



Insights

Risk management in the new normal

Special edition – September 2013

TOWERS WATSON 

Welcome...

We are delighted to introduce this special edition risk management Insights.

Our publication comes at a time when what defines an enterprise risk management (ERM) strategy, and how that should be implemented, have changed markedly over the last five years. Many companies are adapting to economic and market conditions that had first been thought of as a temporary correction to the shocks of the financial crisis, but seem to have become entrenched – a ‘new normal’ if you will. The paucity of investment returns from the traditional assets held by insurers, the shifting impact of different types of risk exposure and dependencies on risk appetite and management have been among the contributing factors to this new normal. And alongside these changes and others, insurers in many regions have had to operate in a form of regulatory ‘limbo’ that shows little sign of abating at the time of writing. In particular, the delay in Solvency II has seen many insurers restructure and shift priorities in their ERM programmes across the region. But at the same time regulators are looking to maintain momentum and are focusing their attention on Pillar 2 aspects including the ORSA (now FLAOR).

So whilst many in the industry continue to recognise the value that ERM can help business, how do we make that a reality in these changed – and still changing – circumstances?

In this publication we feature a number of linked articles that focus on the more practical challenges of effectively embedding risk management in the business and how the ORSA can be used to engage stakeholders. At the same time insurers are increasingly talking to Towers Watson about how they can extract more value from their models in the absence of regulatory certainty, so we have asked our experts to outline their views, and what they are seeing around the market, including the second article in the series on ‘economic capital’. We have also taken the opportunity to present some new thinking around behavioural risk, arguing this should form part of a company’s ERM framework. Building on this further, we share with you the results of an extreme risks survey we recently conducted and discuss why we believe it is important to consider such events as part of a robust risk management approach. Finally we include the first article in a series looking at Towers Watson’s proprietary investment process, exploring what we define as the risk-return habitat.

If you would like to discuss ideas or points of view contained in the articles with any of the individual authors, please do get in touch.

If you would like to receive similar publications from Towers Watson please email hagen.selinger@towerwatson.com.

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Risk models - opportunities for value enhancement

Dermot Mullins and Yurie Budhu

Given that the development and growth of the insurance industry has ultimately been founded upon people and long-term personal relationships, it can be challenging for those not immediately involved in technical risk models to trust and to draw inspiration from the numbers-based outputs. To date the risk modelling teams of many companies have had to prioritise their activities on establishing the core technical modelling foundations to comply with regulatory requirements. In this article, we offer a framework with practical examples for moving risk models forward, beyond the core technical modelling foundations to focus on unlocking commercial and operational benefits.

Introduction

The theory is that with the core technical foundations (risk modelling skills, systems and processes) in place, valuable insights on risk for business decision makers will follow. However, for a large number of companies, it is compliance with regulation (e.g. UK ICAS, EU Solvency II, Swiss Solvency Test, Australia Capital Adequacy) which has primarily driven investment in risk models, modelling resources and infrastructure. This need for technical modelling teams to focus on regulatory or supervisory compliance and reporting has meant that, for many, the opportunity to use risk models to support the broader pursuit and capture of better business benefits and 'bottom-line' wins has not progressed as expected. As a result, many key business stakeholders are sceptical or have limited awareness and understanding of not only the insights which risk models can provide, but also their limitations. A finding from our recent Global Insurance ERM survey illustrates this issue, where management buy-in is cited as the main hurdle to using economic capital to drive business decisions.¹

We believe that to move risk models forward, companies need to build on these core technical foundations and focus on three areas - target value outcomes; stakeholder engagement, communication and collaboration; and business decision-making. The practical examples discussed below reflect actual approaches taken by several of our clients and are stylised so that no specific company is discernible.

Risk models – insights, benefits and prerequisites

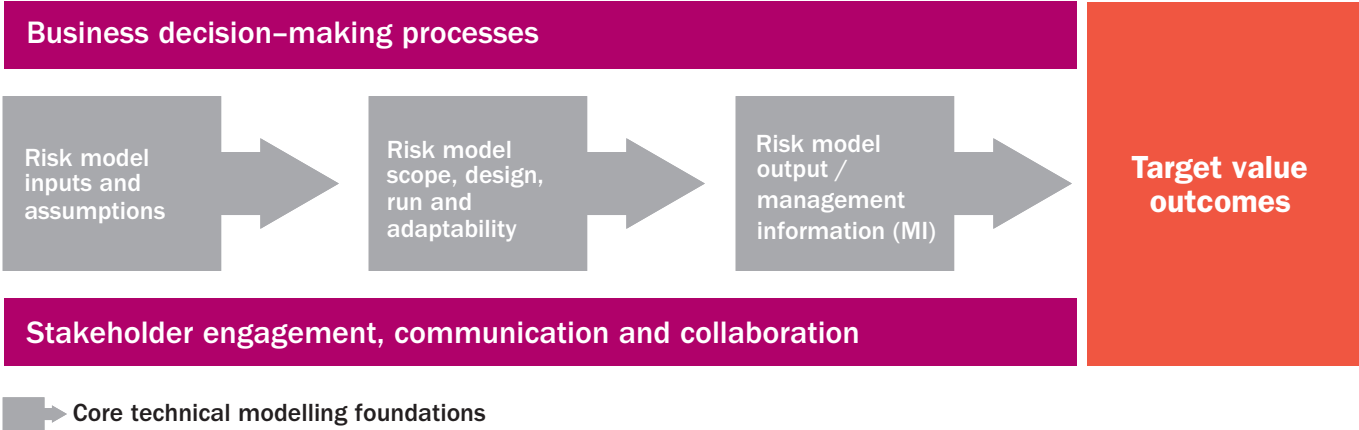
Risk models, by their very nature, do not provide certainty of outcome to (re)insurers. However, if used appropriately, risk models can provide credible insights to support the pursuit of a better understanding of all risks being assumed and the corresponding profitability to underpin a sustainable business strategy. Such insights can include reliable estimates of the range of potential outcomes for risk events, better insights on the interactions between risks, reasonable expectations of the diversification benefits of different risk strategies and the potential range of profitability and capital utilisation of each. The effective use of these insights can lead to tangible beneficial outcomes, for instance, objective assessment of business scenarios such as adding new lines of business, expanding existing lines of business or targeting new segments. These can also lead to intangible beneficial outcomes such as provoking thought, discussion and questions amongst business stakeholders leading to more robust and informed business decision-making. The benefits of using risk models for business decision-making or capital setting is predicated on business stakeholders being engaged in the process by:

- receiving model outputs of risks versus reward, which are robust and timely to enable on-going use in business reviews, debates and decision-making;
- possessing a high degree of understanding and confidence to challenge risk model results and analysis;
- seeing value in the insights provided by risk models and the outcomes which they can enable, that is, the benefits of better understanding of risk so that the risk models are seen as a contributor to profit and not just a non-discretionary cost or overhead.

¹ 'Keep Your Eye on the Prize – 2012 Global Insurance Industry ERM Survey', available at towerswatson.com/ermsurvey2012.

A framework for making risk models more useful to the business

Figure 01. Risk model opportunity and value enhancement framework



To be perceived as being useful business tools, business stakeholders should be clear on the areas where risk models can help them. At the outset of the design and development of the core technical modelling foundations, modelling teams will have engaged with business stakeholders to identify their needs, for example, through a series of workshops. These needs will have been recorded and set out in the form of business requirements as the basis of the use cases for these models. Many companies have now reached the point where these core technical foundations are in place and their risk models are delivering accurate outputs based on reliable inputs and assumptions, and a stable underlying modelling infrastructure. However, as the findings from our recent Global Insurance ERM survey indicate, only a few companies have been able to build on these core technical foundations to create and maintain a high level of awareness, understanding and confidence amongst business stakeholders as to the usefulness of risk models and outputs. Risk model outputs need to be explained in the context of limitations, and there needs to be ongoing challenge and effective formal and informal feedback loops maintained to avoid a false sense of security from the ‘answers’ that the model provides. So what’s next?

In our experience, the companies that have moved forward to the delivery of strategic and business insights have focused on three areas: target value outcomes; stakeholder engagement, communication and collaboration; and business decision-making processes.

Target value outcomes – taking a more expansive and ambitious approach

As outlined, the risk modelling teams of many companies have had to prioritise their activities on establishing the core technical

modelling foundations to comply with regulatory requirements. These regulatory requirements are rooted in prudential objectives such as ensuring overall financial system stability and resilience, and policyholder protection. From a proprietary business stakeholder perspective, this poses a challenge as to the breadth and ambition of the outcomes at which the uses of risk models are being targeted. There are difficult questions which must be considered:

- Has the company’s own proposition for creating value, and the risks which need to be taken to achieve this proposition been considered in the use cases for these models?
- Have the strategic and business insights which can be captured by the use of risk models been established?
- Since the initial risk model design, have the business requirements evolved with the needs of the business?

Developing risk modelling competencies and capabilities which are focused solely on the regulatory/supervisory compliance agenda can create the impression within the business that risk modelling is simply a compliance burden that does not deliver commercial or operational benefits. To move forward necessitates (re)insurers taking a more expansive and ambitious approach. It necessitates the risk modelling team taking the lead on working to set out a performance-based agenda for risk models. Such a performance agenda will focus on clearly articulating for business stakeholders the benefits or target value outcomes that can be achieved. Those companies that have risen to this challenge and set out this performance agenda have taken their initial risk model uses to the next level by generating and testing innovative and value-added ideas and hypotheses. The use of risk models for the strategic application of reinsurance is one example of this.

“the benefits of better understanding of risk so that the risk models are seen as a contributor to profit and not just a non-discretionary cost or overhead”

Case Studies 1 & 2 'Taking reinsurance analysis to the next level'

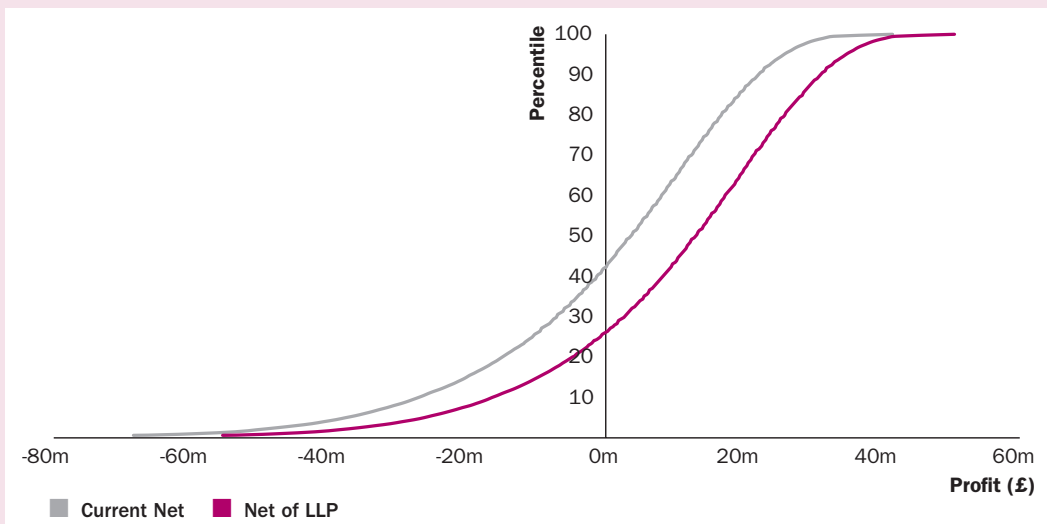
Case Study 1

Many companies currently use their risk models to evaluate current or prospective reinsurance programmes, looking at reinsurance recoveries expected given their gross results, efficiency across various layers and structures in the programme, and the uncertainty inherent in these estimates. It would be expected that these results would be assessed as part of a balanced scorecard including these quantitative factors alongside softer, qualitative factors, such as broker or reinsurer relationships.

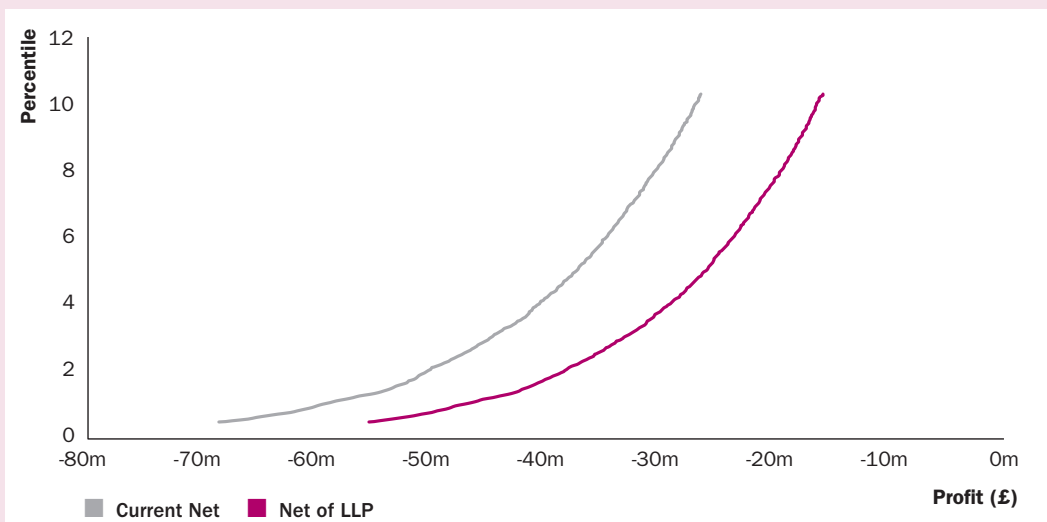
However, evaluating the optimal use of reinsurance within the business often goes beyond the traditional structures and solutions currently in the market. The most advanced companies are now using their risk models to consider innovative reinsurance structures, testing alternative ideas to create truly distinguishing features which give a competitive edge in the marketplace.

The results below show one example of a company's net profit distribution being improved along the full range of potential outcomes having implemented the Towers Watson Large Loss Protector reinsurance product. For companies who have invested the time in developing sophisticated models, and have expounded the value of these models to the business, being able to demonstrate significant 'bottom line' benefit based on the use of the model is a natural progression. During these exercises, regular and clear communication with the stakeholders is critical.

Net profit distribution



Tail of net profit distribution



“During these exercises, regular and clear communication with the stakeholders is critical”

Case Study 2

In a recent exercise with a large, multinational London market insurer, a multi-disciplinary team worked with our client to develop and place an innovative and cost-effective reinsurance solution, bringing direct benefit to the company's capital position and credit rating.

Two key elements of this project were the ability to use our client's risk model for assessing the impact of the proposed reinsurance structure; and regular updates with our client's internal stakeholders, keeping them fully informed of progress, openly and transparently handling queries and bringing comfort in the decisions being made each step along the way.

The successful placement of the proposed reinsurance structure led to significant additional reinsurance benefit, reduction in capital, and reaffirmation of the company's credit rating.

Stakeholder engagement, communication and collaboration – managing performance and compliance agendas

Establishing a performance agenda requires awareness, understanding and confidence by all risk model stakeholders. The risk model stakeholders, depending on the size and structure of the company, will include the CEO, CFO, CRO and Chief Underwriting Officer (CUO). These stakeholders will need to be aware of and understand the benefits or target value outcomes. They also need to have confidence in how these can be delivered alongside the mandatory regulatory/supervisory compliance deliverables. To achieve this and to start to exploit what, in many cases, is now becoming non-discretionary investment in risk modelling competencies and capabilities requires a high-level of cross-functional and collaborative working. This places a high premium on the interpersonal skills and strategic insights, not just for the risk modelling team, but for the company as a whole. Individual workloads and diverse working locations means that such cross-functional and collaborative working is increasingly challenging. Despite this, and given the inherent uncertainty and difficulty in estimating potential risk outcomes, the benefits for (re)insurer decision-making from cross-functionally accessing, evaluating and debating multiple credible views of a company's key risks are clear. However, this presents a dilemma for the risk modelling team – how do they develop more strategic and distinctive risk modelling competencies to address the performance agenda, whilst continuing to deliver on the regulatory/supervisory compliance agenda?

In most companies, elements of this cross-functional and collaborative way of working with

risk models are already in place. Many formal and informal feedback loops with the risk modelling team are well-established. What has changed is that stakeholder management, both internal and external, has become much more challenging for risk modelling teams as outlined in **Figure 02**. There are more stakeholders to manage, each with their own priorities and expectations of outcomes from the use of risk models. Business stakeholders and rating agencies are expecting more insight-driven performance analysis and findings. The demands of regulators/supervisors are increasing with more rigorous testing, documentation, evidence of assurance and challenge, and greater transparency of potential outcomes expected. Risk modelling teams need to ensure that they are constantly engaging and collaborating with all of their stakeholders to create and maintain awareness, understanding and confidence in risk models. As with risk model improvement, risk model stakeholder management is not a 'one-off' exercise but a continuous process, one of on-going multiple stakeholder engagement, communication and collaboration.

“Risk modelling teams need to ensure that they are constantly engaging and collaborating with all of their stakeholders to create and maintain awareness, understanding and confidence in risk models.”

Figure 02. Managing multiple risk model stakeholders to achieve different expected outcomes

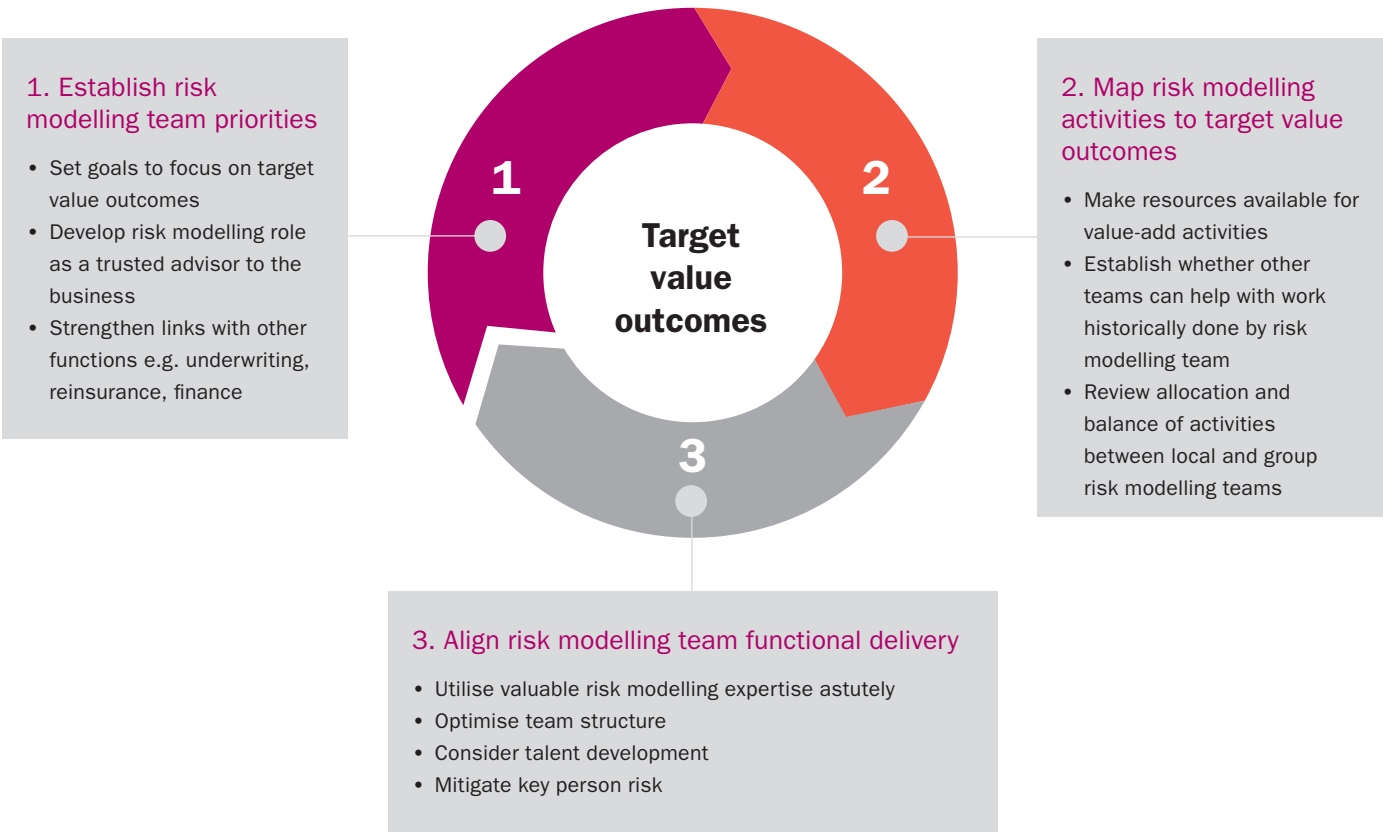
Risk models and outputs			
Awareness		Understanding	Confidence
Modelling focus			
Risk modelling team	The impact on results from the limitations of the model and data/ inputs are continually investigated and articulated to inform the presentation of risk model results	The modelling team has well established formal and in-formal feedback loops (internal and external) to create and maintain clarity, confidence and engagement in terms of the use of risk models in the company	The modelling team provides strategic and business insights using risk model outputs on risks, which need to be taken to achieve the company's value proposition or mission
Performance focus			
Business stakeholders	Business requirements and target value outcomes for use of risk models are well established and clearly communicated across the company	Business stakeholders feel engaged to commit to an on-going process to enhance and improve risk models and their corresponding knowledge and understanding	The strategic and business insights provided by the risk modelling team are valued and seen by business stakeholders as credible inputs to the decision-making process
Rating agency(s)	The strength of risk modelling capabilities relative to the company's risk profile are established	The depth of individual and collective business and modelling knowledge and experience, and the robustness of processes and methodologies provides assurance on the measurement and management of risk from an earnings and capital adequacy perspective	The competitive advantage and improvement in business performance achieved by the company in utilising risk models to inform better risk-reward decision making can be demonstrated
Compliance focus			
Regulator/ supervisor	The extent of reliance of the company on risk models for managing risk including limitations and complexity of models, data / inputs and key underpinning assumptions is clear	The effectiveness of the company's model governance and validation framework to ensure that risk models and their output are performing as expected can be evidenced	The company's use of risk models is considered to be prudent given the inherent difficulties with risk measurement

The companies who are making progress in this area are starting to demonstrate distinctive risk modelling competencies and capabilities to better articulate the business benefits of their use of risk models and their limitations. Clear goals and objectives are being set to focus risk modelling resourcing skills and competencies, processes and technology on target value outcomes. Risk modelling activities are being reorganised and prioritised to ensure delivery of both the performance agenda (for example, group and operating unit business requirements) and the regulatory / supervisory compliance agenda (for example, Actuarial Function requirements). Based on our experience, we have illustrated in **Figure 03**

how some risk modelling teams are enhancing their stakeholder management capabilities to create better clarity, engagement and confidence in the use of risk models. These are the teams who understand that to generate the most benefit for the business, valuable risk modelling resources should be targeted at activities that generate the highest return.

