



Internal Model Industry Forum:

# Operational risk modelling: common practices and future development

Executive Summary



Supported by:



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# Foreword



Operational risk in the insurance world refers to the risk of loss arising from inadequate or failed internal processes, people, systems or external events. Insurers must include these risks within their risk based capital models. Capital requirements in respect of operational risk could range from 2% to over 25%<sup>1</sup> of the overall funds an insurer must hold, amounting to hundreds of millions of pounds for major insurers.

While most of the technical aspects of capital models for insurers are now relatively well developed, industry players, regulators and boards recognise that areas of vulnerability remain, including the modelling of operational risks. Until now, the industry's lack of consistency and definition in this area ran the risk of delivering inaccurate capital requirements.

We are delighted to have worked in close partnership with ORIC International (the Operational Risk Insurance Consortium) to produce this new guidance. It approaches operational risk in the context of insurers' internal risk models. It examines how to validate and communicate the assumptions and techniques involved to produce a result that organisations and regulators can understand and trust.

The approach and techniques described here may also be of interest to organisations outside the insurance field who are increasingly interested in understanding and quantifying their own operational risk exposures and who might be able to benefit from the experience of the insurance sector. The broad membership of the Institute of Risk Management means that it is well placed to promote the cross-sector sharing of knowledge in this way.

This is one of a series of guides being produced by the Internal Model Industry Forum (IMIF), offering guidance on different aspects of insurers' internal risk models.

My thanks to the IMIF members leading this workstream, particularly Michael Sicsic and Caroline Coombe from ORIC International, with support from Oliver Wyman, for their work on this guide. The IMIF Steering Committee also provided valuable project guidance and quality control. We are also grateful to representatives from the Bank of England (PRA) who have ensured a positive dialogue about the IMIF's work between the industry and regulator.

I would also like to thank our sponsors Milliman, PwC, Deloitte, KPMG, and EY. Also, thanks are due to the Institute and Faculty of Actuaries and to ORIC International for their input to this project. As a not-for-profit organisation, IRM relies on enlightened industry support to help us publish this kind of guidance. This support helps us maximise our investment in the development and delivery of world class risk management education and professional development.

**Jose Morago,  
IRM Chairman and Founder of the  
Internal Model Industry Forum (IMIF)**

1. Source: ORIC International and Oliver Wyman 2015 survey on operational risk management and measurement

# Foreword from the ORIC International Chairman



As part of the Internal Model Industry Forum, ORIC International has been working with key experts from our membership to identify and discuss current market practices in operational risk modelling. Given that we are now less than six months away from 1st January 2016, this work has been vital in identifying common practices within the industry and areas for future development.

Operational risk management is still a relatively new discipline – and quantification appears to be the cornerstone of raising the bar for both operational risk practitioners, and more importantly for senior management in their decision-making processes. Indeed, the quantification of operational risk is a critical milestone in the journey of achieving the same maturity level in managing operational risk as is regarded to be the case in the other more established areas of enterprise risk management, such as credit, market and insurance risk.

Preparation for Solvency II has prompted significant progress within the industry in the last two years in order to better quantify operational risk, and quantification is now regarded as a key tool for the management of operational risk; this is a huge step forward compared to approaches under the previous ICA regime.

There is clearly ambition within the industry to use internal models for operational risk, evidenced by over 20 of our survey participants stating they intended to calculate their Solvency Capital Requirements under Solvency II using an internal model for operational risk.

There is always room for improvement however, and our work has highlighted areas where further enhancements can be made. The enthusiasm shown by insurers to develop their own unique internal model should be recognised, but there is potential for convergence in approaches to some quantification techniques that all firms can look to use as an accepted foundation for their operational risk modelling work. Examples highlighted through the research for this booklet include consensus on approaches to correlation within operational risk and aggregation techniques.

Data scarcity is also a key issue, and was the primary reason for ORIC International's formation in 2005. An individual firm will not possess a truly complete dataset of operational risk events, regardless of how mature their data collection process is. The only solution is for the industry to join forces and share data in a secure manner to allow access to a sufficiently wide library of operational risk events, supporting the development of an operational risk internal model.

**Michael Sicsic,**  
**ORIC International Chairman**

# Introduction

Firms use operational risk models to quantify and better understand the risks they are facing. These models should be used to inform senior management decisions and firms that have successfully implemented such an approach can ultimately use the model for the purposes of regulatory and economic capital calculation.

