>Link to Rating Agency assessments</li> <li>Compare to ACE assessments</li> <li>FSA / Lloyds Compliance</li> </ul>	<ul style="list-style-type: none"> <li>Capital Based Performance Measures by line</li> <li>Insurance Risk:                             <ol style="list-style-type: none"> <li>Underwriting range</li> <li>Market / trend cycle assumptions</li> <li>Extreme Event Scenarios</li> <li>Catastrophe Assumptions</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>Tax, dividend and other accounting assumptions</li> <li>Admissible Assets</li> <li>Comparison to ECR/S&amp;P</li> <li>Capital Management - fungibility</li> </ul>	<ul style="list-style-type: none"> <li>Reinsurance assumptions; net underwriting ranges</li> <li>Overall Capital &amp; Liquidity (Treasury)</li> <li>Credit Risk</li> <li>Asset risk</li> <li>Economic Data generator                             <ol style="list-style-type: none"> <li>inflation</li> <li>economic growth</li> <li>investment returns</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>Peer Review</li> <li>Operational Risk</li> <li>Risk Register</li> <li>Internal Audit (Sarbanes Oxley) Controls on process</li> <li>External Audit Review</li> </ul>	<ul style="list-style-type: none"> <li>Reserve Range</li> <li>Reserve Extreme Events</li> <li>Actuarial Review of methodologies</li> </ul>
People & Committees	<ul style="list-style-type: none"> <li>Board</li> <li>Executive Committee</li> </ul>	<ul style="list-style-type: none"> <li>Underwriter Business Line Heads</li> <li>Catastrophe Committee</li> <li>Board Product</li> </ul>	<ul style="list-style-type: none"> <li>Finance Controller</li> <li>Tax Specialist</li> <li>Finance Systems</li> <li>Financial Reporting</li> <li>Planning team</li> </ul>	<ul style="list-style-type: none"> <li>Local Reinsurance Manager</li> <li>Shared Programme Reinsurance Manager</li> <li>Asset Managers</li> <li>Security Committee</li> </ul>	<ul style="list-style-type: none"> <li>Internal Audit</li> <li>Compliance</li> </ul>	<ul style="list-style-type: none"> <li>Actuarial Reserving Team</li> <li>Claims Managers</li> </ul>

Risk Management Activities	<ul style="list-style-type: none"> <li>• Risk Committee</li> </ul>	<ul style="list-style-type: none"> <li>• Operations Managers</li> <li>• Accumulation Monitors</li> </ul>	<ul style="list-style-type: none"> <li>• Sarbanes Oxley controls</li> </ul>	<ul style="list-style-type: none"> <li>• Sarbanes Oxley controls</li> </ul>	<ul style="list-style-type: none"> <li>• Audit Reviews</li> <li>• Process controls</li> </ul>	<ul style="list-style-type: none"> <li>• Sarbanes Oxley controls</li> </ul>
External People	<ul style="list-style-type: none"> <li>• FSA / Lloyds</li> <li>• Rating Agencies</li> </ul>				<ul style="list-style-type: none"> <li>• Auditors</li> <li>• Independent ICAS Review Actuaries</li> </ul>	<ul style="list-style-type: none"> <li>• Independent Reserving Actuaries</li> </ul>