“to generate the most benefit for the business, valuable risk modelling resources should be targeted at activities that generate the highest return.”

Figure 03. Targeting and delivering risk model value outcomes



Case Study 3 – Enhancing operating model to achieve commercial and operational benefits

To realise the potential benefits from a more streamlined and focused operating model, our client set about realigning its actuarial and risk modelling teams within the context of its broader business structure. The view of the senior managers at our client was firmly that risk modelling is not a standalone activity, but a crucial part of supporting strategic decision-making and the daily running of the business. In moving from simply calculating regulatory/supervisory required capital levels, our client aligned their internal reporting, risk modelling and lines of business monitored to be consistent with their risk modelling efforts. As a result, our client was able to realise both tangible and intangible commercial and operational benefits.

A recent expansion of the business into new lines highlighted the need for insightful risk modelling, with the team providing support in assessing the viability and likely profitability of this major decision. The production of timely outputs and a clear communication of the modelled results and potential limitations were crucial to the decision-making.

The business as usual activity has also seen major benefits: quarterly and annual reserving is now done at a line of business level which matches up with the lines of business included in the risk model. This has led to more consistency across the business and a smoother transition from setting the reserves for each line of business to assessing the variability around the whole book. The end-to-end process from data to modelling to reporting has been streamlined, allowing the team to focus on valuable business activities.

A key part of the implementation of this operating model was the drive to educate the business and then entrust more of the risk modelling activity into the hands of business managers. This allowed the business managers to take ownership of their elements of the overall result. At the same time this freed up the risk modelling team to undertake more analysis of the results producing valuable insights for stakeholders. This has increased the understanding and confidence of the business in the modelled results, and driven engagement in risk modelling activity across the business.

Business decision-making processes – better connecting risk models and business decision-making

Through this continuous process of engagement and communication with risk modelling teams, business stakeholders will learn to understand and gradually absorb the subtleties and sensitivities of risk models to acquire more confidence. As business stakeholders become more comfortable with risk models, they will have a better appreciation of how the analysis and insights can inform and assist them in their decision-making processes. However, in a business environment where companies are being forced to adapt more and more quickly to change, risk models too cannot stand still. They must continue to evolve with the business. In our experience, the companies that focus on targeting and delivering risk model value outcomes are better equipped to handle continual model evolution.

Companies that have been exploiting their investment in risk models to focus on performance agenda outcomes are now starting to apply their risk models to more difficult business decisions. The risk modelling teams of these companies view on-going time spent engaging business stakeholders to enable them to become more

comfortable with the uncertainty of risk outcomes to be just as important as the time spent on the technical underpinnings of the analysis. This proactive approach enables the risk modelling team to better understand and position themselves to anticipate and respond to business issues and changing market circumstances. In this way, the timeliness and credibility of the insights produced, based on outputs from risk models for use alongside other reliable views and perspectives, are enhanced. This engenders business trust and creates and maintains stakeholder buy-in to risk models for use in decision-making. High stakeholder confidence in risk models supports the business in adapting to material changes in the external environment, such as using risk models to review investment strategy.

“This proactive approach enables the risk modelling team to better understand and position themselves to anticipate and respond to business issues and changing market circumstances.”

Case Study 4 – Using risk models to adapt to the ‘new norm’

Driven by low returns in the current market, our client decided to use its risk model to investigate alternative asset strategies. The aim was to quantify the alternative strategies’ impact on expected return on equity, whilst ensuring they remained within its stated risk appetite.

Having invested heavily over the years in its risk modelling capabilities, our client’s risk modelling team was strongly positioned to respond to this business requirement. The risk model had been developed and embedded within the business over several years. The risk modelling team had spent significant effort in educating and explaining concepts to the members of the Board and Executive, responding to their challenges, and helping them develop an understanding of the outputs and an appreciation of the model limitations. This resulted in a high degree of confidence amongst the Board and Executive members in the model results and understanding of the model limitations, particularly regarding the regulatory capital requirements and implications.

With a streamlined modelling process, members of the team were able to focus on aligning and calibrating the model for Strategic Asset Allocation (SAA). The client’s modelled assets and liabilities were linked to Towers Watson’s SAA module which supports numerical optimisation and efficient frontier generation, as well as producing the range of reporting needed to assess the risk and return implications of alternative asset strategies.

The modelling results provided one of the key pillars for coming up with a recommendation to change the asset strategy. This was supplemented by qualitative overlays to check the robustness of the modelled results, including stress and scenario testing. The risk and modelling teams presented various alternative asset strategies, quantifying the risk/reward trade-offs in each. As the Board and Executive were already familiar with risk model, they were well-positioned to review model outputs and consider the investment strategy options taking into account other key elements of the business. The outcome was a decision to change the investment strategy, which is currently being implemented.

Conclusions

- Risk modelling teams need to better articulate the benefits of and inspire confidence in risk models amongst all stakeholders to continue to generate buy-in and commitment from both inside and outside the business. Focusing on target value outcomes for the business can lead to tangible bottom line benefits for the company.
- In engaging stakeholders across different performance and regulatory/supervisory compliance agendas, risk modelling team leaders need to be conscious at all times of differences in the levels of awareness, understanding and confidence of each stakeholder, and the different outcomes which they expect.
- Better connecting risk models with the business decision-making process strengthens the ability of (re)insurers to work cross-functionally and harness collective knowledge and expertise. This enables such companies to distinguish themselves in the market by developing risk modelling competencies and capabilities which support the creation of sustainable profitable advantage.

How Towers Watson can help your company

Towers Watson has extensive experience in assisting a wide range of clients in getting the most out of their risk models, contributing to senior management confidence in model results, and bringing significant benefits to the bottom line. Our approach to risk model value enhancement can be tailored to meet clients' needs.

Further information

For more information, please contact your usual Towers Watson consultant or:

Yurie Budhu

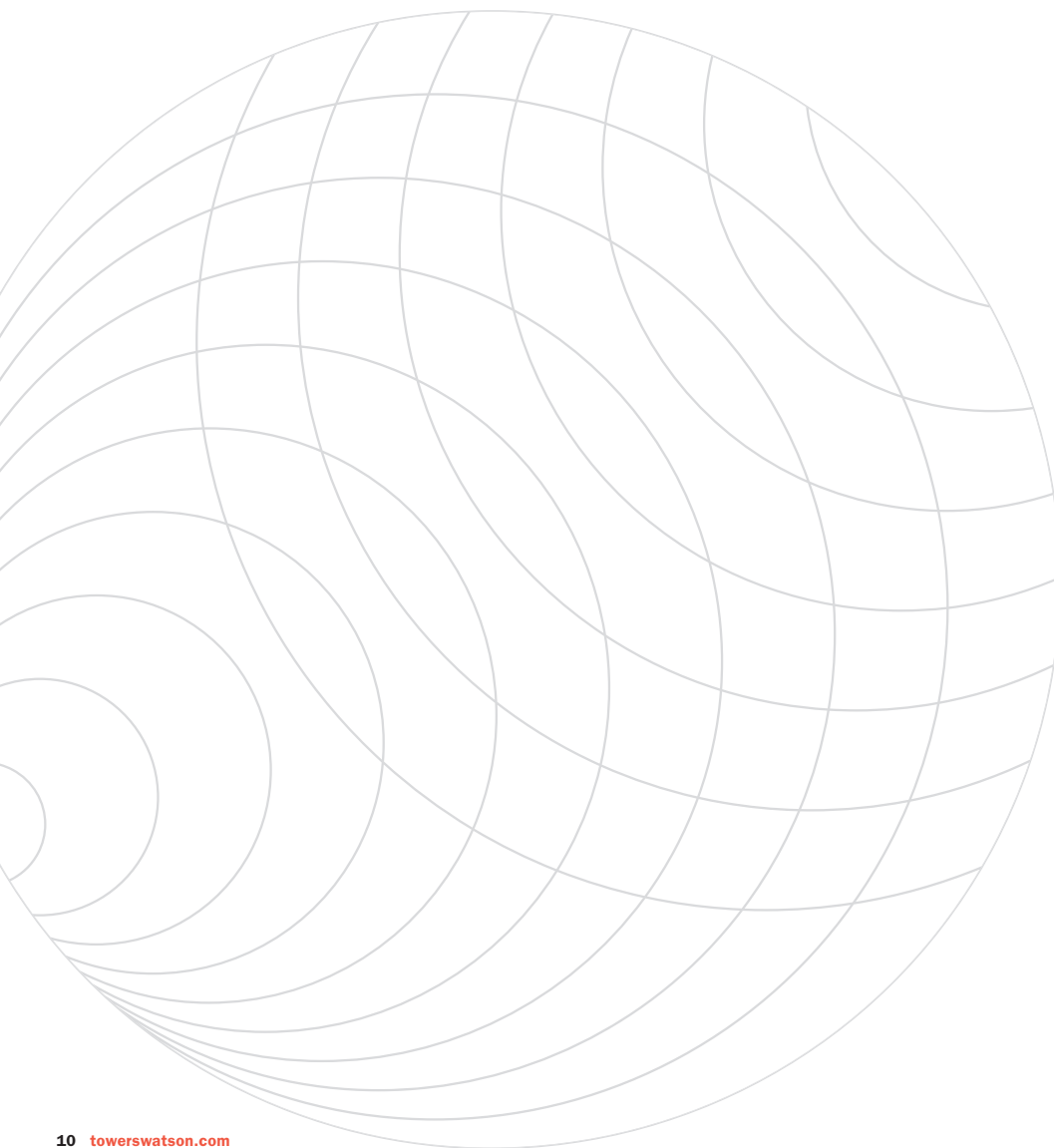
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Delivering risk management into the business – clash of cultures... meeting of minds... adding value

Mike Wilkinson and Sabine Leboulanger

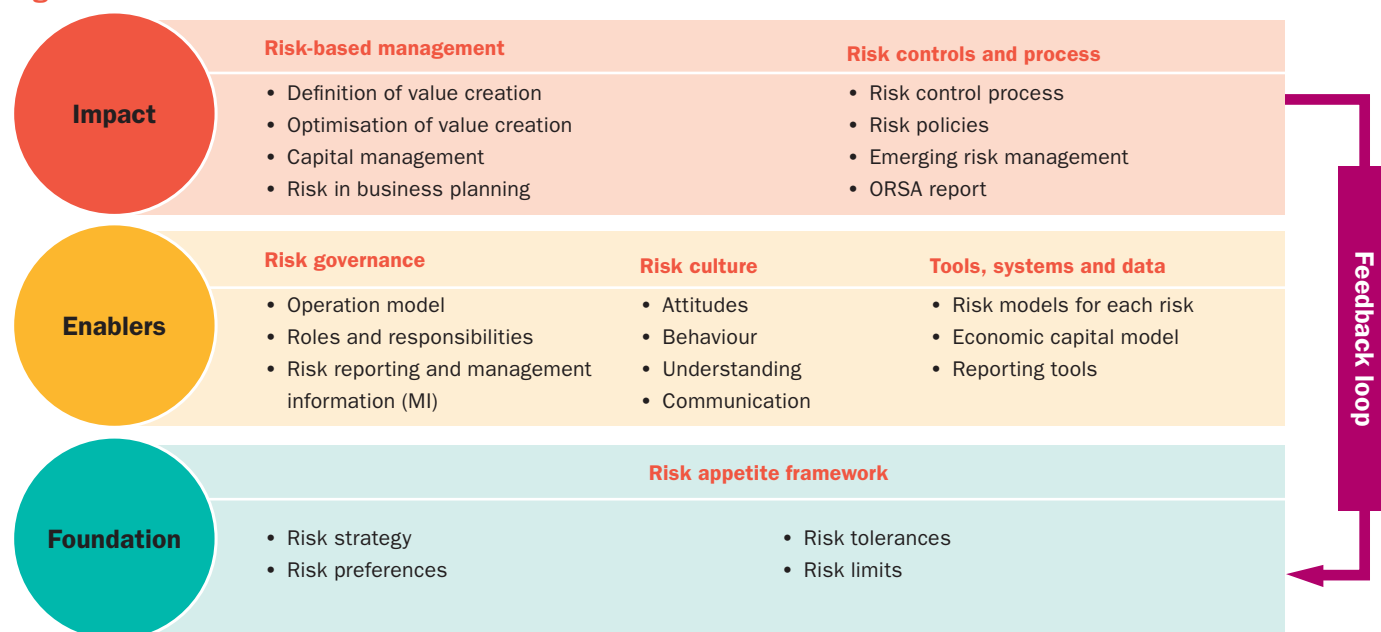
The European insurance industry's investment in Solvency II has yet to yield tangible return. The transition from theory to practical implementation will be protracted, and refinements to risk and capital calculations will continually evolve. Insurers can benefit now from a sensible application of Pillar II to create a firm foundation for integrating more technical risk management into the wider business, but this requires a careful approach to recognise cultural challenges.

"How is our business strategy aligned with our risk profile and strategy?" This is the challenge from the board to the executive. If not now, then soon. If the challenge does not arise, the insurer will stand little chance of implementing risk management effectively in the business as any significant cultural shift must begin at the top. But what does this mean in practice?

Achieving real alignment of the risk and growth strategies is dependent on the risk management system being embedded in the whole management of the company, although this transformation typically requires several years to succeed, improving ERM step by step. Changes will be required to existing policies, processes, responsibilities, governance,

management information, metrics and reporting, with potentially significant implications for each individual regarding their understanding of risk and applying it more explicitly to decision-making. The Own Risk and Solvency Assessment (ORSA) (now renamed by EIOPA to FLAOR) is intended to be the mechanism which explains the ERM framework, how it supports the business strategy and plans, and the way it works from a qualitative perspective, including financial metrics and reporting. **Figure 01**, below, illustrates Towers Watson's view of an insurance focused ERM framework, highlighting the key components required to ensure effective integration across the business. In particular, we have positioned risk culture at its very heart.

Figure 01. ERM framework



Of course any insurer's business has always been about managing risk effectively, so why is it such a cultural issue? In many respects, this derives from the developments both in risk management and regulation changing the way we think about risk. However, both these developments have spawned a new lexicon of risk which, in many cases, has created a divide between those 'in the know' and the business as a whole. We have found incidences of this divide right across insurers' organisations, from board level down to specific business units, functions, locations and roles. The issue works in two ways: by creating barriers to understanding through the introduction of unfamiliar concepts and terminology, and by reducing clarity by using familiar business terminology in different ways within risk management.

In our experience, key success factors for effective implementation are:

- Clarity of purpose and pragmatism in implementation;
- Linkages between strategy, business, technical and financial;
- Prioritisation of the 'journey' to make changes work, step by step, within an iterative process, ensuring the value of each step to the business is recognised;
- Cultural change to develop risk awareness; understanding and responsibilities in the different areas of the company and encourage real ownership of risk in the business;
- Efficiency of the communication; finding common terminology and understanding.

The following examples illustrate effective approaches to delivering risk management into the business.

Example 1: Building an effective risk profile monitoring process

One of the key challenges for insurers and in particular for Chief Risk Officers (CROs), is to ensure that their risk profile, risk appetite, tolerance and limits are aligned and correctly set up to assist the business in achieving its strategic objectives.

The risk profile defines the risks a company is prepared to accept, reflecting the management of its business and operating model. In order for the risk profile to add value to the decision making

processes, it has to be translated into clearly defined risk appetites for each line of business and key risks to which the company is exposed. These should be articulated in both qualitative and quantitative terms, where appropriate, to accommodate not just quantified appetite limits, but also corporate attitudes towards its risks. In our experience, for the risk appetites to be used by the different business units, departments or operations, these should be translated into more granular targets or thresholds, setting up appropriate risk tolerances, risk limits, behavioural expectations and a management framework.

In implementing a practical risk profile monitoring process, we believe that the continuous monitoring of the risk profile should not be seen as a compliance exercise but as a process that contributes to the achievement of the company's strategic goals. For this to happen, it requires the active participation not only of the board and senior management but also the 'buy-in' from the first line of defence – the business units and 'risk takers' in the operation.

The leadership in the company has to drive the definition and setting of the risk appetite and limits. Those responsible for the different business functions have to understand and follow the monitoring framework: they have to *believe* in the benefits of this process and the value of the new metrics as it likely to require changes in behaviour. For example, the continuous monitoring of risk tolerances and limits will help management identify potential difficulties on time so the appropriate corrective actions can be taken.

The ORSA provides an excellent platform to embed this process in the business. However, implementation should be approached iteratively, whereby the company's risk profile, risk appetite, tolerances and limits are reviewed and updated at least annually, as part of the ORSA process. This approach will entrench a cycle of continuously improving alignment of the insurer's strategy, risk appetite, risk limits and operational decision-making, as well as reinforcing cultural alignment.

Many companies have already defined their risk appetite and are now wrestling with the twin challenges of establishing more granular risk thresholds and limits and monitoring their risk profile.

In **Figure 02**, we describe the phases we typically follow to help overcome these issues and develop a practical, risk profile monitoring framework.

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graph LR; P1[Phase 1  
Diagnostic] --> P2[Phase 2  
Risk profile  
and global risk  
appetite]; P2 --> P3[Phase 3  
Segregation of  
risk appetite  
to set up risk  
limits]; P3 --> P4[Phase 4  
Alert thresholds,  
risk control and  
management  
actions]; P4 --> P5[Phase 5  
MI and reporting]; P5 --> P6[Phase 6  
Implementation  
within ORSA  
process]; P6 --> P1; P6 --> P7[A continuous process to monitor the risk profile, including a yearly review of risk appetite and risk limits, as a part of the ORSA process]; P7 --> P1;
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Phase 1
Diagnostic

Phase 2
Risk profile
and global risk
appetite

Phase 3
Segregation of
risk appetite
to set up risk
limits

Phase 4
Alert thresholds,
risk control and
management
actions

Phase 5
MI and reporting

Phase 6
Implementation
within ORSA
process

A continuous process to monitor the risk profile, including a yearly review of risk appetite and risk limits, as a part of the ORSA process

The business strategy and risk strategy must be aligned to provide the board with the appropriate confidence that either will be effective. However, each may also influence the development of the other, therefore business planning and risk assessment processes and timescales should also be aligned to ensure efficiency and consistency, such as in the collection and use of data, allocation of resources and capital model projections. Many insurers are now linking their strategic and business planning and dry run ORSA processes to:

- Achieve process synergies.
- Realise real value to the business from running the ORSA.
- Demonstrate 'use test' of the ORSA and improve understanding of the board.
- Gain experience for further improvement of their business strategy.

effectively requires focused leadership, clearly defined objectives and clear allocation of roles and responsibilities. In practice, this should include:

- Risk input from existing processes such as strategic planning.
- Combined scheduling of strategic planning and the ORSA process.
- Feedback loop between the strategic plan and the ORSA e.g. use the ORSA to refine the strategic plan.
- Efficient communication between the process owners to share useful information and improve complementary processes.
- Use of the governance framework to share integrated business and risk information.