Insurance firms face significant challenges in modelling operational risk and this guidance document has been developed by the industry to assist firms in the development of their operational risk capital frameworks. It draws on:

- The results of a survey ORIC International and Oliver Wyman conducted on Operational Risk Management and Measurement<sup>2</sup>;
- ORIC International's Scenario Universe 2015;
- Leading practices identified in the insurance sector;
- Discussions and outputs from ORIC International's Capital Modelling Working and Discussion Groups; and
- The views and knowledge of subject matter experts from ORIC International, its member firms, Oliver Wyman and the IMIF workstreams.

We trust that you will find this guidance useful for understanding current insurer practices and future areas for consideration, many of which will have broader applicability to other industry sectors.

## **ORIC International**

2. For a copy of the findings from the survey please contact [enquiries@oricinternational.com](mailto:enquiries@oricinternational.com)

# Key Considerations

- There is no ‘one size fits all’ approach to modelling operational risk and model design choices need to be carefully selected.
- If the model can also be used for a wider range of purposes, including as a viable tool for supporting decision-making across the entire firm, then the business case for development, maintenance and evolution of the model is more compelling.
- The most important learnings from the experience of other industries are without doubt around the importance of making modelling an element of the overall risk management framework and focusing on the use of the model by senior management and decision-makers.
- Most firms are utilising some form of hybrid modelling approach, with use of scenarios and loss data in varying combinations and to varying extents in order to calculate their capital figure for operational risk.
- Correlations appears to be an area where collaboration could help to derive industry best practice and perhaps even reach a consensus on an accepted approach to generate these correlations in future.
- Firms modelling by frequency and severity separately also appear more willing to use multiple types of distribution depending on the operational risk being modelled and the availability of meaningful loss data.

- One area of clear convergence is the technique to derive the aggregated loss outputs, with 78 % of those surveyed using Monte Carlo simulation.
- There is perhaps more focus on validation of expert judgement in operational risk due to its pervasiveness throughout the whole operational risk model, especially in those firms relying heavily on scenario assessment.
- The level of independence and oversight provided by Executive ownership could be a very powerful validation tool for firms in a position to follow that path.
- The stability of the model and robustness of its underlying assumptions will be an important area of focus for the technical validation process.
- A firm can have a first class approach to modelling operational risk, but you have to properly document this in order to get your internal model approved.
- It will be vitally important to use feedback received constructively and utilise it as a means of effective engagement with the regulator.

# Modelling Operational Risk Challenges & Benefits

## Challenges

There is no ‘one size fits all’ approach to modelling operational risk and model design choices need to be carefully selected.

When looking to model operational risk there are several specific challenges facing insurers who are considering developing an internal model. Some of these challenges are due to the varied and wide-ranging nature of operational risk itself and the scarcity of operational risk event data, whilst others are a result of historical approaches to operational risk and the impact that is now having on attempts to quantify a firm’s loss experience.

The definition of operational risk provided in Solvency II gives some insight into the challenge of ‘scope’ as a wide variety of risks fall under this:

***“the risk of loss arising from inadequate or failed internal processes, people, systems or external events”***

“Failed internal processes, personnel or systems” covers almost all aspects of a business’s operations, which can’t be all be treated and assessed in an identical manner; then adding “external events” includes an additional range of exposures that have limited similarities in terms of risk drivers or causal factors.

The scarcity of internal operational loss event data is a significant issue for insurance firms, the majority of which will supplement this using external data provided by a consortium such as ORIC International. The lack of sufficient data means that a purely data-driven approach is not feasible for most insurers, leading towards a more scenario-based approach. However this places a large reliance on expert judgement, which could be subject to bias and brings challenges, especially when validating approaches and results.

Due to both the nature of operational risk and the scarcity of data, traditional modelling approaches such as a pure Loss Distribution Approach (LDA) will not be satisfactory. Even though capital model design in the insurance sector has been shaped by a number of precedent regimes, including the Basel II Advanced Measurement Approach (AMA) framework for banks, the most popular approach to operational risk modelling is a hybrid model in which scenario analysis is combined with loss data analysis to form a combined capital estimate.

Firms have approached this challenge in slightly different ways, with modelling approaches being grouped into two general themes for these hybrid models: primarily data-driven models or primarily scenario-driven models. However even amongst these two groupings there is some cross-over and blurring of lines when looking closely at various approaches.

With limited regulatory guidance, firms have been left with an unenviable task of determining the best modelling approach for them. This goes some way towards explaining the variety of approaches seen across the industry.

Based on group discussions, we have been able to establish that a solely data-based approach will be challenged to meet the forward-looking requirement of the models; the use of a scenario-based approach helps to ensure this prerequisite is met.

Another challenge, given the extensive scope and diversity of operational risks, is that they can potentially interact with each other, as well as other risk types within the scope of Solvency II such as insurance, credit and market risk. Some aspects of the operational risk taxonomy cover areas that have historically fallen under other risk categories (especially insurance risk); which can add complications when assessing capital in relation to external fraud risk or even underwriting errors for example.

If firms are incorporating these types of loss events into the insurance risk module of their capital models, whilst at the same time only viewing operational risk as a small proportion of their overall capital figure, they need to consider whether their current methodology is the most accurate reflection of their true risk profile and the impact this could be having on both their model and their risk management resource allocation.

## Benefits

In the face of such challenges, people might wonder why firms are even pursuing approval for an internal model for operational risk. The primary reason, especially for larger insurers with a global footprint, is that the Standard Formula basis of calculating risk-based capital for operational risk is viewed as an unsuitable proxy for risk exposure as it is not risk-sensitive and relies entirely on volume of business (using Earned Premiums, Technical Provisions or Unit-Linked Expenses). This will potentially penalise larger insurers despite their size providing more capacity to resource a larger and more mature risk function, whilst also failing to incorporate potential diversification benefits between entities operating in different geographies and business lines.

It also penalises rapidly growing firms, by essentially doubling the charge on earned premium if they have grown by more than 20% over the previous year's figures and can result in volatile capital figures if premiums fluctuate.

**If a bespoke model can also be used for a wider range of purposes, including as a viable tool for supporting decision-making across the entire firm, then the business case for development, maintenance and evolution of the model is more compelling.**

Whilst there are obvious risks around significant business change, this infers that firms will be unable to proactively manage their changing risk profile throughout that process. Also, what does this mean for larger firms who may have very mature risk management processes, but have undertaken a large acquisition or been part of a significant merger?

One of the most problematic aspects of the Standard Formula for operational risk is the way it is aggregated into the overall capital figure. Despite its very nature as a wide-ranging area of risk, with the ability to interact with other risks all over the business, there is no method for allowing any more sophisticated aggregation techniques than simple sum with other risk types and there is no diversification benefit. These factors can be accounted for within an internal model and are some of the primary benefits of following that route.

The lack of risk-sensitivity in the Standard Formula metrics provides an opportunity for businesses pursuing Internal Model approval to use the work to improve their risk management processes. Reliance on data, ensuring identification and assessment processes are rigorous, and implementing a strong governance framework will help improve a firm's ability to reduce risk, and embedding these processes throughout all business areas will help to improve risk culture, eventually reducing exposures to the major risks faced by the organisation. Additionally linking capital to the quality of controls can incentivise investment in improving controls via the prospect of a reduced capital figure after implementation. The more detailed models which create a full probability distribution can also be a tool to challenge the business on the reporting of losses and near misses for example, thus the very process of establishing and running an internal model will lead to a reduction in operational risk creating an 'observer effect' where the act of measuring operational risk via an internal model affects the underlying risk itself.

There is also potential for an Internal Model to provide real value to the business. Creating a bespoke model that is tailored to a firm's unique risk profile should provide a capital figure which is more reflective of the firm's true risk exposures. If a bespoke model can also be used for a wider range of purposes, including as a viable tool for supporting decision-making across the entire firm, then the business case for development, maintenance and evolution of the model is more compelling. This is especially relevant for operational risk due to its pervasiveness throughout all business processes.

# Operational Risk Modelling Market Practices

Under the Internal Model Industry Forum's direction ORIC International has worked with member firms in a variety of ways, including both internal working groups and our benchmarking survey in partnership with Oliver Wyman, to provide a clearer picture of current market practices.

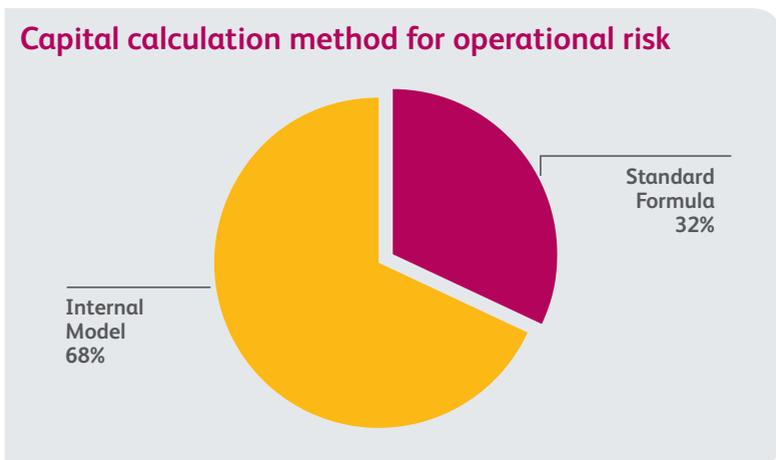
We've been assessing and discussing various approaches to modelling operational risk over the past few months, and this enables us to provide a unique insight, especially within the UK.