We believe there is no single approach to linking strategic planning and the ORSA processes. The choice of approach will depend on the profile, size, complexity and ambition of the business. However, there are some logical and practical steps that an insurer can follow to achieve the synergies and benefits. This is explored further in the article 'Engaging the business through the ORSA' on page 39.

Critical to this successful integration is the education and the support of the company's senior executives and non-executives, to embed the corporate strategy taking account of its impacts on the risk profile and to provide appropriate challenge in decision-making.

“Integration and consistency of its various components are key for efficient ERM. However, not all targets can be met simultaneously. Creating a realistic roll out timeline covering all elements is critical.”

Stéphane Le Donné, Global Head of Solvency II at AXA

Example 3: Using risk governance and risk culture as enablers of change

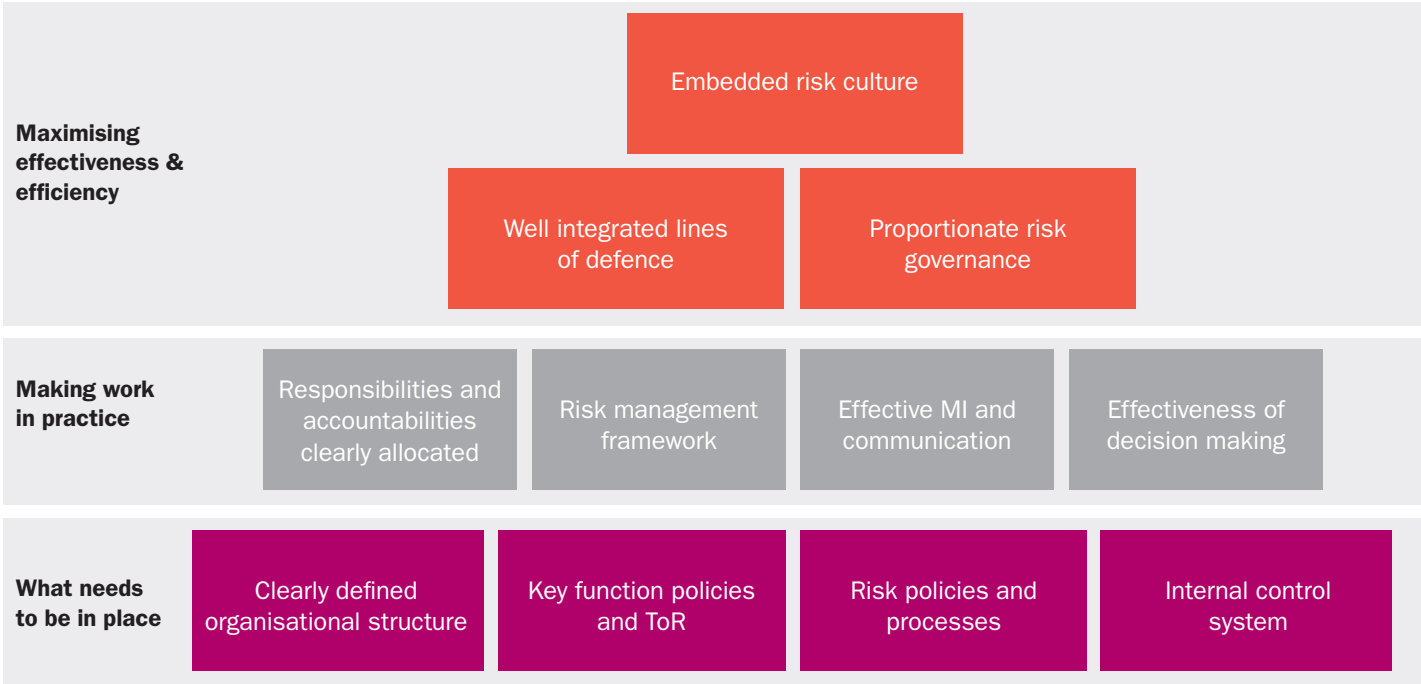
The increased pressure of implementing the new regulatory regime over the past few years has resulted in risk governance being seen by many companies mainly as a regulatory compliance obligation. However, we believe that an effective risk governance system not only protects businesses against unwanted risks but, more importantly, can be an effective driver of change, enabling the organisation to improve its overall business performance by improving its accountability, transparency, communication and strategic decision-making processes. In summary, effective risk governance will assist businesses in taking advantage of profitable opportunities in the market.

Nonetheless, effective risk management starts with clarity around risk strategy, risk appetite and governance. Risk governance, in turn, influences the

culture of the organisation; for example if there are no clear lines of responsibility, this can generate a culture where issues will either not be escalated or will be escalated too late, resulting in losses. The central role of culture in promoting effective risk management has been increasingly recognised both by insurers and supervisors. Indeed, in Towers Watson’s most recent global ERM survey, over 80% of respondents rated risk culture as highly important to their end state vision for ERM – significantly more than for any other component.

The close relationship between risk culture and the insurer’s risk governance operating model is illustrated in **Figure 03** below. It is not uncommon for risk governance to be defined in narrow terms covering the governance functions, risk policies, etc. However, we have found it important to ensure that it is broadly defined to incorporate risk perspectives across all areas of the business, including ‘first line’ business activities.

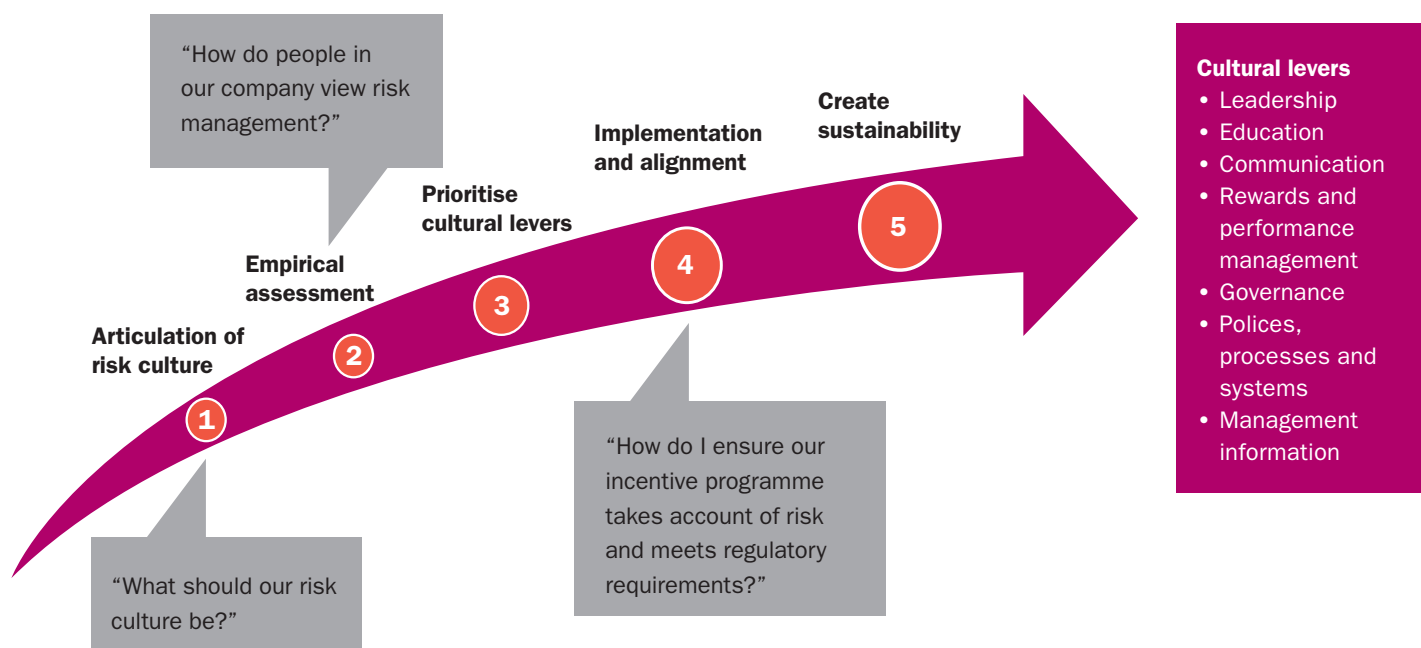
Figure 03. Risk governance operating model maturity framework



A positive risk culture needs the commitment of senior management and will not change overnight, needing continual reinforcement through the governance system and in many cases, educational and change programmes. It is a *journey* as illustrated in **Figure 04**. This journey typically starts with the articulation of an end-state vision of risk culture, performed with active participation of senior management; an empirical assessment, to identify strengths and weaknesses; a prioritisation of cultural levers, to identify which areas the insurer must address in order to improve its risk culture;

implementation and alignment, applying a practical approach and promoting the business buy-in; and regular monitoring, to ensure progress takes place. While there is a logical flow to this journey, in our experience it is not uncommon for insurers to start their own implementation at different points along the path, for good reasons. For instance, beginning with an empirical assessment can be useful to understand the current position and provide a benchmark to measure future progress as well as pointers for articulating the desired state.

Figure 04. Risk culture approach



Throughout this journey, it is important to recognise that developing risk culture should not be seen in isolation, but should be closely aligned with risk appetite, governance and processes. For instance, if current employee attitudes and behaviours do not fit with expectations, the processes, governance and monitoring may need to change to ensure risk

is managed effectively. Equally, feedback loops, performance management and rewards should be used to reinforce the desired behaviours and help to align corporate and individuals' risk appetites. Key to this step is ensuring that the expectations are understood, achievable, evidence based and seen to be fair.

Conclusions

In this paper we have discussed principles and practicalities of integrating new risk management techniques with existing business strategy and planning, processes, monitoring and culture. We believe that to be effective, risk must be seen as part of day to day business activities and not as something separate. However, this requires real, conscious effort – and time – to blend the theoretical with the practical and take account of business realities. Key elements to keep in mind are following:

- Full integration of the business and risk strategies. Clear articulation of the insurer's strategy in the business planning horizon taking into account market conditions, financial performance, risk profile and risk appetite.
- Risk appetite framework supporting the business strategy. Risk appetite definitions and metrics geared towards monitoring performance against the agreed strategy, such as volatility in earnings.
- Processes and roles and responsibilities. Clearly defined processes and an effective risk governance where responsibilities and accountabilities are well defined and communicated.
- Evaluating and monitoring. Agreed framework for evaluating and monitoring performance, defining the appropriate management information, frequency and reporting mechanisms.
- Dry runs and validation of ORSA. Defined process for the independent challenge of the ORSA process, ensuring its implementation follows the expected standards set in the ORSA policy; promoting confidence in the process amongst all stakeholders, internal (board and senior management) and external (regulators and rating agencies).
- Risk culture. This key element will enable effective integration by using the cultural levers to promote a consistent understanding of the risk management approach and information; align all stakeholder expectations around risk; set clear goals for risk attitudes and behaviours and implement a robust monitoring, measurement and management framework.

In our experience, there are four key cultural areas to consider in order to deliver and make risk management work effectively across the business.

• Risk awareness

Creating an environment of overall awareness by each stakeholder of risk and risk management principles; how they relate to the insurer's business, risk profile and their own business area; the organisation's risk management objectives; and expectations of individuals to raise risk concerns.

• Risk understanding

Ensuring each individual has an appropriately enhanced, common and consistent understanding of how risk management is used in the business to enhance performance; risk dynamics and drivers; risk appetite and risk metrics; and appropriate use of statistical analysis in conjunction with judgement to overcome natural biases.

• Risk responsibilities

Clarifying responsibilities for risk management across the organisation, including relationships between business operations and the risk function and between each governance function; ensuring individuals have relevant risk responsibilities defined in their objectives; and appropriately integrating risk into performance management and reward programmes.

• Risk communication

Defining and communicating formal risk metrics and reporting processes; creating an environment of shared knowledge and openness to encourage horizontal and two-way vertical communication; and providing the linguistic framework to promote a shared understanding of risk management and communication.

While we have described delivering risk management into the business as a long journey, we need to recognise that most insurers are not starting from scratch. Risk is part of the business already, although a step change is required for many. And as with so many aspects of ERM, effective implementation requires a clear view of the target end-state and the understanding – and acceptance – that the process will need to be iterative to ensure it works effectively once the theory encounters practical realities in the business. As with any journey, key to success is establishing the right steps along the way, which can demonstrate both progress and incremental value of the approach.

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Behavioural risk – has your ERM framework missed a fundamental risk type?

Graham Fulcher and Matthew Edwards

Enterprise risk management (ERM) in insurance firms has concentrated on such risks as mortality, reserving underwriting, catastrophe, financial and operational risk. In addition insurers, particularly life insurers, have concentrated on behavioural analysis of their policyholders. In this article we will argue that insurers should pay particular attention to the behaviour of their own risk stakeholders and incorporate this behaviour as another risk in their ERM framework.

To put this idea in context, it is instructive to consider how risk management has moved over the last ten years. The focus on sources of variation (in other words, risk) was initially all about parameter risk: how much might equities move? Attention moved on to consider, in particular, how these different parameter risks might interact; and then, with such aspects 'solved', less tangible but very important forms of risk such as basis risk and model risk came into view. But even if a firm has all of these supposedly under control, there is still enormous scope for damage from the behavioural characteristics of its risk stakeholders.



Introduction to behavioural economics

Conventional neo-classic economics was developed on the assumption of individuals (including groups of individuals such as shareholders) having rational preferences among outcomes and acting rationally to maximise utility given these preferences.

However over the last 30 or so years a group of economists have developed the concept of behavioural economics. Behavioural economics explores the limits to the conventional economic approach. In particular it incorporates insights from psychology and especially the ways in which social, cognitive and emotional factors cause individuals to act in ways which appear irrational and demonstrate biases in behaviour and decision making, especially when faced with risk and uncertainty.

In our view Chief Risk Officers (CROs) of insurance companies and others involved in ERM have much to gain from an understanding of behavioural economics. After all one of the important roles of ERM is to help firms to make appropriate decisions in the face of risk and uncertainty. Further management of risk is intrinsic to the very nature of (and indeed economic rationale for) insurance companies. If individuals in an insurance

company (as well as their customers, shareholders and competitors) have biases in the face of risk and uncertainty then it's essential for a CRO to understand these biases, help individuals manage them and understand the implications for the wider risk management framework of the firm as well as its external actions.

Thinking fast and slow

One of the leading researchers in this field is the psychologist Daniel Kahneman who was the winner of 2002 Noble Prize for Economics for his work (principally with the late Amos Tversky) on heuristics and biases and on prospect theory.

Heuristics are experience-based techniques for problem solving such as rules of thumb. Prospect theory is a generalisation of the classical utility approach, which allows for the biases that people exhibit when faced with uncertainty.

Kahneman has pulled together and amplified his work in this field over the last 40 years in his 2012 publication *Thinking, fast and slow*. In this book he draws on recent research in cognitive and social psychology which has given more of an underpinning to many of his insights (which have typically been

“In the context of financial risk management issues, most attention ... targets the measurement and information production activities rather than the decision-making processes that use them. ... human emotions, biases and frames surrounding problems and information play a critical and poorly understood role in risk and top management decisions.”
Luca Celati, *The Dark Side of Risk Management*

discovered by experimental research). As well as identifying the various biases to which humans are subject in the face of risk and uncertainty Kahneman develops a vocabulary that people and firms can use to acknowledge and discuss these biases, and suggests ways in which the biases can be taken into account in decision making.

In the remainder of this article we draw on a small sample of some of the biases that individuals exhibit and discuss applications to the role of risk management in insurance companies. Further, by helping their firms understand the ways in which these biases can impact decision making, that CROs can, in our view, assist their firms with the management of behavioural risk.

Areas that we cover are:

- Anchor bias
- Availability heuristic - risk identification
- Black swans
- Anti-fragility and risk mitigation
- Planning fallacy

Enterprise Risk Management in insurance firms has concentrated on such tangible risks as mortality, reserving, financial, catastrophe, and operational risk. In addition insurers, particularly life insurers, have increasingly considered the behavioural traits of their policyholders. In this article we argue that insurers should pay particular attention to the behaviour of their own risk stakeholders, because their behaviour is itself a considerable source of risk. Indeed, we regard it as a risk as important as model risk, if not more so, sitting 'above' many other sources of risk.

To put this idea in context, it is instructive to consider how risk management has moved over the last 10-15 years. The focus on sources of variation (in other words, risk) was initially all about parameter risk: how much might equities move? Attention moved on to consider, in particular, how these different parameter risks might interact; and then, with such aspects 'solved', less tangible but very important forms of risk such as basis risk and model risk came into view. But even if a firm has all of these supposedly under control, there is still enormous scope for damage from the behavioural characteristics of its risk stakeholders.

Anchor bias

Anchor bias is one of the best known findings of experimental psychology. This bias occurs when individuals are asked to estimate an unknown quantity. If before estimation the individuals are presented with a particular value for that quantity then their estimates inevitably stay closer to that prior value than would otherwise have been the case.

Typically the way this is illustrated is by asking the question in two parts; for example subjects asked the two questions:

- Was the Peace of Westphalia signed before or after 1815?
- What is your best estimate of when the Peace of Westphalia was signed?

Respondents will typically produce answers to the second question significantly higher in average (in some cases even on average 300 years higher) than a group asked the same questions but with the 1815 anchor changed to 1515.

Astonishingly the same bias is produced even when the individuals 'know' (or would if they were acting and thinking rationally) that the anchor in the first question cannot have any influence on the second question (such as when they generate the last three digits of the first number themselves, for example from their own telephone number).

In a purely ERM context, anchor bias is often exhibited by insurers in their choice of parameters when building internal models – a bias encouraged sometimes by a regulatory focus on expecting firms to justify deviations from previous iterations or from some form of market average or standard regulatory formula. Anchoring can also apply in a qualitative sense; insurers can be anchored in their model design to market standard approaches or to models developed for a different context or purpose.

However, the applications are much wider. For example, in our experience a full understanding of anchor bias can be very useful for insurers when involved in mergers and acquisitions.

For a seller, the early release of internal reserve reviews and even sell-side valuations can cause potential buyers to be anchored towards the vendor's own reserve position and preferred valuation.

“Anchor bias is often exhibited by insurers in their choice of parameters when building internal models – a bias encouraged sometimes by a regulatory focus on expecting firms to justify deviations from previous iterations or from some form of market average or standard regulatory formula.”

For a potential buyer it is important to avoid this anchor effect. For example, the buyer might prevent its own teams or advisors from being anchored by

withholding that information from them until they have completed their own work. A second more psychological approach (which proves effective in practice) when presented with a valuation from the target firm is to internalise arguments against this anchor; for example by focusing on other anchors such as the cost to the seller of not making the sale or an estimate of the minimum possible price the vendor could conceivably accept.

Anchor bias can also be important for finance and actuarial teams in insurers when setting reserves for new lines of business (especially where they are long-tailed). In this case it is often the business plan of the new underwriting team (in some cases the business plan which may have formed part of an acquisition or interview process) which can unwittingly act as an anchor. Furthermore the standard Bornhuetter Ferguson reserving technique can mathematically incorporate these results as an anchor on the real results for many years if (as is common) the business plan is used to set prior loss ratios.

One potential application for insurers in their external dealings is explicitly mentioned by Kahneman. Insurers and their insureds have often lobbied for caps on personal injury awards – but Kahneman argues that the very existence of a cap can act as an anchor to judges or juries and cause the average size of awards to increase. Consequently, awards which would otherwise have been set much lower are moved upwards due to the cap acting as an anchor in the award making process.

Availability heuristic - risk identification

Availability heuristic is a shortcut which people make when trying to estimate the probability of events, in which their probability estimate is biased by how front of mind the event is (in other words by the *availability* of the event to their thinking).

One well known example is that public surveys reflect a view that high profile causes of death which typically receive media coverage (tornadoes, accidents, lightning strike) are estimated as being much more frequent than they actually are, whereas the opposite is the case for 'lower profile' causes such as diabetes or asthma.

Even though risk evaluation is the core function of the insurance industry, insurers are not immune from this type of bias as can be seen by reviewing surveys of which risks most concern insurance practitioners.

For example take the Centre for the Study of Financial Innovation: bi-annual *Insurance Banana Skins* survey which asks respondents to rank the risks that most concern them.

Climate change, was ranked 4th in 2007 (the year of the high profile *IPCC Fourth Assessment Report*) falling to 28th two years later, although given the

long term nature of this risk little if anything had changed in its potential impact.