The survey consisted of 97 questions designed to explore participants' current operational risk management and measurement practices and priority areas for future enhancements. The 30 participants represented a broad range of the global insurance industry, including life insurers (43%), general insurers (27%) and composites (30%) of varying sizes.

## Internal Model

Of the 28 participants in the survey who revealed their intended operational risk modelling method, 68% intended to use either a full internal model, or a partial internal model with an internal modelling approach being adopted for operational risk.

Of the firms planning on initially using the Standard Formula, a number are in the process of developing their internal model for approval at a later stage, i.e. not in time for 1st January 2016.



Whilst it is positive from a risk management perspective to see such a high proportion of respondents aiming to use an internal model for operational risk, there are concerns about whether it is feasible for so many firms to have an internal model approved in the short-term. It remains to be seen how regulators will approach these issues.

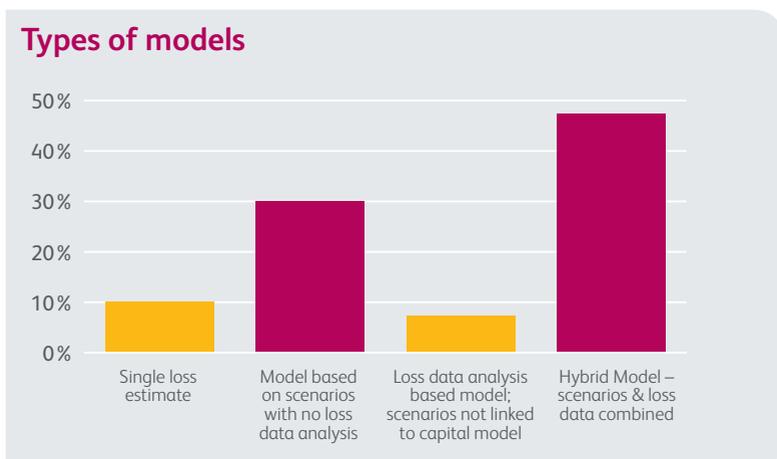
Clearly banking and insurance are separate industries and we are not looking to compare their respective approaches. There is little desire to imitate the steps banks have taken under Basel II and there are different operational risk exposures affecting each industry that just aren't experienced by the other. However the banking experience of operational risk model development should be borne in mind when considering how the model approval process may play out over the next few months.

There is a huge opportunity for insurers to leverage the lessons learned from banks and therefore avoid the same pitfalls. The most important learnings are without doubt around the importance of making modelling an element of the overall risk management framework and focusing on the use of the model by senior management and decision makers.

## Varying Approaches

### Types of model

One notable finding of our work is the variety of approaches that firms have developed in the absence of any detailed regulatory guidance. The graph below highlights this fact with a variety of paths being chosen, albeit scenario-based/hybrid models clearly the most popular approach.



It is unsurprising that pure Loss Distribution Approach (LDA) models are not popular, due to the bias toward being backward-looking and relatively scarce loss event data to provide sufficient comfort in that methodology. We have also concluded that a pure LDA model will not be satisfactory for decision making and supporting the overall management of operational risk. At the other end of the spectrum, models built without loss data analysis may lack robustness and should be only be considered as a transitional step for firms currently improving their risk event collection and analysis capabilities.

**We have been able to establish that hybrid models are the most popular and should also represent the standard going forward, with some firms leading the way in this direction.**

The hybrid approaches cover various practices, with a few examples below of uses for loss event data:

- As a direct input into scenario quantification
- To parameterise scenario quantification
- To support the validation/back-testing of scenario quantification
- To derive parts of the loss distribution, but using scenario outputs to shape the other (generally more extreme) parts of the curve

There are a wide range of business types included under the 'insurance' umbrella, and this is a key driver in the variety of approaches followed. Most notably 'life' and 'general' insurers will show a significant difference in risk profile due to the fundamentally different nature of their businesses. That doesn't even include further specialisation into specific lines of business within those respective industries, let alone 'composite' firms and reinsurers. In light of this underlying variety of industry participants, it is unsurprising that the outcomes of model development have not been universally agreed upon.