In the 2009 survey the top four ranked risks: investment performance, equity markets, capital risks, macro-economic trends were all clearly related to the financial crisis. Only two years previously these had ranked 11th, 13th, 26th and unranked.

Concerns over natural catastrophe risk varied depending on recent activity: 2nd in 2007 (with the 2005 trio of Katrina, Rita, Wilma still upper most in people's minds) down to 22nd in 2009 (as the financial crisis distracted attention and completely dwarfed the impact of Hurricane Ike) back up to 4th in 2011 (after a range of catastrophe losses globally). Again understanding of the severity and probability of catastrophe risk changed little over this period – what altered was people's perception – even sophisticated professionals working in the risk management industry.

For a CRO (or other executive) whose role is to identify, assess and rank the risks facing a company, a clear understanding of this bias is key in the risk identification process.

We suggest that CROs can adopt a two stage strategy here, splitting risk identification into working risk identification and tail risk identification.

Working risk identification focuses on risks with say a 1 in 10 year return period (or similar order of magnitude). For these risks availability bias can in anything be a positive influence and the focus is on recent historical performance.

Tail risks (say 1 in 200 year risks) are where the impact of availability bias is greater.

Strategies a CRO can adopt in tail risk identification include:

- Consulting as widely as possible in the organisation.
- Reading as widely as possible across industries and looking at historical crises and events so as to expand the number of risks 'available'.
- Looking back at past year's lists of major risks and consciously ensuring that the risk ranking does not vary too much from year to year in light of topical events.
- Encouraging people in risk workshops to reduce their focus on recent events by proposing approaches such as "Imagine you had not read a newspaper for the last five years, what risks would you see as facing our firm?"

Black swans

It has become common for organisations including insurers to say that they are devoting time to identifying potential black swan events (after the famous book by Nicolas Taleb of the same name). In other words insurers regard black swans as being an issue of better risk identification.

This shows a fundamental misunderstanding of black swan events which are by their very nature outliers, outside the realm of regular expectations, because very little in the past can plausibly point to what form they might take. Instead in our view black swans are an issue of risk mitigation. Given the difficulties of predicting these events, most CROs would be better not spending their time trying to identify black swans. Instead, their key focus in these areas should be to reduce the fragility and to increase the robustness of the insurers for which they work to ensure they can better withstand these remote and inherently unpredictable events.

“Insurers regard black swans as being an issue of risk identification...in our view black swans are an issue of risk mitigation.”

Anti-fragility and risk mitigation

The key role of the CRO and of ERM cannot be to try to identify black swans. Instead it is to reduce the fragility and to increase the robustness of insurers to ensure they can withstand these remote and inherently unpredictable events.

In his latest book *Anti-Fragile* Taleb defines fragile entities as ones which are particularly vulnerable to uncertainty, risk and shocks. Robust entities are effectively invulnerable to shocks whereas anti-fragile entities actually benefit in times of stress or volatility. An example of an anti-fragile strategy is buying options on stock market volatility – with downside limited to the option cost and upside unlimited.

Intrinsically insurers (and particularly reinsurers) are fragile entities as their very economic existence is to assist firms (or insurers) with limiting their downside. As Taleb points out in his book, insurance contracts have the opposite pay-off to that described above with upside limited to their premiums and a large potential downside. He gives the example of the Lloyd's insurance industry where “one single episode [asbestos] bankrupted families of Lloyd's underwriters and lost incomes made over generations”.

However, as he also points out, one upside of insurance is that the best reinsurers actually make money from their risk management mistakes as typically after a tail event reinsurance is overpriced during a period of stress. As a result the best run reinsurers can become anti-fragile. The trick as Taleb describes it is for insurers to “keep their mistakes small enough to survive them”.

This was an idea developed by perhaps the most successful insurance practitioner Warren Buffet in 2001 in the aftermath of the World Trade Centre attacks where he stated his three rules of running an insurance company, the second of which was to “limit the business accepted in a manner that guarantees you will suffer no aggregation of losses from a single event or from related events that will threaten your solvency”.

Strategies a CRO can adopt include:

- Ensuring that robustness as a concept is embedded in underwriting risk management practices, so that concepts such as named perils and limited reinstatements are rigorously enforced in hard markets and not replaced in soft markets with unlimited coverage for multiple losses or any perils.
- Concentrating on older fashioned limit measures such as total aggregate exposures by zone/peril alongside the more detailed probabilistic output of catastrophe models. These should be considered on a gross as well as net basis (that is assuming an associated counterparty risk failure). Even the traditional concept of maximum foreseeable losses (MFL) while still susceptible to black swan events is a more robust measure than the 1 in 200 year probable maximum loss (PML) measures currently used which ignore the issue of tail risk.
- Ensuring their firm has a robust source of contingent capital (Co-co), contingent only on a financial impact not on a named event, so that they can take immediate advantage of the market dislocation after an event.

“With a robust approach to risk mitigation a reinsurer can transform itself from a fragile entity to an anti-fragile one.”

With a robust approach to risk mitigation a reinsurer can transform itself from a fragile entity to an anti-fragile one, positioned to prosper in times of stress, shock and uncertainty.

Planning fallacy and related biases

Another key bias that Kahneman and Tversky identified was the planning fallacy, in which plans (for example business plans or project plans) are unrealistically close to best-case scenarios and significantly underestimate the likelihood or potential scale of failure.

Again this is a key area for a CRO whose key role is often identifying the risks inherent in a plan; be that a major project or the insurers' financial business plans over say a one or three year time horizon.

A key remedy to counter the planning fallacy that Kahneman identifies is “reference class forecasting” – that is accessing as wide a possible a source of distributional information about the outcome of similar projects or plans, and especially information sourced from outside the enterprise doing the planning.

For an insurer this typically involves making extensive use of market and external benchmarks and external advice.

There are many related biases which can both cause and aggravate the planning fallacy:

- Anchor bias (as discussed above) so that an initially over optimistic plan becomes an anchor when considering risks.
- The illusion of control and over-confidence; both in explaining the past and when considering the future, individuals are prone to dismiss poor performance or outcomes as one-off bad luck and to attribute good performance to skill. These illusions alongside the planning fallacy are manifestations of a broader bias – the optimism bias.

In the context of setting business plans both these biases are readily observed:

- We have already seen that business plans can often anchor initial financial results and even reserves over a period of time.
- Likely future results are often assessed using an “as-if” version of historical results which explicitly identifies incidences of past poor performance as due to one-off factors and non-repeatable factors and which are therefore removed from the historical records.
- Market outperformance even over a short time period (say five years) is explained as due to some systematic and repeatable feature of the underwriting. Interestingly Taleb addressed this issue of ‘narrative fallacy’ (the attribution of what is really luck and randomness to skill and determinism) at some length in his book *Fooled by Randomness* which first introduced many of the concepts for which ‘Black Swan’ made him famous. He also talked about ‘survivor bias’ – in the context, of say underwriting performance this means that underwriters who underperform the market will typically move firms or stop underwriting so that those with a long track record will have necessarily outperformed the market.

They are however much harder to overcome. One key consideration is simply by training and increasing awareness of these biases; another idea is the pre-mortem (see side box).

Pre-mortem

The psychologist Gary Klein developed the concept of a pre-mortem to overcome the issues of planning fallacy and the associated issues of positive group-think and over-confidence.

Applying this concept to insurance:

Before an insurer commits to a business plan, we suggest that the CRO should gather all key stakeholders in a room and tell them “imagine we are 18 months into the future, we implemented this plan and the outcome was disastrously worse than plan even allowing for the risks we have identified in the plan. Please spend 5-10 minutes writing an email to me as CRO explaining what were the key reasons why the plan failed.” The CRO then goes around the group asking each person to suggest ideas for the failure from their email until all of the causes of the ‘failure’ have been captured and discussed. The CRO can then decide if these risks need mitigating or even may cause the project to be reevaluated.

The power of this simple technique is that it creates a safe environment in which people can express their concerns about the plan. In our view it also has something of a framing or anchoring effect. The very act of anchoring people’s views on the failure of the plan makes it mentally much easier for them to think in terms of the risks of the plan, whereas in a normal business planning context people are committed to and anchored on the success of the plan.

“The very act of anchoring people’s views on the failure of the plan makes it mentally much easier for them to think in terms of the risks of the plan.”

Conclusion

Risk culture is at the heart of an ERM and we have seen great value in firms commissioning an external risk culture survey.

However as we have shown in this article, even risk professionals in an insurer are subject to a number of biases in their behaviours. We have explored a subset of these biases and suggested some ways in which CROs or others involved in risk management can address these risks not just in their ERM framework but in the wider decision making of the insurer.

One starting point for this is to include a behavioural assessment as part of a wider risk culture survey within an insurer.

When developing a capital model one of the most important and often neglected risks is model risk. Model risk can be defined as the *meta* risk of things going wrong with the model due to largely qualitative factors, for example: re-using an inappropriate old model rather than developing a new one: misinterpreting results; failure to communicate the results of the model effectively. Insurers that are most advanced in capital modelling understand and mitigate model risk alongside other risks.

In our view behavioural risk is another meta risk: that risk stakeholders exhibit biases or behaviours which mean that a firm's whole ERM framework does not function as it is supposed to. Those firms who want to develop the most advanced ERM frameworks need equally to manage and mitigate behavioural risk.

Further information

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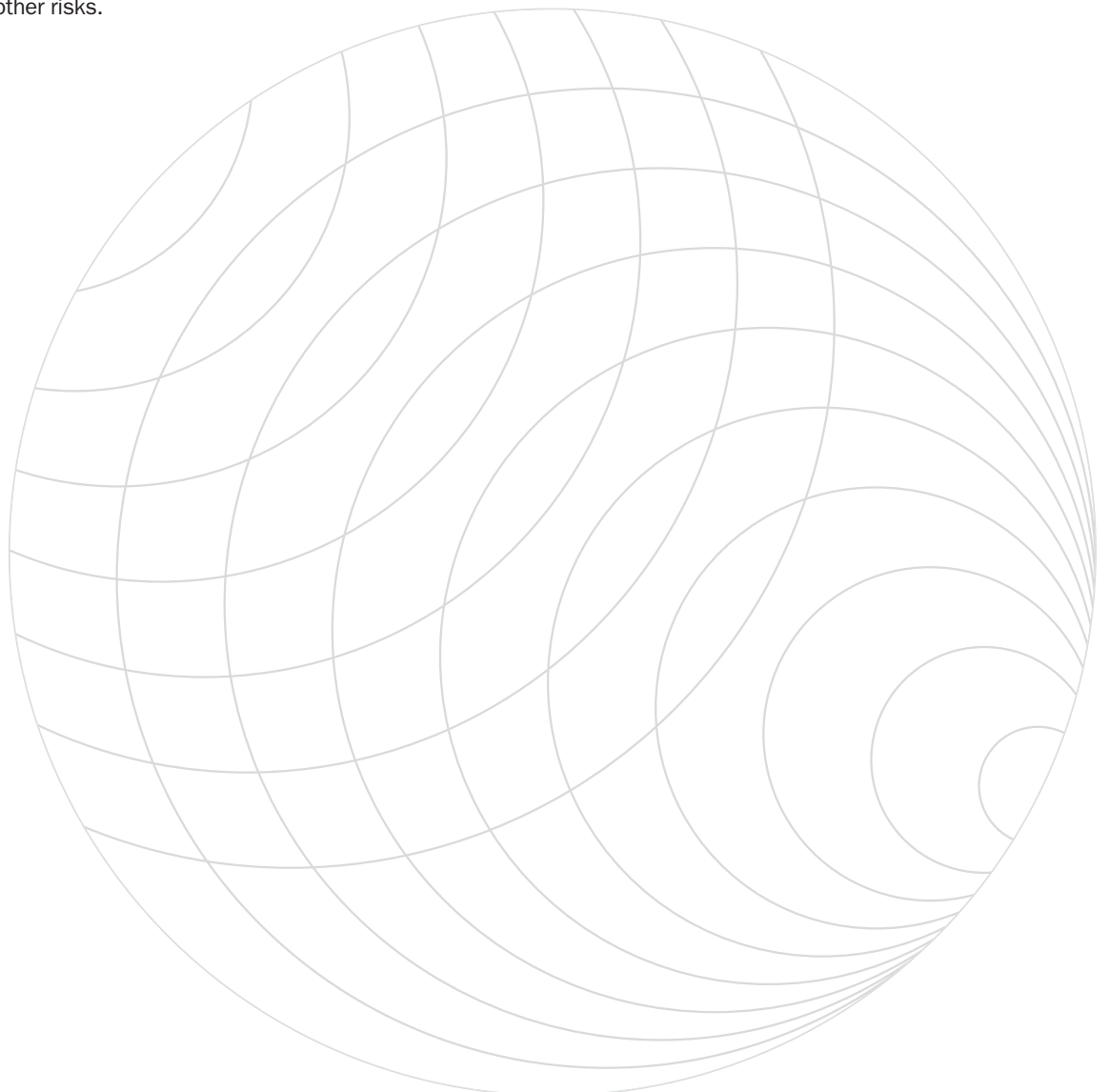
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Extracting value from capital modelling - an inconvenient truth

Rob Collinson

Many conversations with C-level clients in recent months have shared a common theme – “so much energy, effort and cost has gone into the implementation of Solvency II internal models, we really need to start to see some return on the investment now”.

Introduction

The statement above is a reassuringly positive view and acknowledges the role that the internal model can play within a business and demonstrates consistency with the promise of the key foundation principle of the Solvency II Use Test:

“the undertaking’s use of the internal model shall be sufficiently material to result in pressure to improve the quality of the internal model”

However, the pressure to make use of the model to support the business is rarely accompanied by an explicit articulation of what this might mean in terms of realistic benefits, limitations and, significantly, the considerable set of prerequisites that must be in place.

This article is the first in a series on capital modelling. In this article we will examine the pre-requisites that companies need to consider to allow models to achieve full potential. This will be followed by more in-depth articles that look at the consequences of not meeting these pre-requisites together with the pragmatic approaches that can be used to achieve them.

Whilst the difficulties surrounding Omnibus 2 have now resulted in a hiatus, Solvency II timescales have required businesses to pursue a ‘forced march’ to ensure the capability of the calculation kernel to generate a defensible ‘snapshot’ SCR.

As businesses make the transition from the ‘soft’ regulatory use case to the support of ‘hard’ business use, it is necessary for businesses to face some uncomfortable truths.

As companies developed their models, weaknesses within the model design or errors and approximations in the implementation have sometimes been compensated for within the existing parameterisation. The key aim of this was an SCR which, for the most part, was known before the modelling exercise started.

However, when used as apparently intended by the designers of Solvency II, the model can potentially be supporting decisions that put significant sums of money at risk. It is likely that many such business decisions will require the calculation kernel to represent novel situations, the result of which is not known before the model is run.

So what are the key pre-requisites required to enable firms to allow models to achieve full potential?

- Reliability and model assurance – how can a business achieve and describe the confidence that they have in the model
- The integration of the business risk tolerance with business objectives in the modelling process
- Real value from the model

Reliability

The first pre-requisite centres on the key property of reliability. This simply relates to the confidence that the business can have that the internal model does what it is supposed to do. Internal models are typically unavoidably complex structures and will frequently produce perfectly ‘correct’ but unintuitive results. How is it possible to differentiate undesirable model behaviour from genuinely useful but unexpected insights?

Whilst slightly prosaic and much misunderstood, robust and comprehensive testing is the only sure approach. In principle, the aim of model testing is simply to determine that the model will behave ‘correctly’ in all reasonably foreseeable circumstances. This requirement means that it is not appropriate to assume that because the model behaves reasonably for the current calibration that it will also do so for another arbitrary structure and parameterisation.

In addition, there should be recognition that the model will be at risk of being subject to ‘out of scope’ or otherwise invalid inputs. In such circumstances the model must behave predictably and in extremis it is preferable that the model

should fail by halting execution rather than produce subtly misleading results.

The extent of such testing has a direct impact upon the extent to which a model can safely be

used to support any material business decision. The table below sets out seven key stages of testing together with the consequences on scope of the model to safely support the business in the decision making process.

Testing Stage	Testing Scope	Model Capability
0	Limited or no testing	Should not be used to draw conclusions about the business or support use
1	Reconciliation to current plan and broad reasonableness	Should not be used to draw conclusions about the business or support use
2	Independent replication of methods and test against current calibration	Should only be used with caution to draw conclusions about the business or support use
3	As Stage 2 but with narrow range of “normal” parameters	Should only be used to draw conclusions or support use for small changes to the business
4	As Stage 3 but including full range including “extreme” parameters	Can be used to support most appropriate business scenarios. But requires strong processes and discipline
5	As Stage 4 but including invalid parameters	Can be used to support most appropriate business scenarios with confidence
6	As Stage 5 but test process built into all new developments	Can be used now and as the model evolves to support business decisions with confidence.

The development of capital models is entirely analogous to the development of any other software product. However, whilst all commercial software developers will almost certainly be at the 6th stage of testing, the same may not be said of many insurance businesses having implemented models who remain at the very earliest stages. The consequences of this scale of testing are profound and potentially mean that such models cannot, with confidence, be used to support any material business decision.

The next line of defence for businesses in ensuring the appropriate conclusions are drawn from model output is to ensure that the key consumers are appropriately equipped to understand and investigate both unexpected and seemingly unexpected. Capital models can provide genuine insight into the manner in which the various parts of a business interact, particularly in stressed situations. However, this behaviour is frequently unintuitive and regularly requires the business to question whether an insight is genuine or an articulation of a problem with model calibration or methodology.

It is therefore crucial that the business develops a systemic process by which the key drivers of any given result can be clearly identified enabling model users to gain an immediate view as to the likely reliability and provenance of results. With experience, businesses inevitably build their own approach to such investigation, but are likely to include some core staples such as comparison of the mean financial statements with business plan,

capital driver analysis and an understanding of the impact of dependency, particularly in the tail.

However, it is worth noting that such review makes significant demands upon the output of the model, requiring a significant volume of diagnostic information not directly required for capital calculations but necessary to obtain the confidence necessary to understand and make use of any output.

Finally, the independent validation process was formalised by Solvency II and sets a standard for independent challenge of a model to ensure that it represents a realistic and robust representation of the business, covering all material risks. This is well documented and is a key tool to ensure the sustained reliability of the model.

Usability

The principle of usability relates to the extent to which a model can be deployed in a sustainable manner that integrates within, and enhances the decision making processes within the business. Whilst the properties that confer ‘usability’ are relatively mundane, it is crucial that they should not become barriers to use. Whilst many features together contribute to eventual usability, including issues such a maintainability and transparency of results, the ease and speed with which the modelling process can be completed ‘cradle to grave’ is a key and meaningful metric.

The period of time taken to complete a model run has become a primary issue for almost all model implementations, having been broadly relegated to a second order issue during the build phase for many.

It is worth noting that, in addition to the requirements for increasingly short run times, the market standard for the number of simulations continues to increase. Whilst this should of course ultimately depend upon the business' own requirements, the practice of peers inevitably has an impact upon the expectation of regulators, putting still greater emphasis on the run time of models.

It is crucial that the model can run in a sufficiently short period of time to be integrated within the typically short time window available for business decisions: as a general rule of thumb, we have observed that for successful integration in the process, models must be capable of being fully run twice within a working day, giving opportunity for the calibration errors and adjustments that are an inevitable part of 'real time' modelling.

However, it should be noted that model run time is only a single component of the total time required in a full process ranging from preparation and cleaning of data, through calibration and finally reporting and interpretation.

Decision constraints

The key role of the model in the support of decisions is to place a coherent structure upon the tension between the propensity to accept risk and the strategic and tactical goals of the business. This role gives rise to the remaining pre-requisites:

- The business has a methodology and process to evaluate the options available for any given decisions.
- The business has a clearly articulated view of risk appetite, each element of which is susceptible to measurement and which is indeed *actually* measured

With any potential decision it is necessary to articulate how the consequences fit with the risk appetite of the firm and, in particular, that the decision does not contravene one or more of these constraints. As a result it is important that the risk appetite statements are specified in a form which can be easily compared to model output (for example linking directly to a source of profit/loss in the model).

It is necessary for each appropriate risk appetite statement to be capable of expression in a suitable form to enable the business to decide if a given potential decision contravenes one or more of these constraints. Capital model consistent articulations of risk appetite are therefore necessary to form the 'decision space', defining the unique within which any action the business takes must exist.

Conclusion

The race to add value through the capital model is gratifying for all modellers; recognising as it does the capability of the tool to highlight valuable but potentially obscure insights. Equally important however, it is also crucial that the business understands the risk of model use and the minimum key safe guards that must be in place to make the best use of the tool.