The challenge for the industry here is to identify and articulate the key differences and clearly justify why differing methodologies can be appropriate.

## What is being modelled?

The question of “what is being modelled?” would seem like a straightforward one, however this is another area where we have seen differing approaches, namely around the granularity of where operational risk is being quantified.

A sizeable proportion of firms approach this by mapping to risk categories such as Level 1 & 2 risk categories exemplified in the ORIC International taxonomy. Others may use a bespoke internal categorisation mapped back to those categories. In this case, around 20 individual categories are modelled.

In contrast, some firms quantify at the scenario level, ensuring that their scenarios provide coverage of the operational risk categories and their risk profile. However this approach can add another layer of complexity i.e. through having to justify coverage of the risk categories to ensure completeness, as well as the methodology for aggregation of scenario outputs if there is overlapping of risk categories or more than one scenario for a specific risk category. In this case, firms in general consider between 15 and 20 wide scenarios for a given business unit.

Other firms that model risks separately from any categorisation or individual scenarios do so at an individual risk level. The examples analysed as part of the working included firms considering between 80 and 150 individual risks. This approach may give some additional comfort about the coverage and increases model stability as each individual risk is relatively less significant to the total, but raises its own challenge in terms of the relevance for many risks with a relatively low impact and determining correlations between many risks.

## Correlations

The varying approaches to risk categorisation also have an impact on correlations, which is another ‘hot topic’ when looking at operational risk modelling.

The correlations themselves will be impacted by what is actually being modelled. Will the model deal with correlations between risk categories, or specific scenarios, or even individual risks themselves? This will in turn impact what the firm is attempting to correlate. For example if a firm is correlating Level 2 risk categories there may be around 20 different correlations involved, but if a firm is taking an individual risk approach, then there will be a significant impact on the diversification benefit being gained.

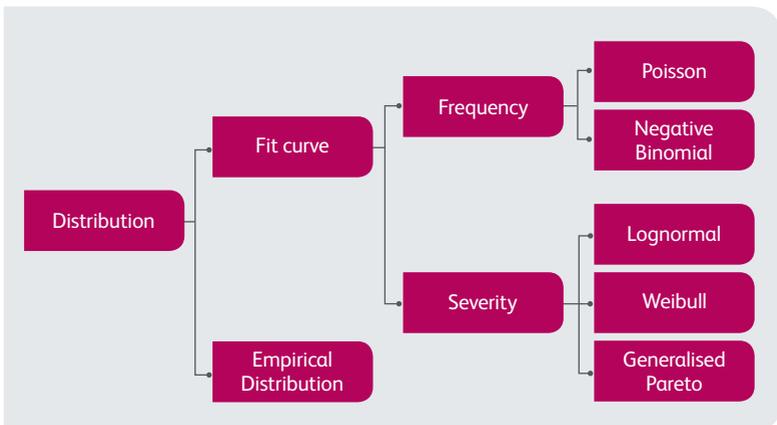
Another area of difference would be the approach to individual correlations themselves. Some firms have opted for a more simplistic approach and just use constant values assuming a general level of correlation, others have chosen varying correlations based on the relationship between the two units being assessed. Some even follow a hybrid approach, mixing a general fixed level of correlation with more complicated approaches for the 'bigger risks' the firm faces.

Finally, the method of deriving these correlations tends to be mainly statistical (using both internal and external data) or utilising expert judgement, however empirical data can be used to validate expert judgement involved in the generation of correlations. Neither approach is without its challenges, and firms have tended to choose what suits their approach the best whilst still being rigorous and clear as to why they chose the approach they did.

This topic seems like an area where collaboration could help to derive industry best practice and perhaps even reach a consensus on an accepted approach to generate these correlations in future. It is an area that will clearly benefit from additional data analysis using consortium data in order to be able to define some standards. ORIC International has just launched a project to produce correlation analysis between level 1 and 2 categories using the 10 years of loss event data the consortium holds.

## Quantification techniques

The technical approaches towards quantification also provide extensive differences in approaches, especially when looking at distributions. A flow diagram outlining the most common choices for loss distribution curves are shown below:



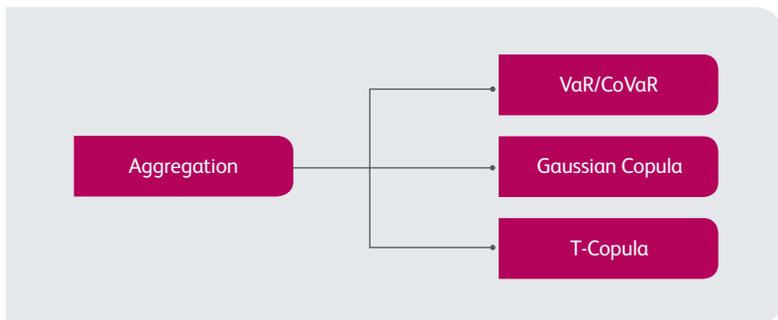
Firms have decided to adopt several different approaches, although there does appear to be heavier convergence here on particular techniques:

- 65 % of respondents are modelling separate distributions for frequency and severity, of which:
- 86 % are using Poisson distribution for frequency; and
- 73 % use Lognormal distribution for severity

One interesting trend to note is that firms modelling by frequency and severity separately also appear more willing to use multiple types of distribution depending on the operational risk being modelled and the availability of meaningful loss data.

40 % of these firms use more than one frequency distribution and 47 % use multiple severity distributions.

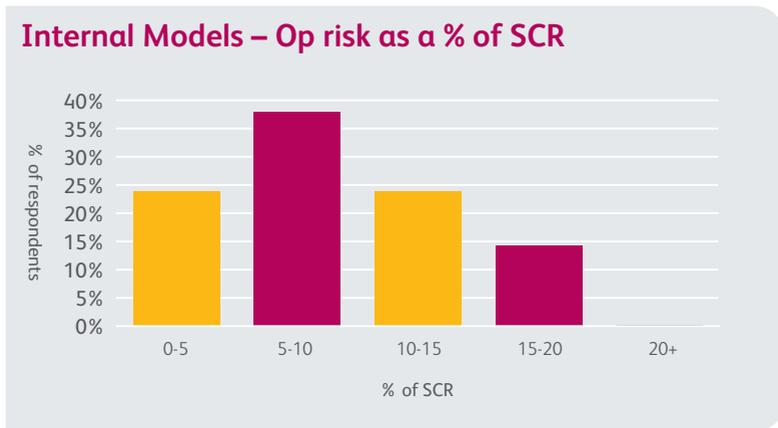
Similarly, when looking at aggregation processes there is no single dominant approach. The most popular, Gaussian Copula only accounts for 30 % of responses. The three most popular are shown below, but others selected include Simple Sum, Sum of Squares and Rank Copula.



One area of clear convergence is the aggregation technique to derive the outputs, with 78 % of those surveyed using Monte Carlo simulation.

## Capital figures

A range of capital figures are derived from these differing internal model approaches, as displayed in the graph below (of the 21 respondents willing to share their figures).



86% of respondents sat between 2-15% of total SCR and no one running an internal model responded with a figure over 20%. Outputs between 5-10% were the largest grouping, which resulted in a mean value of 8% and a median value of 7%. In comparison, two of the respondents using Standard Formula returned operational risk capital figures in excess of 20%.

All firms should embrace the opportunity to use benchmarking of their model outputs against the Standard Formula as part of the business case for supporting the operation of an internal model, as this would provide a clear incentive for firms to pursue an internal model if their Standard Formula figure was greater than 20%.

## Common modelling practices

Whilst there may be no single 'universally accepted' approach to the modelling of operational risk, there are some common approaches, which appear to be in use across a majority of industry participants.

Most firms are utilising some form of hybrid modelling approach, with use of scenarios and loss event data in varying combinations and to varying extents in order to calculate their capital figure for operational risk.

Of these firms, a significant proportion are taking the approach of modelling frequency and severity separately, and there are clear leading choices of distributions for those two in Poisson and Lognormal distributions respectively.

We would not expect to see firms producing identical figures for operational risk capital, but as the previous graph shows, there is a clustering of capital figures as a percentage of the firm's total SCR somewhere at 15% or lower, which goes to show firms are producing capital figures that are somewhat consistent and are not substantially varied.

The use of 'hybrid' models and Monte Carlo simulations to create the model output seems to be the strongest examples of shared practices and the closest thing we currently have to something that's 'universally-accepted'.

Divergence in outputs can be justified around different processes, risk profiles, business lines or strategic direction, but it can be argued that there should be slightly more convergence on methods used to reach that outcome. This would make it easier to justify methodology choices to regulators.

Examples of potential areas for convergence in the modelling of operational risk would include a move towards consistent approaches to the generation of:

- Definition of a scenario.
- Correlations, and also some consensus on correlation coefficients between the categories of operational risk.
- Aggregation techniques

## Impact

The impact of the range of approaches is yet to be determined, which presents a significant amount of uncertainty for insurers as we move towards 1st January 2016. With the potential volume of Internal Model applications outlined previously, there is significant pressure on regulators to process applications in time, further complicated by having to make decisions based on varying approaches.