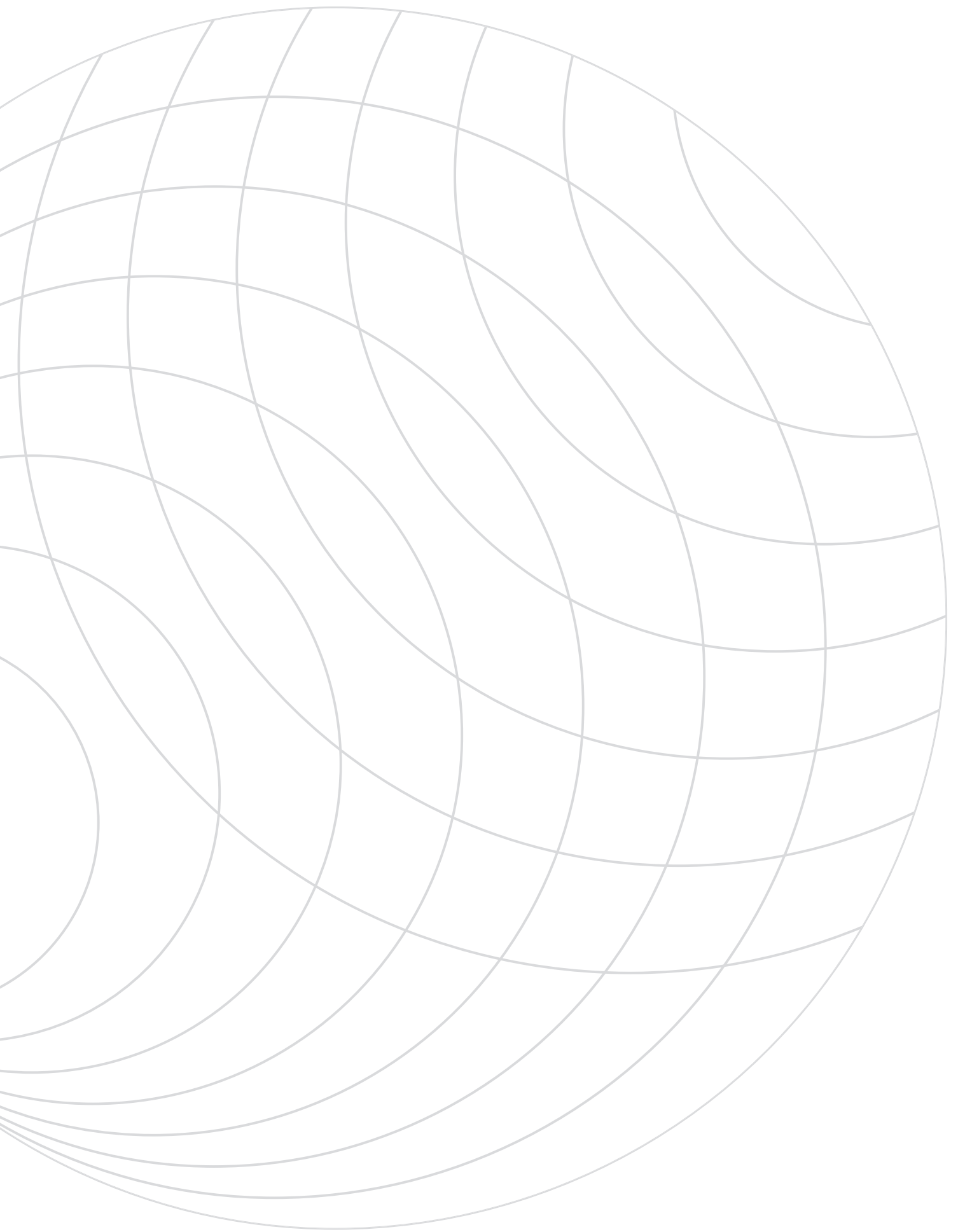
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‘Most risk management is really just advanced contingency planning and disciplining yourself to realise that, given enough time, very low probability events not only can happen, but they absolutely will happen. The definition of infinity is that if you wait long enough, everything happens.’

Lloyd Blankfein, Goldman Sachs CEO, July 2013.

Introduction

This quotation highlights one of the important reasons for considering extreme risks. Extreme risks are potential events that are very unlikely to occur (therefore infrequent), but could have a significant impact on economic growth and asset returns should they happen. We continue to argue that a robust risk management approach should not stop at a particular percentile (whether VaR_{95} or $\text{VaR}_{99.5}$) and have updated the extreme risks paper we wrote in 2011.¹

In the following article we first examine what we have identified as the top 15 extreme risks and consider their potential impact. We then focus more specifically on insurance with highlights of a survey carried out over summer 2013 that sought the views of executives on which extreme risks mattered most for the insurance industry.

The top 15 risks

We maintain a list of the top 15 extreme risks in the following six groups:

- **Financial:** This category of extreme risks concerns an inability to meet liabilities. This can occur as a liquidity event, such as a **banking crisis**, where an institution has insufficient cash or other liquid assets to meet a current demand for payment, even if the institution has more assets than liabilities. Failure to make that payment can cascade rapidly through the financial system, with further institutions then unable, or unwilling due to a collapse in trust, to meet their own payment demands. The alternative mechanism for a financial extreme risk is a solvency-driven crisis, such as an **insurance crisis** or **sovereign default**, where there are insufficient assets to meet the liabilities irrespective of how liquid the assets are.
- **Economic:** These risks arise from a shock to growth, a shock to price levels, or a collapse in trust which is essential for the efficient working of any economic system. Growth shocks can take the form of a **depression** or **stagnation**. The former has a painful contraction phase but then relatively swift recovery, compared to a stagnation episode where growth is weak for an extended period. Price level shocks can occur in opposite directions; rapid rises in hyperinflation (an extreme risk considered but not included in the top 15) and falling prices in **deflation**. In both cases the ‘incorrect’ price signals cause serious economic damage and destruction of wealth. If a collapse in trust occurs in the value of a major currency, a **currency crisis** follows.
- **Political:** This category of extreme risks comprises those which derive from policy decisions. **Global trade collapse** follows policy decisions to favour protectionism over openness and globalisation. **Terrorism** is included in the political category due to its ideological foundation, and as the target chosen for the act of terrorism is likely to have political ramifications.
- **Environmental:** The risks in this category are threats to human safety and well-being arising from a disruption to planet earth’s environment. Only one environmental extreme risk is included in the top 15 – **global temperature change** caused by human behaviour that tips Earth’s climate into a less-habitable state.
- **Social:** The social extreme risks are those threats that could adversely affect the smooth functioning of society. It should be noted that the categories we are discussing are not independent and the social risks link to policy decisions, the environment, and, in some cases, to technology. This is obvious in the case of **food/water/energy crisis** which will have political, environmental and technological drivers as well as offsets. **Health progress backfire** refers to a reversal in the trend of improved health while, in the other direction, **extreme longevity**

¹ ‘Extreme risks – the 2011 update’, Towers Watson, 2011.

becomes a risk when viewed through the lens of a retirement provider. In most other contexts it would be considered a boon.

- **Technological:** Our final category of extreme risks concerns technology. The two risks included in the top 15 represent a failure in current technology (**nuclear contamination** and **infrastructure failure**) but it should be noted the risks can also arise from the possible consequences of emerging technology (eg cyber warfare and biotech catastrophe).

Assessment and ranking

To decide which risks are included in the top 15 and to rank their respective importance, we assess the risks in the following ways:

- **Likelihood:** the more likely a risk, the higher up the ranking it should be.
- **Impact** is considered in two dimensions: intensity (whether a risk event is 'endurable', 'crushing' or 'existential') and scope (whether a risk event has a local or global impact or an impact beyond just the current generation). The

greater the intensity of impact and the larger the scope of the impact, the higher up the ranking a risk should be.

- **Uncertainty:** how certain are we about the likelihood and the impact of the risk? The less uncertainty, the higher up the ranking the risk should be.

Our ranking is shown in **Table 01**. At the top of our ranking is food/water/energy crisis. This is primarily driven by our assessment that this is one of the most likely risks and that there is relatively little uncertainty attached to either the likelihood or the consequences. The consequences themselves, locally crushing, are not particularly severe (in relative terms) and so these are not a driver of the top ranking. The second ranked risk, stagnation, differs only in respect of the intensity of impact which is assessed to be enduring rather crushing. In contrast the third ranked risk, global temperature change, has much more severe consequences (trans-generationally crushing) but is assessed to have a lower likelihood of occurring. The ranking highlights the risks to prioritise when it comes to management actions.

Table 01. Extreme risks ranking as at 30 June 2013 – top 15 risks

Rank	Risk	Description
1	Food/water/energy crisis	A major shortfall in the supply of food/water/energy
2	Stagnation	A prolonged period of little or no economic growth
3	Global temperature change	Earth's climate tips into a less-habitable state (hot or cold)
4	Depression	A deep trough in economic output with massive increase in unemployment
5	Global trade collapse	A worldwide protectionist backlash against cross-border trade
6	Banking crisis	Banking activity halts due to lack of liquidity
7	Sovereign default	Non-payment by a major sovereign borrower
8	Currency crisis	Extreme movement between floating rates
9	Deflation	Goods and services prices fall for an extended period
10	Health progress backfire	Massive rise in morbidity or mental ill-health, antibiotic resistance
11	Nuclear contamination	A major nuclear disaster, leading to large radioactivity release and lethal effects
12	Extreme longevity	Significant increase in life expectancy overwhelms support systems
13	Insurance crisis	Insolvency within insurance sector
14	Terrorism	A major ideologically-driven attack
15	Infrastructure failure	An interruption of a major infrastructure network

*Our subjective measure based on the intensity and scope of the impact, the likelihood, and the degree of uncertainty in assessing the risk level

Investment implications

While interesting in its own right, we believe the consideration of extreme risks can be useful in helping to design more robust investment portfolios and more robust risk management processes.

The starting point in building a robust investment portfolio and reducing (but not eliminating) tail risks is to introduce greater diversity. The next step is to explore some hedging strategies and, broadly, there are three alternatives available to us:

- Hold cash. The option value of holding cash increases in periods of market stress, allowing investors with cash to buy truly cheap assets.
- Derivatives. It is worth mentioning that cost and usefulness are often in opposition. The cost of derivatives protection can often be reduced by specifying more precise conditions – but the more precise the conditions, the greater the chance that they are not exactly met and hence the ‘insurance’ does not pay out.
- Hold a negatively-correlated asset. There is no single asset that will work against all possible bad outcomes. Furthermore, there is no guarantee that the expected performance of the hedge asset will actually transpire in the future event.

In essence the exercise of considering extreme risks is time spent on ‘pre-mortems’. While a post-mortem seeks to establish the cause of death, pre-mortems are about trying to determine in advance what could, colloquially, kill you. We

believe that being adept at pre-mortems means you are a better risk manager, and can react more flexibly in the event of an extreme event happening, particularly as the event is unlikely to evolve precisely along the lines predicted. Consequently, the obvious application of extreme risk thinking is in stress-testing or scenario planning, but it is also constructive to consider whether the thinking can be incorporated within the process for managing an investment institution’s balance sheet.

One option would be to penalise the existing ‘normal state’ assumptions by slightly reducing expected returns, or pushing up volatilities, and/or correlations to reflect the impact of infrequent extreme events. A second option is dynamic switching of some sort. We either build two sets of assumptions (‘normal’ and ‘extreme’) or we design a second, extreme-risk, portfolio directly from first principles. Then ‘all’ that is left to do is successfully time the switch between the two, not forgetting the need to time the switch back so we can go on harvesting returns when the conditions are conducive.

We would also advocate establishing some sort of early warning system to closely monitor what could develop into extreme events. While this is probably once again one of the areas where things are easier said than done, some promising research does show signs of predicting the seemingly unpredictable. For example, Didier Sornette and his Financial Crisis Observatory have plotted a set of early warning signs for unstable, growing systems.²

² This is explained in a talk given by Didier Sornette, the director of the Financial Crisis Observatory (http://www.ted.com/talks/didier_sornette_how_we_can_predict_the_next_financial_crisis.html)

Survey results

Over the summer we invited insurance executives to engage in a survey on which extreme risks matter most for the insurance industry. This paper provides an analysis of the responses to the survey.

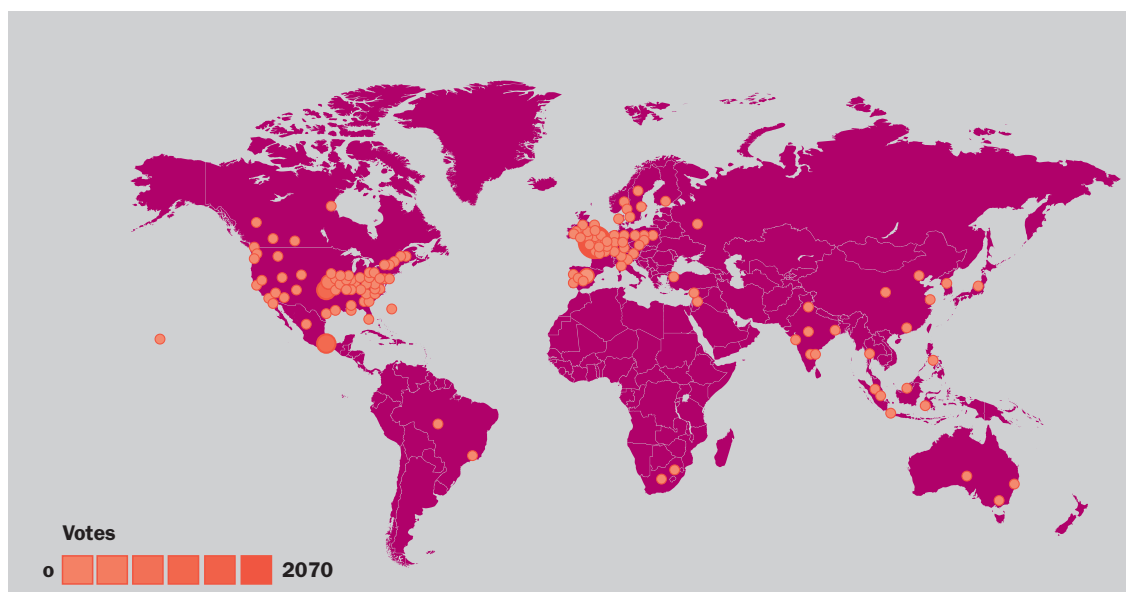
We used a relatively new way of gathering views and ideas – a wiki survey. Wiki surveys are open, simple and are seeded with initial ideas, in this case the extreme risks discussed in our research paper.³ Participants were asked the question ‘Over the long term, which is the biggest extreme risk for

the insurance industry?’. They were presented with two of the extreme risks selected by an algorithm,⁴ and either clicked on the one they thought was the biggest threat or had the opportunity to submit their own idea.

The response to the survey was beyond our expectations with over 30,000 votes being cast from countries spanning the world.

While the voting activity was heaviest in the USA and Europe there was a wide geographical distribution of participants as shown in **Figure 01**.

Figure 01. World map of all votes



The ranking of all seeded and user-submitted ideas is shown in **Figure 02**. Their respective score is calculated as the estimated chance that the idea would win against another randomly chosen idea. For example, a score of 100 means the idea is predicted to win every time and a score of 0 means the idea is predicted to lose every time. Interesting observations from the ranking include:

- Pandemic, natural catastrophe and food/water/energy crisis are voted by respondents as the three most important extreme risks for the insurance industry to worry about in the long term
- We would suggest that #4, cyber warfare, and #5, threats relating to data stored in the cloud, are closely related with one being a more extreme version of the other.
- Risk #8 was submitted by a respondent and refers to an unidentified event that causes property damage, supply chain failures, business interruption and death on a significant scale.

While the risk description clearly sets out the liabilities the insurance industry would face, it is a shame the source of the risk is not identified as this would give some idea as to whether it was hedgable or not.

- A clustering of risks could be made from #9, rise in extreme weather that exceeds the capacity of insurance industry, which could be argued, is one of several potential manifestations of global temperature change (#26), as are rising sea temperatures (#17)
- At the bottom end of the ranking we see the threats that respondents collectively opted not to worry about. It is interesting to see that factors specific to the insurance industry were included in these low rankings including higher own fund requirements #46, dis-intermediated by technology #48, change in tax policy #51, and breakdown of motor market #56

³ Please see ‘Extreme risks, the irreversibility of time and the retirement anomaly’, Towers Watson, 2013 and ‘Extreme risks – 2013’, Towers Watson, 2013. Or, for a shorter summary, please see ‘Extreme risks summary paper – 2013’, Towers Watson 2013

⁴ The algorithm is essentially random, but with tweaks. For example, new user-submitted ideas have a higher-than-random chance of being selected in order that a meaningful number of votes on them (positive or negative) can be gathered.

- Of interest to us is the very low ranking of the user-submitted idea of super volcanos in the US (#53) when the natural catastrophe seed idea is ranked at #2. For us, a super volcano is an intrinsic part of thinking about extreme natural catastrophe risk. Consequently we wonder whether respondents in effect voted for a 'confluence' of more 'traditional' natural catastrophe risks rather than extreme versions (eg magnitude 10 earthquake plus 30 metre tsunami). This could be due to behavioural biases (such as availability or recency) with insurance respondents influenced by recent events or by those for which they most commonly plan.
- Cosmic threats or aliens invading were not deemed a significant worry for responders. However, it is not clear whether this is because the threats are too remote, or because *force majeure* clauses in insurance contracts would make these liability-free events

Figure 02. List of ideas

Rank	Idea Text	Wins	Losses	Score	Seeded/User-submitted
1	Pandemic: A new, highly infectious and fatal disease spreads through human, animal or plant populations worldwide	1095	427	71.9	Seeded
2	Natural catastrophe: A confluence of major earthquakes, tsunamis, hurricanes, flooding and/or volcanic eruptions with major global effects	1009	521	65.9	Seeded
3	Food/water/energy crisis: A major shortfall in the supply of, or access to, food/water/energy, causing severe societal issues	1054	554	65.5	Seeded
4	Cyber warfare: Computer sabotage/espionage at a major scale, with severe damage to infrastructure, financial, medical or defense systems	1009	538	65.2	Seeded
5	Technology: Large quantity of personal, business, or government data stored in clouds are found to be hacked, compromised, or misused	173	96	64.2	User-submitted
6	Depression: A deep and protracted trough in economic output, massive increase in unemployment, restriction of credit, shrinking investment	1012	573	63.8	Seeded
7	Banking crisis: Central banks unable/unwilling to supply liquidity in the next crisis, causing banking and real economic activity to stop	960	560	63.1	Seeded
8	An extreme event that causes property damage, supply chain failures, business interruption and death on a significant scale	329	192	63.1	User-submitted
9	Rise in extreme weather: Events exceed the capacity of insurance industry and governments to respond, with physical and social implications.	495	290	63.0	User-submitted
10	Sovereign default: Non-payment by a major sovereign borrower, causes market panic and adversely disrupts the global economy	988	603	62.1	Seeded
11	Hyperinflation: Prices increase rapidly, wiping out savings, provoking extreme consumption and hoarding of real assets	981	601	62.0	Seeded
12	Infrastructure failure: An interruption of a major infrastructure network, disrupting economies or impacting basic needs	943	590	61.5	Seeded
13	Default with Knock-on effects: extreme event leading to default of major insurer/reinsurer, then resulting in difficulties for many others	267	189	58.5	User-submitted
14	Terrorism: A major ideologically-driven attack on an important target, inflicting large-scale human and financial damage	907	665	57.7	Seeded
15	EUR-Break up with political turmoil and wars	285	220	56.4	User-submitted
16	Regulatory paralysis: Regulations are introduced that significantly constrain the insurance industry removing consumer choice and competition	512	410	55.5	User-submitted
17	Rising sea temperatures: Leading to increased flood risk and cyclonic activity	520	427	54.9	User-submitted
18	Biotech catastrophe: Biological technology (genome, nano, etc.) is applied in a destructive way, either intentionally or inadvertently	844	717	54.1	Seeded
19	Break-down of capitalism: Distrust in the private capital/property system, causing a collapse in economic activity and asset prices	835	711	54.0	Seeded
20	Inability of our form of government to effectively manage spending and taxes - destroying entrepreneurship	121	103	54.0	User-submitted
21	Anarchy: Income inequality and modern communication cause extreme social disorder in a major state, causing government and economic collapse	808	695	53.8	Seeded
22	Biodiversity collapse: Destruction of the world ecosystem leading to problems with human food and water supplies, disease, or climate issues	851	732	53.8	Seeded
23	Currency crisis: A significant devaluation of a major currency that becomes self-fulfilling, with loss of purchasing power	829	717	53.6	Seeded
24	Extreme longevity: Advances in medicine or genome science significantly increase life expectancy, overwhelming support systems	842	748	53.0	Seeded
25	Global trade collapse: A protectionist backlash against cross-border mobility of labour, goods and capital, causing global trade to collapse	808	719	52.9	Seeded
26	Global temperature change: Earth's climate tips into a less-habitable state (hot or cold), disrupting social and economic systems	821	737	52.7	Seeded