The potential for forced convergence is a legitimate concern, which would likely lead to many firms not following the 'chosen path' having their modelling approach challenged and potentially having their applications rejected. The problem for those firms is that other than the Standard Formula, what alternatives are there?

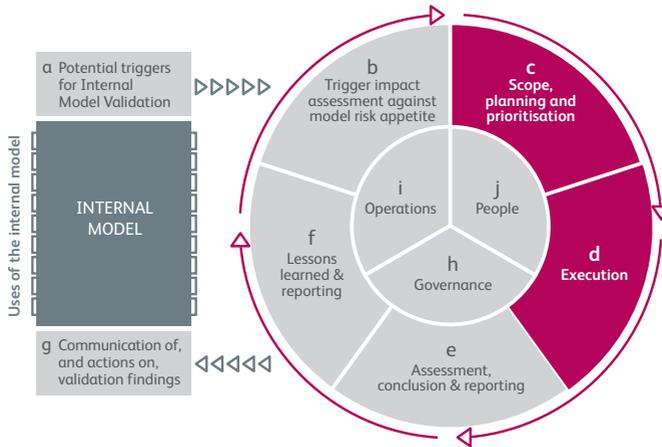
Capital Add-ons have been mooted as a possible regulator action, but there's no definitive information currently available on this. There are no other regulator-approved models on which to base a comparison, and it is highly unlikely any will be proposed soon due to both legislative constraints and limited resources at EIOPA (which recently admitted it didn't have the resources to review the Standard Formula, let alone investigate alternative models).

*“We believe the industry must continue to look to examples of leading practices amongst peers and continually strive to converge on these approaches. Otherwise, there may be a risk that regulators step in and force convergence to more rigid, simplistic practices – which would end the healthy competition of new ideas and practices now observed across participants.”*

### **Operational Risk Management & Measurement**

Survey by ORIC International and Oliver Wyman

# Operational Risk Modelling Validation Approaches



One area outside of modelling approaches where we saw a good level of convergence is in regards to validation.

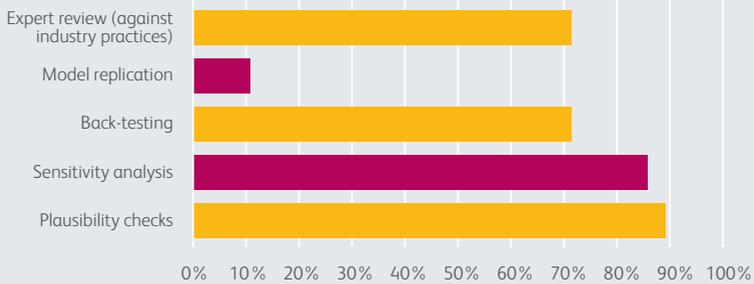
For more information on the validation cycle, as depicted in this diagram, see our previous IMIF publication 'The validation cycle: developing sustainable confidence and value'.

**86% of respondents stated they were validating their model on at least an annual basis.**

And there was convergence on techniques used with all of the following being used by more than 70% of responders:

- Plausibility Checks
- Sensitivity Analysis
- Back-testing
- Expert review (against industry practices)

## Primary validation techniques for operational risk



### Who is performing the validation?

There was however divergence when it came to who was performing the validation, with only 18 % of respondents using an external party to perform any aspect of validation. Others used independent internal team varying from a section of the risk function/ actuarial/capital management community to a dedicated Independent Validation Unit. External validation can (on occasion) be a useful component of an overall validation framework to provide a clearly independent viewpoint.

### Expert judgement

There is perhaps more focus on validation of expert judgement in operational risk due to its pervasiveness throughout the whole operational risk model, especially in those firms relying heavily on scenario assessment.

Examples of market practice discussed in working groups regarding validation of expert judgement include:

- Minutes of workshops
- Participant knowledge/skills description
- CV's of employees providing expert judgement to document suitability
- Not including the risk owners in workshops to get impartial views
- Sensitivity analysis on judgements to assess impact of using a different assumption

## Executive-level oversight

From a governance perspective, an interesting example of good practice is one firm having a Non-executive Director oversee a specific part of the model. Obviously this is reliant on firms having appropriately skilled NED's to perform this role, but the level of independence and oversight could be a very powerful validation tool for firms in a position to follow that path. It will also provide very senior ownership of aspects of the model assisting visibility at board level and providing a point of escalation for any issues encountered during the process.