Rank	Idea Text	Wins	Losses	Score	Seeded/User-submitted
27	A weak public sector and high social disparity leave society unprepared to face collective challenges like pandemics or major cat events	359	327	52.3	User-submitted
28	Under reserving: companies lowering assets backing reserves in an attempt to increase reported profits.	151	138	52.2	User-submitted
29	Stagnation: A prolonged period of little or no economic growth, usually accompanied by high unemployment	845	773	52.2	Seeded
30	Nuclear contamination: A major nuclear event, leading to lethal effects on individuals or large radioactivity release to the environment	805	752	51.7	Seeded
31	Political extremism: The rise to power in a major economy of an oppressive government, leading to mass murders and threat to global peace	794	748	51.5	Seeded
32	Social Contract Erosion: Unwillingness of persons, legal systems, governments to abide by prior binding contracts (coverage, limits, etc.)	503	474	51.5	User-submitted
33	Deflation: Goods and services prices fall for a long period, transferring wealth from borrowers to savers; often associated with Depression	731	775	48.5	Seeded
34	Religious fanaticism: A wave of religious fanaticism (Islamic, Christian or other) disrupts social and economical structures	130	139	48.3	User-submitted
35	Peak Oil: Declining oil supplies disrupts transportation and food production, resulting in economic, financial, and political collapse	434	479	47.5	User-submitted
36	Elimination of Middle Class: Upper Class captures more and more wealth, thereby eliminating the middle class, which reduces insurance sales	307	353	46.5	User-submitted
37	Population explosion: the BRIC countries lift their population from poverty causing exponential consumption growth and adverse consequences	111	130	46.1	User-submitted
38	World War III: A military war among many of the world's major countries, killing many millions, destroying physical and human capital	690	841	45.1	Seeded
39	The definitive disconnect between economic growth and employment because of technological advances leading to societal unrest	406	502	44.7	User-submitted
40	Solar weather event: electricity is interrupted throughout large portion of the United States for several months.	172	235	42.3	User-submitted
41	Health progress backfire: Massive rise in morbidity or mental ill-health, perhaps due to an unintended consequence of new health practice	612	866	41.4	Seeded
42	Nitrogen shock: Over-fertilization leads to soil degradation and oxygen-starved freshwater lakes and oceans, fish populations collapse.	265	428	38.3	User-submitted
43	Abandonment of fiat money: A collapse in confidence in the purchasing power of paper currency and the consequent return to a gold standard	579	963	37.6	Seeded
44	Peace project EU fails, national tendencies increase, stop of European integration	261	454	36.5	User-submitted
45	Technological singularity: Technological advancement proceeds beyond the point of human understanding or control, threatening human life	520	950	35.4	Seeded
46	Change in Legislation: higher own fund requirements than in S2	178	331	35.0	User-submitted
47	Organised crime: A significant increase in the scale of illegal operation in a major economy, threatening legitimate economic activity	497	1040	32.4	Seeded
48	Sharing Economy: continued trend of democratization, insurance reverts to its main form-risk pooling-through technology (eg Kickstarter)	227	489	31.8	User-submitted
49	Cosmic threats: Planetary risks such as a big meteorite impact, changed orbit due to a passing asteroid, or giant solar flare/magnetic storm	481	1059	31.3	Seeded
50	Anti-immigration sentiment leads to vigilante activity in major cities around the world	102	240	29.9	User-submitted
51	Significant change in tax policy that penalizes off-shore transactions	190	535	26.3	User-submitted
52	On-going high levels of political correctness, eg. EU gender ruling.	125	364	25.7	User-submitted
53	Super volcanos in the US (Yellowstone)	67	207	24.6	User-submitted
54	Integration of man and machine yielding a form of immortality	87	393	18.3	User-submitted
55	Advances in cryogenics that allow people to be preserved for extended periods and then reawakened.	40	185	18.1	User-submitted
56	Break down of motor market due to automatic driving gears	86	436	16.6	User-submitted
57	Alien invasion: An invasion of non-peace-seeking aliens that seek either to remove the planet's resources or enslave /exterminate human life	205	1317	13.5	Seeded

Figure 03 compares the ranking of the seed ideas from the survey with that of Towers Watson's research (user-submitted ideas have been excluded). The Towers Watson ranking assesses the extreme risks in a more generic way with respect to the economy, business/investment activities, general society and, in some cases, the future of the human race. The wiki survey responses specifically reflect an insurance industry perspective, and this is the key driver of the discrepancies seen in the two rankings. Some observations from the comparison include:

- Food/water/energy crisis is considered as one of the top three extreme risks for both general society and the insurance industry
- While pandemic, natural catastrophe, cyber warfare and hyperinflation are seen as important (top 10) for the insurance industry, Towers Watson research suggests that they are far less important for society as a whole

- The most polarised opinion is in relation to natural catastrophe, which our respondents think is the second biggest extreme risk for the insurance industry to worry about in the long term. Our own research ranks it as one of the bottom five. We have posed the question above as to whether survey respondents or Towers Watson are 'off the mark' due to behavioural influences. A further possible explanation for the discrepancy could be that this would be an existential threat to the insurance industry, but not necessarily for humankind
- On the other hand, some important risks in the Towers Watson research such as global trade collapse, global temperature change, stagnation, deflation and health progress backfire are considered to be less important to the insurance industry
- Political extremism, abandonment of fiat money, cosmic threats, organised crime and alien invasion are in the bottom 10 for both the Towers Watson and wiki survey rankings.

Figure 03. Seeded ideas

Rank	TW assessment	Wiki survey on seeded ideas*
1	Food/water/energy crisis	Pandemic
2	Stagnation	Natural catastrophe
3	Global temperature change	Food/water/energy crisis
4	Depression	Cyber warfare
5	Global trade collapse	Depression
6	Banking crisis	Banking crisis
7	Sovereign default	Sovereign default
8	Currency crisis	Hyperinflation
9	Deflation	Infrastructure failure
10	Health progress backfire	Terrorism
11	Nuclear contamination	Biotech catastrophe
12	Extreme longevity	Break-down of capitalism
13	Insurance crisis	Anarchy
14	Terrorism	Biodiversity collapse
15	Infrastructure failure	Currency crisis
16	Biodiversity collapse	Extreme longevity
17	Pandemic	Global trade collapse
18	World War III	Global temperature change
19	Technological singularity	Stagnation
20	Cosmic threats	Nuclear contamination
21	Cyber warfare	Political extremism
22	Anarchy	Deflation
23	Abandonment of fiat money	World War III
24	Organised crime	Health progress backfire
25	Hyperinflation	Abandonment of fiat money
26	Natural catastrophe	Technological singularity
27	Break-down of capitalism	Organised crime
28	Biotech catastrophe	Cosmic threats
29	Alien invasion	Alien invasion
30	Political extremism	

*Ranking is based on unadjusted scores

Conclusions

So how should companies actually adapt in recognition of extreme risks? We would suggest a prioritisation exercise: first, worry about the events ‘that can kill you’, that is permanently impair the company’s mission. This should identify which extreme risks matter and which can be ignored. For the former, the right thing to do is to pay up for the insurance, given that the prioritisation exercise has shown the company cannot afford to self-insure. Second, a company should do the simple thing of ensuring its risks are as diversified across as many different drivers as possible. For an investor, they should also fully diversify within asset classes and create a strategic allocation to cash to provide optionality. Finally, greater hedging complexity can be added over time, assuming it passes a considered cost/benefit analysis. This is likely to involve adding long-dated derivative contracts in a contrarian manner, that is, when they are cheap rather than popular.

Further information

Readers looking for a more detailed tour of this subject should refer to:

- ‘Extreme risks, the irreversibility of time and the retirement anomaly’
- ‘Extreme risks – 2013’.

For more information, please contact your usual Towers Watson consultant or:

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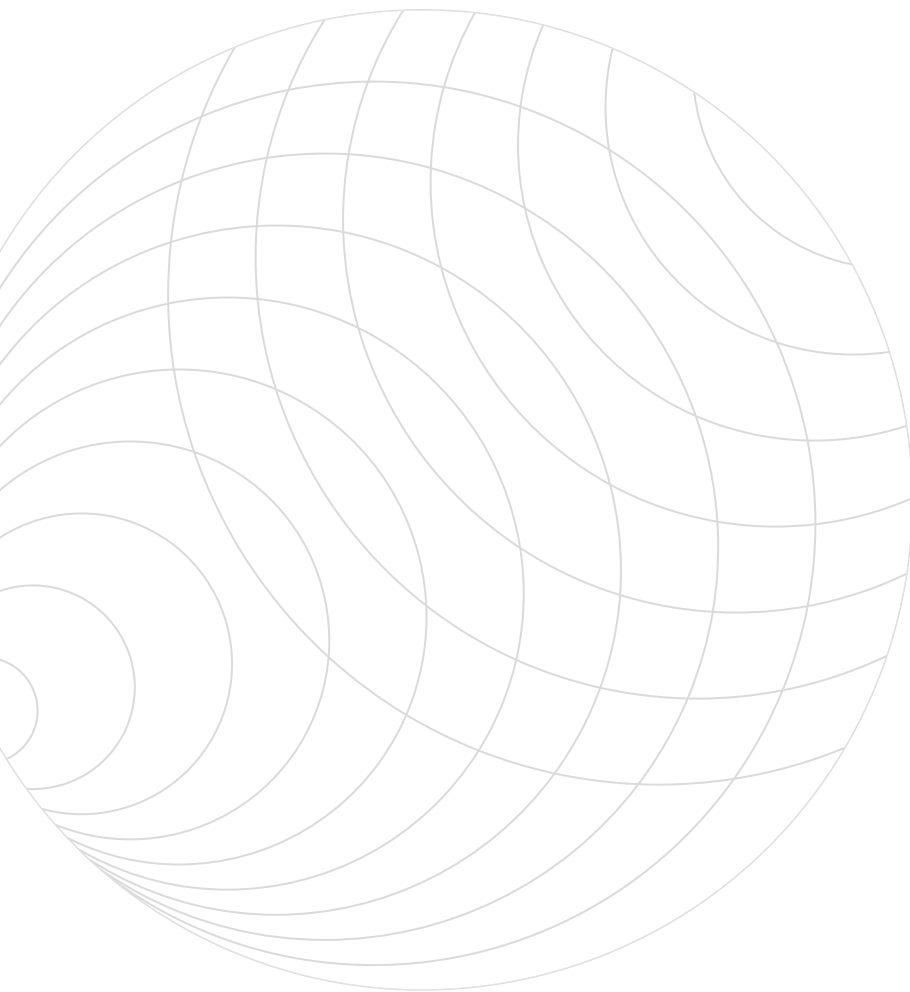
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Building a more efficient investment process

Andrew Epsom and Neil Chapman

Anyone who says that investing is simple probably is not doing it properly. It requires time, effort, big-picture thinking, fine-detail thinking, organisational capabilities, patience and persistence.

This first article in a series looking at Towers Watson's proprietary investment process, explores what we define as the risk-return habitat. We will publish future articles that discuss the other steps in the process that we believe gives investors the greatest chance of achieving their investment goals. This process is summarised below.

- I. **Defining the mission** – what the business objectives and priorities are, e.g. how closely should liabilities be matched and what additional return needs to be achieved?
- II. **Exploring the risk-return habitat** – once an investor's basic mission has been identified, the next task is to build a picture of the risks that will help the mission succeed. We consider the pay-off between risk and return and put a framework around it to create a risk-return habitat.
- III. **Setting risk-return assumptions** – the real-world characteristics of markets and assets that are assumed will strongly influence the resulting investment strategy. Our assumption-setting process for asset classes and strategies is ultimately judgmental – we do not believe that any single methodology or approach has a monopoly on truth and a great number of approaches can provide appropriate return assumptions. Therefore, the outcome of the process should be expressed as a range of assumptions.
- IV. **Portfolio construction** – diversification of assets by geography or by asset class is a common approach but is vulnerable to correlations being unstable. Instead, identifying the return drivers of the asset is our preferred way to create a minimally correlated portfolio that is less sensitive to the impact of economic and financial crises.
- V. **Risk mitigation** – some risks may need to be adjusted now or in the future to better reflect an investor's risk preferences and appetite. This may mean overlaying the portfolio with derivatives to address specific risks such as inflation, longevity, currency and extreme (or left-tail) risks.

VI. **Managing assets dynamically** – risk, return and risk appetites are not constant and neither should an investment strategy be.

This article looks at the second step in this process – exploring the risk-return habitat.

This step involves building a picture of which risks will help the mission succeed and which to avoid – this is not yet about selecting assets or building models, both of which come later in the investment process. It is about considering the pay off between risk and return and putting a framework around it to create a risk-return habitat. We believe the optimal risk-return habitat is derived from four key risk elements: risk need, risk tolerance, risk attractiveness and risk governance as shown in **Figure 01**.

Figure 01. The optimal return habitat



Risk need

For an insurer, there are several factors that may affect the level of investment return required (and therefore the risk needed). These can include:

- Targeting a particular return on capital required by shareholders
- Growing the level of capital to meet the senior management's business objectives (e.g. to support acquisitions or expanding the writing of new business)
- Maintaining premiums at a competitive level
- Investing to meet the costs of any capital guarantees in insurance products
- At least matching the levels of return generated by the insurer's peer group

Risk tolerance

Many investors are spooked by volatility. Yet volatility is no more than a risk measure used by investment professionals to measure short-term movements in prices. This is very different from permanent capital loss, which is the real worry and the true risk.

For investors with longer-term horizons, volatility only leads to losses if a) they lose their nerve or b) they exhaust their risk tolerance. Keeping your nerve or sticking to the plan is all about risk governance, which we discuss next. Risk buffers are practical methods of mitigating volatility. Risk buffers should be quantified on a real world and regulatory basis to understand the level of protection they are likely to afford and their consistency with the company's risk appetites.

In simple terms, without sufficient risk buffers, investors may be forced to de-risk at the wrong time. For example, buying equities as they reach their peak or selling them as they approach a cyclical low.

Risk buffers include: investing for longer, taking more risk if an asset's price falls, having the ability to call on external capital, taking management actions to reduce discretionary liabilities, building in margins (capital buffer) or taking out insurance against loss.

There will be some 'extreme risks' to which investors are always exposed. Investors should consider their exposure to 'extreme risks' and whether they wish to hedge, retain, or even increase exposure to them. If investors build in buffers for every possible event, they take no risk at all and consequently receive no return.

Risk attractiveness

Determining the optimal mix of assets is fine, but an assessment of current valuations is essential. This may sound obvious, but many investors buy market risk at just the wrong time. There are times when taking significant risk is well-rewarded (March 2003 and March 2009) and times when it is not (1973, the end of 1999 and the summer of 2007). For investors wishing to allocate resources to less risky assets, these latter periods would have been attractive moments to invest. In general, risk is attractive when other investors are risk-averse and vice versa.

Risk governance

Ensuring that all the decisions made about the risks being taken are well-informed and well-implemented requires a strong risk governance framework. Investors with such a framework are better placed to take logical decisions when faced with worse than expected outcomes. Conversely, poor risk governance can lead to lower realised returns. Retail investors – US mutual fund investors, for instance – typically display poor governance because they tend to buy and sell based upon past performance. More sophisticated investors often have the resources and the experience to implement high quality risk governance. We believe this should encompass:

- **Mission clarity.** Extreme clarity of mission, vision and values and their connections to beliefs, norms, enablers and strategic plans.
- **Effective resourcing.** Resourcing each element of the investment process with an appropriate budget.
- **Strong beliefs.** Strong investment beliefs that are aligned with goals and inform all decision making.
- **Risk budget framework.** Frame the investment process with reference to a risk budget aligned to the goals.
- **Competitive positioning.** Frame the investment process with reference to the investor's comparative advantages and disadvantages.
- **Real-time decisions.** Make decisions in real-time, not calendar-time.
- **Learning.** Adopt a learning culture which encourages change and challenges orthodoxy.
- **Appropriate time horizons.** Balance long-term investing with the exigencies of short-term stresses.
- **Risk excellence.** Identify, conceptualise and measure risks and lay the foundations for the better management of risk.

“Put simply, investors should take as much investment risk as they need to meet their investment return objectives and no more.”

Case Study

We have recently undertaken a governance review of the investment risk management practices of the committees of a large UK With Profits Fund.

We first considered existing practices through the Terms of Reference of the committees and their composition. This used the Clark/Urwin study on good practice in investment management (October 2007) as the benchmark, encompassing many of the best practice factors described above; it is widely recognised as the seminal study in this area.

Secondly, we evaluated the investment risk management practice of peers, highlighting global best practice in the areas. This focused on three main areas: the existence and roles of the CIO and investment committees; the relationship of subsidiaries (including asset management units); and benchmarking of the approach relative to other comparable UK With Profit funds.

On the basis of our report, the insurer changed the structure of its investment decision-making structures at the various committee levels to incorporate the recommended improvements from our review, and we believe it is now better equipped to implement and manage the risks in its strategy.

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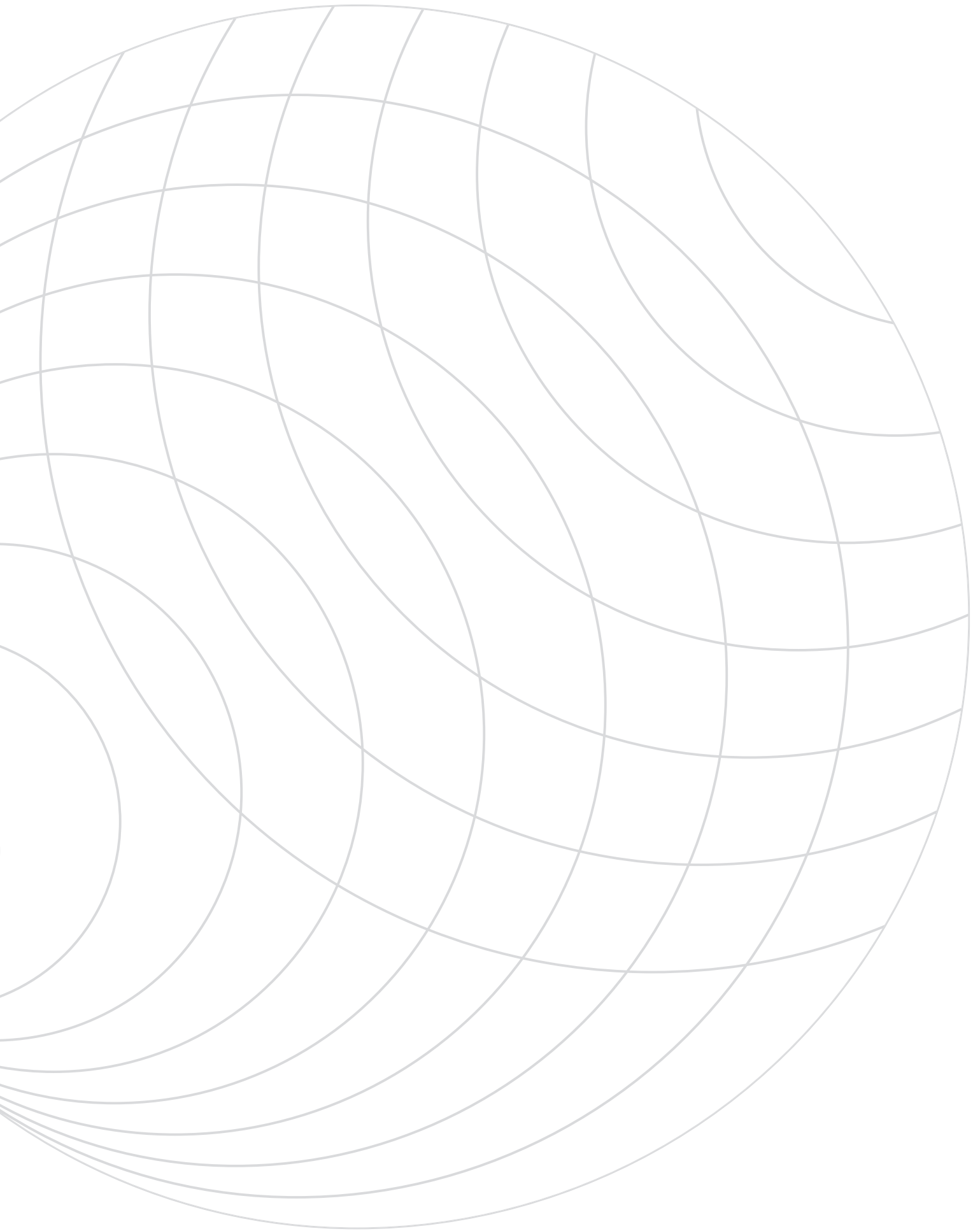
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“The ORSA is the most valuable tool available to a CRO because it engages the business at multiple levels to create a single unifying understanding of risk.”

Alex Duncan (CRO at Just Retirement Limited)

In the earlier article ‘Delivering risk management into the business: clash of cultures... meeting of minds... adding value’, we discussed the principles and practicalities of integrating new risk management techniques with existing business strategy and planning, processes, monitoring and culture. The article looked at how the ORSA (now renamed by EIOPA to FLAOR) provides an excellent platform to embed the risk profile monitoring process and how it can be linked to the strategic and business planning process to deliver tangible benefits to the business. In addition we considered the importance of risk governance and culture as enablers of change.

Throughout the article a key theme was ‘engaging with the business’, through:

- Getting buy-in from staff in the first line of defence to help build an effective risk profile.
- The active participation of all areas of the organisation to help align the strategic planning process and the ORSA.
- The active participation of senior management in the articulation of an end-state vision of risk culture.

In this article we will emphasise the importance of engagement, challenges in achieving this and ways of ensuring it happens effectively. One of the main objectives of the ORSA is to embed risk and capital considerations within decision making processes throughout the business, and we focus on using the ORSA as a platform for this.

The importance of engagement

There are a number of advantages to using the ORSA to engage the wider organisation in risk management:

- A better understanding of current and future risks facing the business, and the impact of these on the business, should enable management to make better strategic decisions, and ultimately increase value.
- Clear risk dialogue throughout the whole company is an important element of achieving a common risk culture.

- In calculating capital requirements, and in implementing the ORSA, engaging the business is essential to ensure that risks are identified and fully understood. Failure to identify risks could lead to an unnecessary loss or a missed opportunity to generate value.

The ORSA is a particularly valuable platform for involving the business in risk management. It takes the risks identified by individuals in the organisation, and the mitigating actions for those risks and demonstrates how they impact the company’s financial results. It allows the management to analyse the impact of decisions they are making and helps them understand the impact of events on the current and future balance sheet and profit signature. This feedback demonstrates to management how their actions in relation to risk may impact the business.

Challenges in achieving engagement

Given the delays to Solvency II and the cost of implementation projects to date, anything related to Solvency II can prove unpopular with senior stakeholders. Many insurers have invested heavily in Solvency II, yet feel that they have realised few benefits so far. It is therefore important to try to move away from this link and sell the advantages of the ORSA, even if Solvency II does not happen. In fact, the ORSA can be positioned as a means to bring together much of the work that has been carried out to date on Solvency II and realise value from this work.

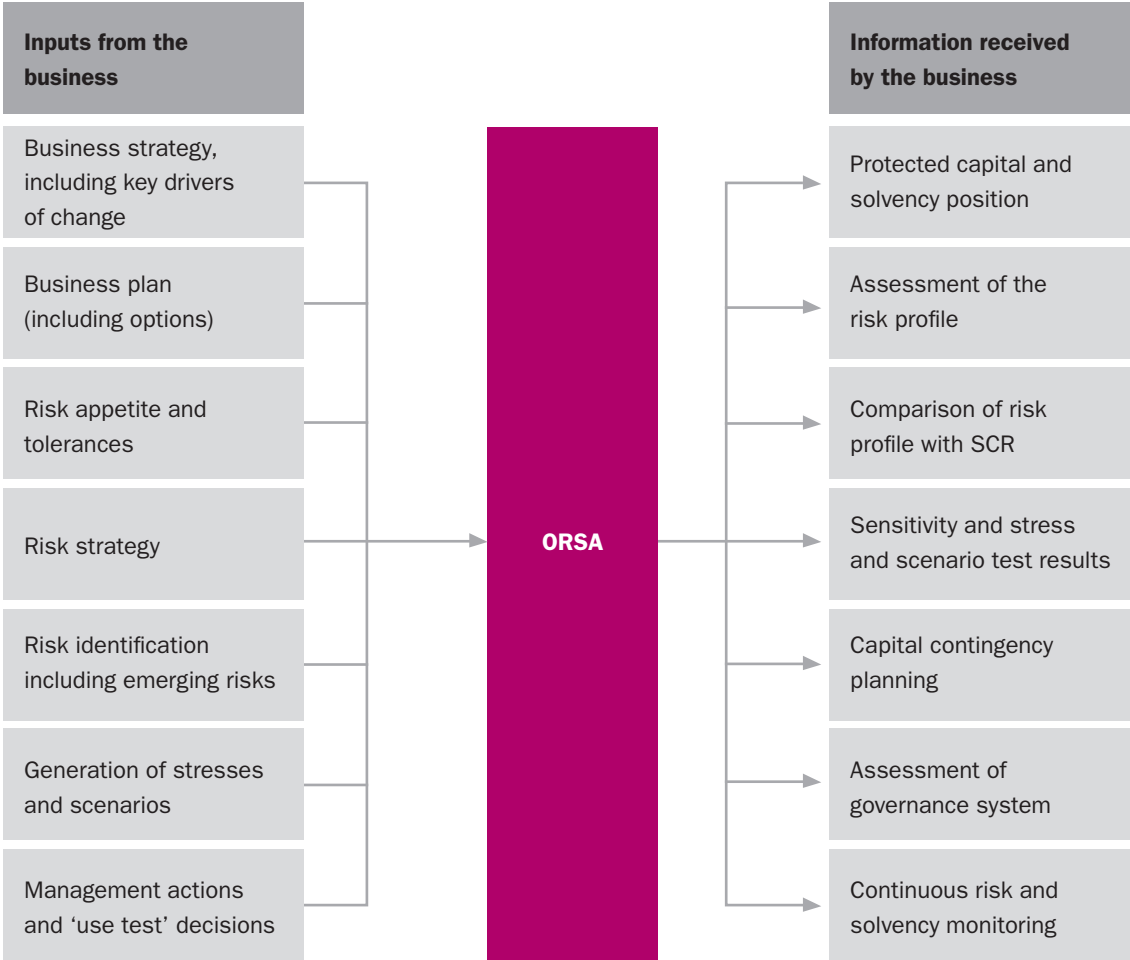
Another obvious challenge that is likely to arise through the introduction of the ORSA is a resistance to ‘new’ information. Therefore, the introduction of the ORSA needs to be carefully managed. It will require CROs to sell the ORSA to the business and demonstrate how it will benefit them. Showing the board a projection of the risk profile from the ORSA which highlights the top five or ten risks the company is likely to face over the next two or three years is one technique to use. Examples like this should demonstrate to them that the ORSA process is a way of giving them an improved level of understanding of the risk and capital dynamics of the business.

Insights – ways of achieving successful engagement through the ORSA process

Throughout the ORSA process there should be a continuous flow of information from and to the business as can be seen in **Figure 01**.

Consideration must be given to the engagement with the business at each of these points to ensure the ORSA is fully embedded. In the next few sections we highlight some useful touch-points to achieve engagement both in the development and BAU operation of the ORSA.

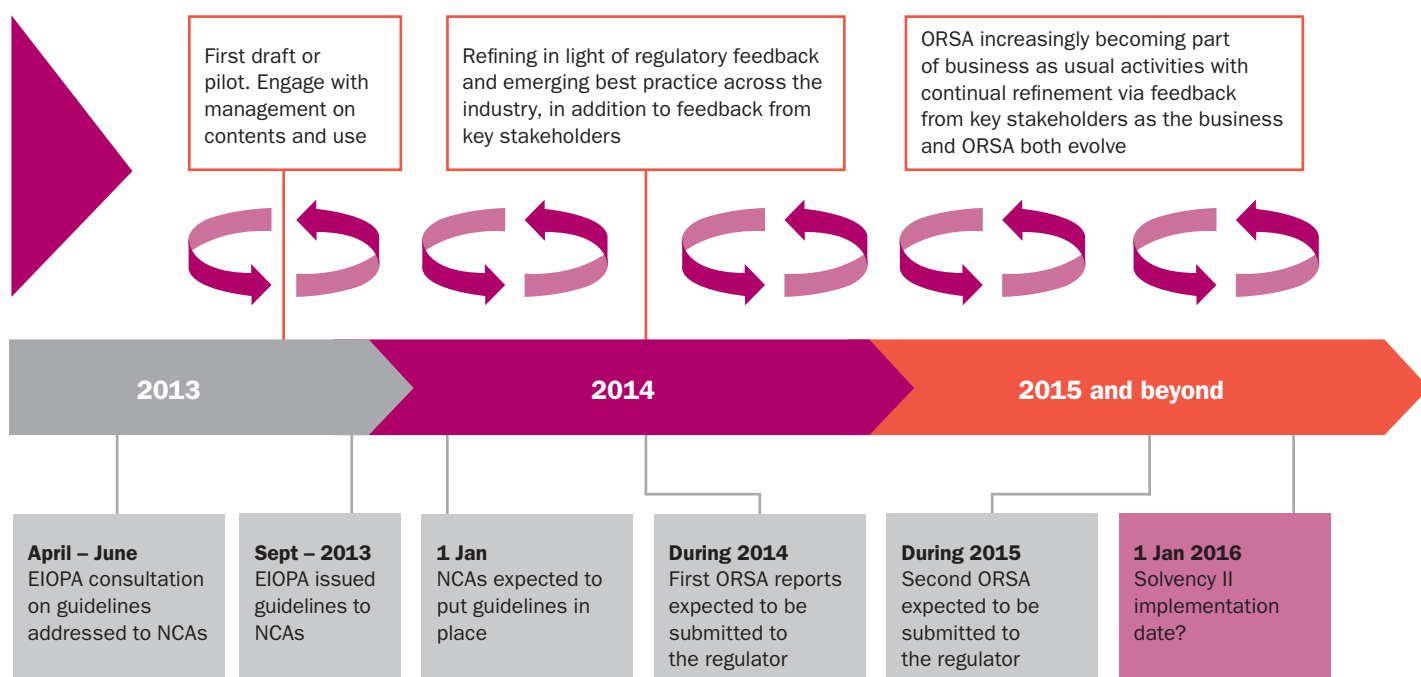
Figure 01. ORSA information flow: touch-points for engagement



It is important that engagement from the relevant stakeholders is obtained throughout the implementation process. We suggest that the most effective approach to implementation of the ORSA is to take an iterative approach. The advantages of this approach are:

- It will enable people across the business to provide input into the development of the ORSA during each iteration. If individuals feel that they have helped to design the process, they are much more likely to be engaged in using the ORSA in making key decisions.
- It provides advance warning to the people who will be involved in the process and enables them to understand what will be required of them.
- It allows time to ensure the information required as part of the ORSA can be calculated and presented in a robust manner.
- It will enable the company to take account of emerging best practice and regulatory requirements. This can then feed in between iterations without resulting in a constantly moving target during development.

Figure 02. Iterative approach to implementation of the ORSA



An illustration of the iterative approach for the ORSA is shown in **Figure 02** above.

We would expect such an approach to be more efficient than the alternative of a ‘big bang’ implementation as it ensures buy-in from the business, raises issues early and in a practical manner and is more likely to result in a process which is actually used in practice.

A fully fit for purpose ORSA report

We suggest an initial template is developed, building on pre-existing work, to educate and familiarise senior management with the report. Subsequent iterations of the report can be used to get feedback from senior management and ensure it fully meets their needs.

During this process of embedding the report it is important to engage with senior managers individually, as well as through the usual reporting channels. This gives them the opportunity to ask questions that they may be embarrassed to ask in a wider group to ensure they truly understand the content and purpose of the ORSA report. This will then allow them to give more useful feedback so that the next iteration of the report can better meet their needs and so become more embedded in the business.

Risk identification

Risk identification is one of the key areas of the ORSA process in which the wider organisation can be involved in risk management. At least annually, key individuals from each function (e.g. underwriting, asset management, marketing, legal etc.) should be brought together to have a discussion about the risks currently facing their business area, and any emerging risks they consider may impact the company in the medium to long-term.

The benefits of such an approach are two-fold:

- The risk identification process is likely to be more comprehensive as it is being carried out by the individuals most familiar with running the business, rather than solely the risk function; and
- Risk management will no longer be viewed as solely the responsibility of the risk function. Involving the key functions in risk identification will increase their sense of ownership in terms of managing those risks.

Different techniques can be used to engage with the business functions, taking into consideration the level of knowledge and interest of the individuals and the dynamics of the group of people being engaged. The amount of preparation time will also be a key factor.

For example, a brainstorming session, where a list of risks is gathered from spontaneous contributions by members of a group, can be used for risk identification. This has the advantages of being easy to prepare for, and staff will feel that their views are fully taken into account. However, brainstorming is not always very systematic and risks can be overlooked.

Another technique is process analysis: this involves constructing flow charts for all processes within the company and then identifying the points at which risks can occur. The advantages of this are that it focuses discussions and idea generation and is often more systematic than a brainstorming session. It is important to ensure that all processes are captured in order to analyse them and it can be time consuming to prepare for this type of analysis.

The key consideration is what approach suits the style and culture of the business. It may be necessary to trial alternative approaches with variations across different functions.

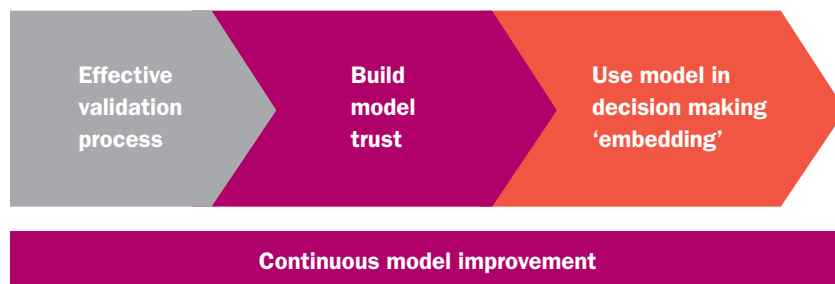
Stress and scenario analysis

Stress and scenario testing, including reverse stress testing (and more recently recovery and resolution planning), are also essential components of the ORSA. Stress and scenario testing workshops can be a very effective way of achieving engagement. These typically involve face to face round table discussions with the objective of generating plausible risk scenarios that could affect the business. Reverse stress testing and the development of recovery and resolution plans both require a significant amount of input from across the organisation. Reverse stress testing considers the failure of the business model. Taking this a stage further, recovery planning considers the contingency actions that might be taken in extremis in order to recover the company from distress. If the events are so extreme that the company is beyond recovery, it is considered to have failed, and more extreme options need to be laid out (such as mergers with other organisations).

Often the most effective way to carry out such analysis is a series of workshops, with a cycle of information whereby initially the participants are generating scenarios, whereas in the later workshops they are informed on the financial and non-financial impacts and they start to consider how the events would be managed.

Confidence in the numbers

Engagement will ultimately be achieved when the business starts regularly using the ORSA to support decision making processes. However, to achieve this, there must be a high level of confidence in the numbers being included in the ORSA. It is only when senior management trust the ORSA results and process that they are likely to use it in anger as a real part of their decision making process.



A key part of building trust in the results is educating them on the model used and how it is validated. An effective validation process will help to give them the confidence to use the results produced by it.

In addition, as people within the business become more familiar with the ORSA, they will begin to understand any limitations in the results and how they wish to use the results, taking into account the limitations. Demand from the business for more robust, accurate, granular and additional information will drive a cycle of continuous model improvement. This in itself will result in greater confidence in the numbers.

“Engagement will ultimately be achieved when the business starts regularly using the ORSA to support decision making processes. However, to achieve this, there must be a high level of confidence in the numbers being included in the ORSA.”

Conclusion

The ORSA provides a unique opportunity to engage the organisation as a whole in understanding how risk impacts the business and to drive home the message that risk management is not just the responsibility of the risk function.

The link that the ORSA provides between individual risks, events and actions across the business as a whole (including regulatory capital, economic capital and strategy) allows everyone within the organisation to better understand the risk and capital dynamics of the business. This will inevitably result in better informed strategic and operational decision making.

There are many points of engagement within the ORSA process that can be used to involve the wider organisation, and identifying these up-front will ensure that the maximum value will be obtained from the process. The alternative, that the ORSA remains a process to be carried out solely by the risk function, and that the ORSA report remains a once a year regulatory delivery, is an opportunity clearly wasted.

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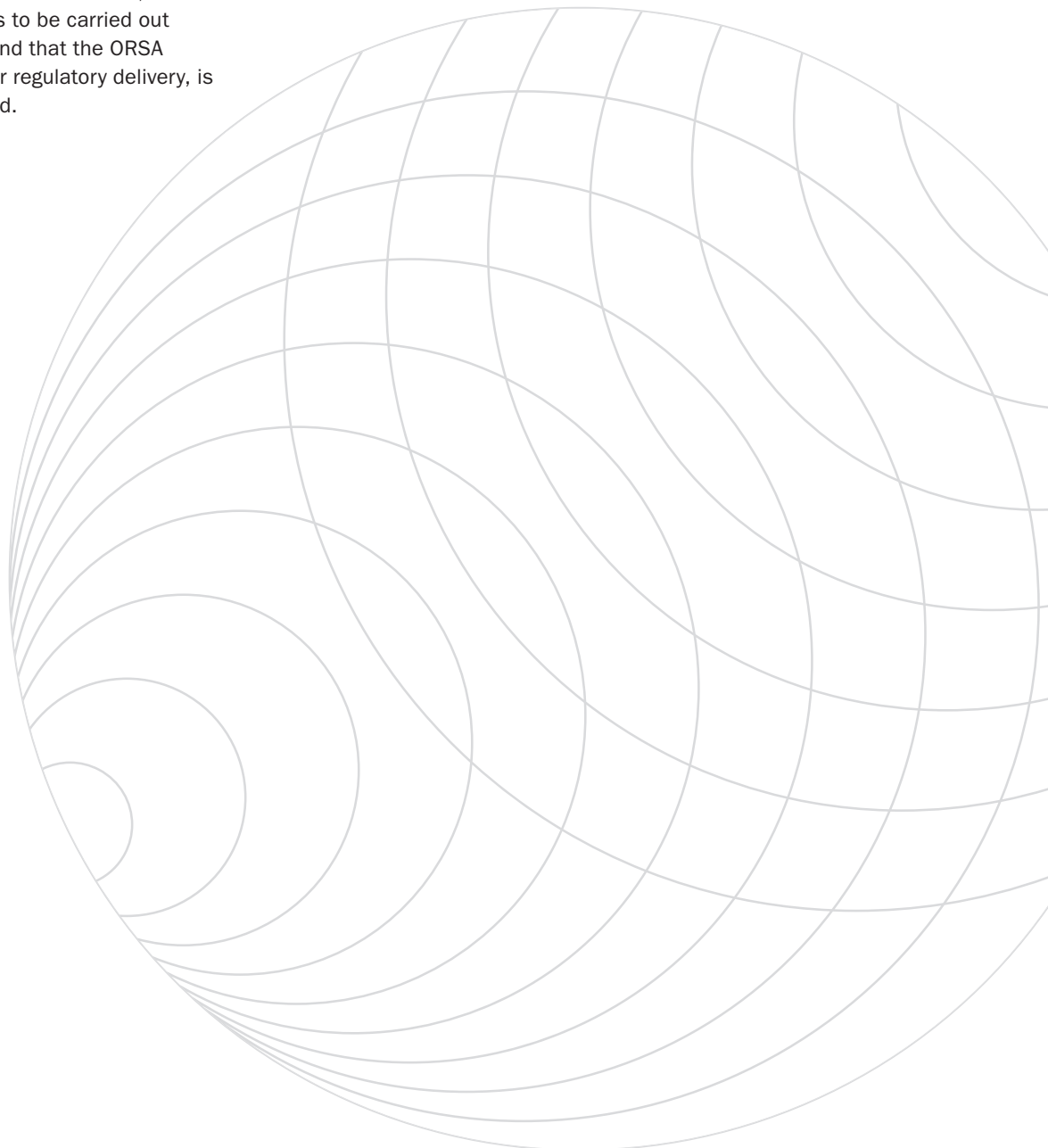
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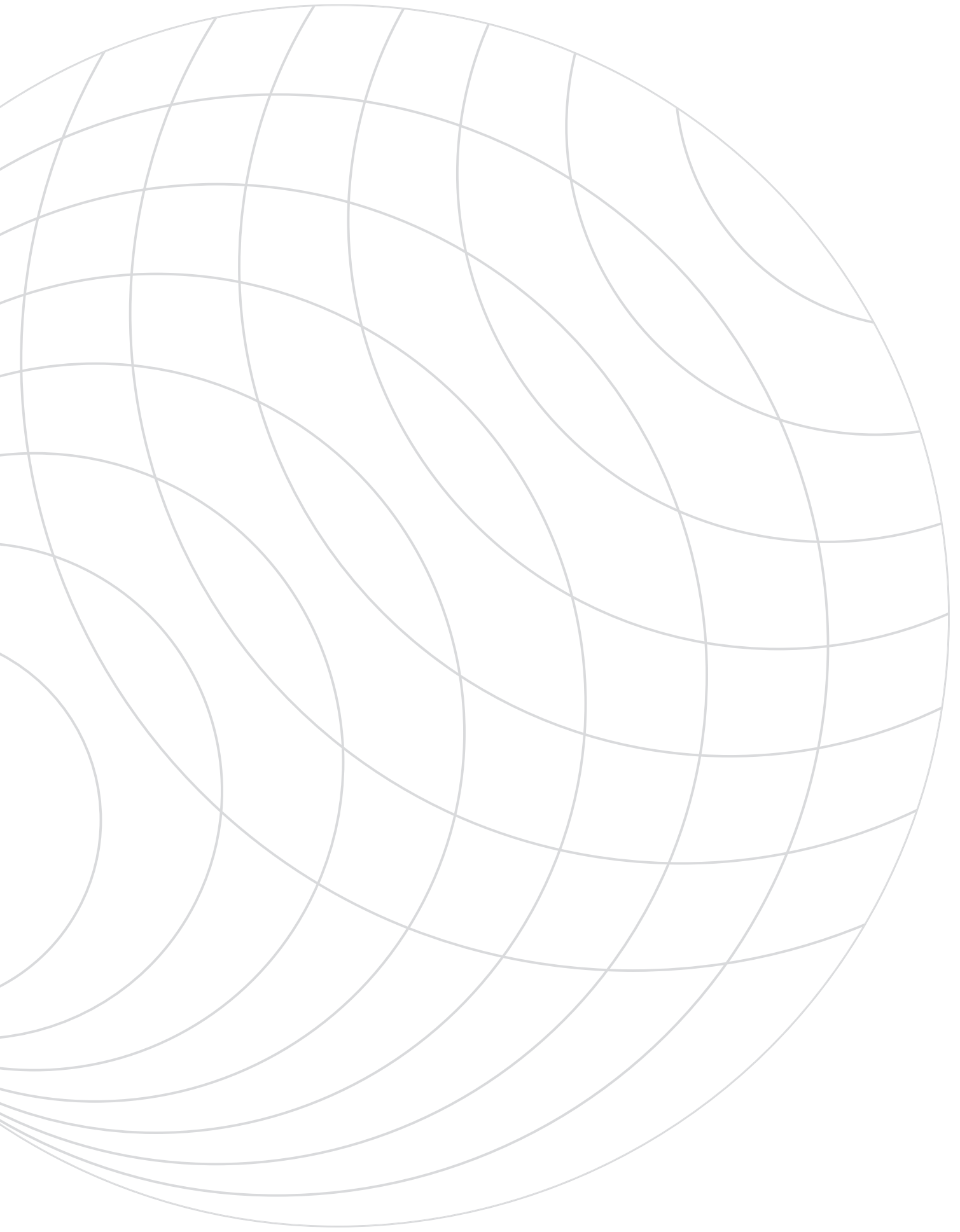
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Economic capital for life insurers – embedding the model

John Rowland and Peter Murphy

Our vision for an internal model is a model that is transforming risk and capital management such that it is a core activity permeating every business function and process.

Background

The catch all phrase for embedding under Solvency II was the ‘use test’ – internal model approval being contingent on demonstrating that the model was truly used to manage the business. ‘Use’ is the key word here: ‘an Internal Model is only useful if it is used’. There are many areas where internal models should be providing real value beyond simply measuring capital requirements. These include key business processes such as risk strategy, risk appetite setting and risk limit monitoring; merger and acquisition analysis, restructuring and ALM; product development and pricing; and asset, hedge and reinsurance strategy and analysis.

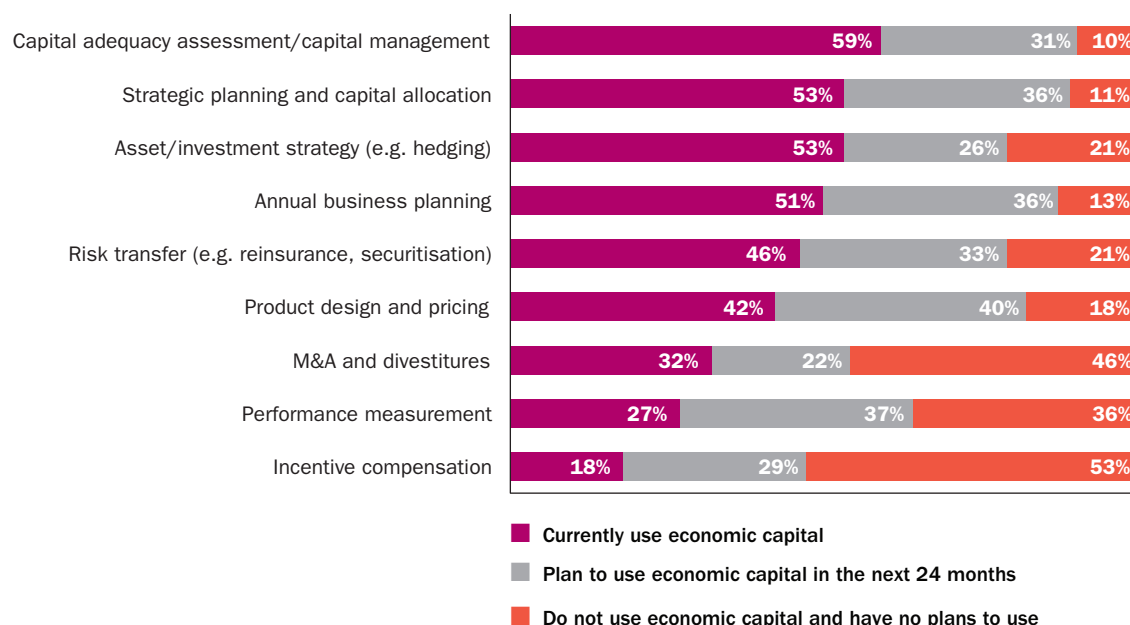
When considering this goal, the key questions are: Where are insurers on the road towards achieving this goal? Are insurers starting to reap the benefit of their investment?

Towers Watson’s seventh biennial global ERM Survey provides insights here, considering:

- How insurers are currently using economic capital.
- The challenges faced in embedding in the business.
- The areas where insurers’ would like to improve their use of economic capital.

The survey shows that economic capital is used in a broad range of business decisions, as can be seen in **Figure 01** below. For each business decision listed, participants were asked whether they currently use economic capital in decision-making, or plan to use it in the next 24 months.

Figure 01. Economic capital is currently used in a broad range of business decisions



Base: Those calculating economic capital **n = 347**

In the same survey, creating management buy-in (for example, educating the decision makers on the role and uses of economic capital) and reliability and robustness of results were identified as the key challenges to making economic capital more widely accepted in the business as a decision tool for risk taking (62% and 61% of respondents respectively). Perhaps key for our discussion in this paper was the fact that producing results in timeframes that allow utilisation in the business was cited as a key challenge by 50% of respondents.

It is not surprising that 96% of insurers responding to our survey said that they plan to develop their economic capital calculations and/or framework further. Specific examples highlighted included: improving the controls and governance surrounding the economic capital model; data and calculation processes, and the quality of risk-factor calibration.

Insurers have invested heavily in internal models, but for many the process is incomplete. Much

work remains to embed the model in the business and to extract value from the investment. For many insurers the scale of the investment made was very significant; really demonstrating business value from the investment is therefore a priority. Most insurers have made progress but few have completed the comprehensive transformation originally promised.

This article considers steps insurers can take to embed their internal model focusing on practical steps that utilise the more advanced internal models implemented in specialist internal model aggregation software such as Towers Watson’s RiskAgility EC that was discussed in the paper, ‘Economic capital for life insurers: The ‘state of the art’ – an overview’ in January 2013.

Embedding internal models

Embedding an internal model can appear to be a daunting task, but following a step-by-step process, makes this easier to achieve. One such approach is set out in **Figure 02**.

Figure 02. An embedded capital model should permeate all aspects of the business



We envisage 5 steps, covering external reporting, internal solvency monitoring, risk strategy, corporate strategy and product strategy. We have set out a sequence and there is an internal logic to this, but it is not necessary to follow all the steps in the order specified. In particular, embedding is often most effective when it is iterative and we would expect each step to be revisited and improved, refined by the fire of practical use.

Step 1 focuses on external reporting. In our experience, in many cases the initial internal model development project incorporates this and perhaps Step 2, internal solvency monitoring. The first real tangible benefit delivered by a modern internal model is solvency monitoring, where monthly or even daily monitoring is now possible. Even here, though, many insurers are still working on improving the efficiency of processes surrounding their internal model to reduce the costs associated with calibration and to meet timescales required for external reporting. Methods to address these issues will be discussed in a future article.

Steps 3 to 5 move away from reporting and monitoring into active management, starting with risk strategy, moving on to corporate and then product focused activity.

The remainder of the paper considers how solvency monitoring capabilities support the process of developing and embedding risk strategy, risk appetite and risk limits.¹

Developing and embedding risk strategy

Once a solvency monitoring capability is developed, a key question is what and how frequently information is required to assist decision-making. Most internal models allow insurers to model their available economic capital and required economic capital. Having these updated monthly enables management to confirm basic solvency, but does not directly improve risk and capital management – this is where risk strategy comes in.

Risk strategy considers what and how much risk a firm wants to take and avoid, and what tolerance the firm has for breaching such considerations. Thus, risk strategy includes setting ‘appetites’, ‘tolerances’ and ‘limits’ for risk and capital. A key step is defining these in terms that are measurable in a manner timely enough to be managed. This is where solvency monitoring with an internal model comes in, covering for example:

- Current solvency on a management/legal entity basis, and allocation of capital by product and risk.
- Whether solvency is breached after predefined sensitivities and stress tests, and consideration of reverse stress tests.
- How available and required capital compare against tolerances and risk limits.
- How solvency has moved since the last time-period and an analysis of movement.

When considering frequency, there are two broad categories of information:

- **Urgent:** A flash report meets an urgent need. Many insurers create a weekly report that can be produced on ‘any given day’. It has been described colloquially as the ‘four o’clock report’ – it responds to a need for immediate information to enable an insurer to respond to a crisis before the financial markets close. This is produced using roll-forward functionality allowing for market movements and focuses on a solvency snapshot position without all the additional detail described above.
- **Timely:** The second category is reports designed for timely management of the business. Alongside the weekly report, a monthly report is made available on the second or third working day of each month. This includes the greater depth of analysis and allows for changes in both the financial markets and product exposures, such as increments, decrements and new business.

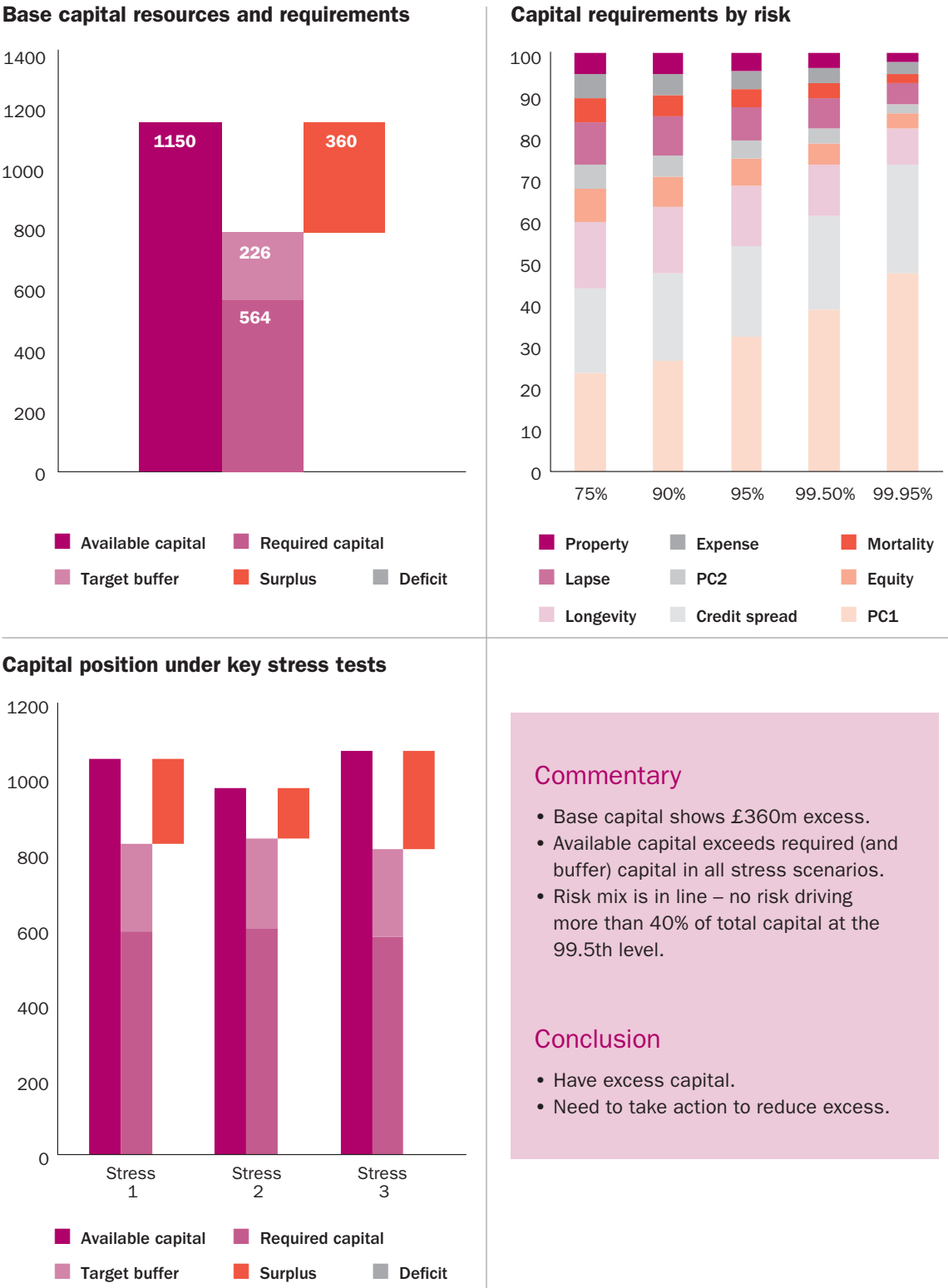
¹ Please refer to the Towers Watson series ‘Another bite at the apple’, which presents our latest thinking on risk appetite to help insurers make it a more effective and valuable process.

Reporting, data visualisation and dashboards

Simply generating numbers is not enough. Information needs to be presented in a manner that makes it easy to interpret in the context of the risk strategy. Flexible reporting tools provide

powerful ways to visualise and more easily understand the data. These can be provided via web-accessible dashboards viewable via desktops, laptops and other devices, such as tablets and smartphones. **Figure 03** is an example of how information might be presented visually in such a dashboard.

Figure 03. A risk dashboard is used to monitor the risk strategy



Dashboards are easily configurable and can be set up to draw on output from the internal model and other applications to meet standard and tailored reporting requirements. They can highlight the most important data and arrange information in a way that makes the most sense to users. Information can be organised with both high-level and detailed views and be specific to different audiences.

The internal model generates a wealth of detail, hence, thought is required otherwise there is the possibility of data overload. For example, the internal model will generate a complete risk view, a full probability distribution forecast and allow for interactive ad hoc analysis – all of this can be easily exported and made available.

A risk dashboard can be used to help accomplish the following:

- Business performance management to gauge historical and actual risk metrics versus limit thresholds, benchmarks and/or objectives.
- Reporting of detailed risk analysis at all levels and ensure transparency.
- Risk monitoring with notifications and alerts via emails of updated positions, and of warnings when actions are required.
- To map and display an overview of global or regional positions.
- Presentation tool to convey risk or performance indicators to a larger audience.
- Management instrument to query data to determine trends to provide guidance and direction.

Calculating economic capital under roll-forward and projections

The first paper in this series, 'Economic capital for life insurers: The 'state of the art' – an overview' (January 2013), described the economic capital model that is emerging for European life firms, namely, the 1-year value at risk modelled using the 'risk factor loss function' paradigm. This paradigm directly models risks ('risk factors') faced by a firm and values the balance sheet under variations in risk states using a 'loss function', typically a polynomial function of the risk factors.

A significant advantage of this approach is the separation of the capital model from the underlying 'heavy' asset and liability models.

This means reporting can be undertaken without the need to re-run ALM systems and makes roll-forward, stress testing and projection of capital positions possible in a time frame to support decision making. We illustrate how to achieve this using functionality built into Towers Watson's RiskAgility EC, the principles can be applied in any internal model implementing the risk factor loss function paradigm.

To roll forward a capital position from a calibration date to the current date or to project forward into the future requires estimation of the change in both available capital and required capital since the last calibration of the internal model. There are two changes to consider:

- Changes in the risk factors over the period monitored – yield curves may have moved, equity markets fallen.
- Changes in risk exposures over the period monitored – assets may have been sold, lapses will have occurred.

In practice while the 'state' of all risk factors will have changed, not all will have changed materially. Deciding which risk factors to include in the roll forward is important. Some risk factors may either not be material or just unlikely to change substantially over the period of the projection:

- Market risks: The most material state changes are likely to be from these risk factors, for example, equity, credit and interest rates.
- Non-market risks: Only include volatile risks that change exposure unless there are exceptional changes: for example, lapse experience over a period will have to be reflected, but lapse assumptions are unlikely to vary.

The next stage is identifying proxies to reflect the exposures. This is necessary even for vanilla asset holdings, as few companies have actual performance data on actual equity holdings available in the timeframe required. Thus, to carry out the solvency monitoring, it is necessary to find a proxy such as a quoted index that reflects the exposures of the company. Typically many such proxies are already available, having been identified to support updates of other reporting processes.

Estimating the change in available capital

Under the risk factor loss function paradigm, an estimate of the change in available capital from changes in risk factors is very simple, as it involves valuing the loss function at a different risk factor 'state'. However, the impact of changes to the risk exposures needs to be considered:

- **Existing business:** Scale the loss functions to allow for changes in the exposure to risks. To improve accuracy some firms split inforce loss functions into two categories – business that will mature over the next year and business that will be inforce at the end of the year. Changes in exposure can then be estimated by scaling the two loss functions using scaling factors.
- **New business:** Introduce a new loss function that specifically allows for new business. This could also be useful from a reporting point of view, enabling a clear understanding of the capital impact of new business.

Estimating the change in required capital

Calculation of the change in required capital can be more complex. To calculate capital requirements, the starting point will have to be calculated first, namely today's available capital. Thereafter, assumptions are needed about the distribution of risk factors. It is this second part where complexity starts to arise.

In order to demonstrate this approach, we consider the simple example where roll forward from calibration to today involves a fall in equity prices. After the fall, the expected distribution of equity returns for the company has to be estimated. This is done by considering what the output of the risk factor calibration process would be in these new circumstances. The first step is to consider whether the calibration is dependent on the level of the equity market, that is, is the calibration 'point in time' or 'through the cycle'. It is possible to argue that the volatility of equity returns should be higher, lower or the same after a fall. Whilst for equities most insurers are likely to have assumed that the equity return distribution is not dependent on the level of the market, this will not be the case for risk factors such as interest rates.

The next step is to think through whether the distribution should either remain the same in nominal or relative terms. This becomes clearer if we consider the equity example:

- Equity return distribution remains constant in nominal terms: If the start index was 5,000 and the 0.5th point was 3,000, then for a post-shock point of 4,500 the 0.5th point would be 2,500.
- Equity return distribution remains constant in relative terms: If the start index was 5,000 and the 0.5th point was 3,000 (40% fall), then for a post-shock point of 4,500 the 0.5th point would be 2,700 (a 40% fall).

As in the calculation of available capital, the impact of the changes in risk exposures has to be estimated. For required capital, this can be more complicated, as experience can change the exposure to different risk factors in different ways. Here it could be necessary to scale different elements of a loss function separately.

These techniques can form the basis for an internal model, which provides the information that management requires, quickly and efficiently, however, building such a model requires thought to ensure that the results are robust and that the user has a clear understanding of the limitations of the approach.

The approach set out above generates robust estimates of available and required capital, but requires significant assumptions to be inputted by insurers into the internal model. Construction of these assumptions – especially for how a loss function will evolve – can prove a challenge. The good news here is that there are techniques to automate this process. Many firms are experimenting with Least Square Monte Carlo techniques to construct loss functions in the first place. The beauty of such methods is their ability to not only construct loss functions at $t=0$ but also to project them forward for use in roll-forward and projections. This will be discussed in a future article in this series.

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TW-EU-2013-34423. October 2013.

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