Having executive-level ownership and responsibility for each of the operational risk categories/scenarios within the capital calculation can help to gain buy-in and embed use within the business. However, if executives contribute a major part of the expert judgment the company needs to take especial care to consider how it counterbalances the potential for bias and 'gaming' of the result. This is where appropriate governance frameworks and use of loss data are of vital importance.

## Statistical tests for validation

In addition to the 'softer' validation questions, such as whether people understand the model, and if there is clear and robust governance around data quality, model assumptions and expertise of those providing judgements within the model, technical tests are required to ensure the robustness of the firm's chosen modelling approach and that the output is appropriate.

The stability of the model will be an important area of focus for the technical validation, in order to provide comfort that the choices made in development of the model are acceptable. These tests will focus in particular on the sensitivity of results to changes in the key underlying assumptions and may include back-testing, which will bring in tests of the underlying data that has informed outputs to ensure that it is 'accurate, complete and appropriate'. Complete replication of a model could also assist in validation of this aspect, however as the graph on the previous page shows very few firms are currently choosing to do this.

Changes to choices and assumptions that shape the model will also be assessed, which for example may include curve fitting with a variety of different distributions to verify the choices made in regards to these aspects of the internal model are appropriate. This is motivated by the need to ensure that the choices and assumptions forming the model are not reducing the overall capital requirement output. Statistical tests such as Skewness and Kurtosis can allow analysis of the shape of the full distribution, whilst also giving insight into the 'fatness' of the tails to ensure an overall view of the statistical distribution output from the model.

Finally, there is specific analysis that can be used to test the tail of the distribution to ensure it is 'fat' enough such as analysis of the 1 in 200 loss figure against the 1 in 200 expected shortfall amount or the maximum loss, as well as potentially using a mean-excess function (especially relevant when validating a Generalised Pareto model).

## Documentation

A key area of importance related to the validation of an internal model is the associated documentation. This needs to be at the level that a 'knowledgeable third party' would be able to understand it; so you are not writing this solely for an internal audience, which has a significant bearing on content.

Some key points to consider on this topic include:

- The Solvency II (SII) requirements in relation to documentation are clear. Your firm's SII document management policy should be consistent with this in defining the requirements that your operational risk material need to meet.
- At the front of the document, state the owner of the document and the governance process it has been through (including when the next review is due).
- An early cross-reference to the key regulations that each document seeks to comply with can be helpful, as can schedules of related material.
- Structure documents in a logical way, such that a 'knowledgeable third party' can form an understanding of your firm's structure, lines of business, and approach to modelling operational risk. Material differences between areas should be explained and justified.
- Avoid use of jargon and internal acronyms. Glossaries can be useful.
- Explain how the capital model is a good fit for your business model.
- Discuss and explain alternative approaches considered and why they were rejected in favour of the approach adopted.
- Reliance on expert judgement is material for operational risk, so needs to be thoroughly explained and justified.
- A well prepared document will support independent validation, making that task more straightforward.
- This material cannot be written to sit on a shelf and gather dust – it should be reviewed for currency and refreshed on a regular basis.

**A firm can have a first class approach to modelling operational risk, but you have to properly document this in order to get your internal model approved.**

# Operational Risk Modelling

## Where do we go from here?

Currently firms are heavily focussed on getting regulatory approval for their internal model. A number of firms well advanced in the process are looking long-term at how the model can be embedded in the business.

**The objective is to produce a useful business tool rather than just a means of calculating regulatory capital.**

If it can deliver both, then it improves the business case for continuing investment in the work if setbacks are encountered through the IMAP process for Solvency II.

The current focus on measurement is understandable in the context of where the industry is in advance of 1st January 2016, but firms are also looking to use the model for management purposes which will be vitally important beyond that date. Examples of this include: assessing strategic decisions by their impact against risk appetite, ensuring capital allocation is appropriate and setting metrics/limits/thresholds for business decisions across the entire organisation.

Regardless of the numerical output of the model, a monetary figure will never be acknowledged as the best mitigant for operational risk. The impact the model development process has on informing and improving the firm's risk management framework will have a much more significant impact on its ability to improve management of operational risk, especially with a structured process of education and awareness-building to help develop risk culture through embedding relevant aspects of the model throughout the firm.

One area that is currently underdeveloped but firms are exploring, is the use of insurance as a direct input into the capital model. It may already be considered indirectly as part of quantification exercises for scenarios, for example 50% of respondents to our survey consider insurance as a mitigant in this manner, but as a direct input into the internal model there has yet to be substantial uptake within the industry. This is likely due to both lack of understanding/appetite as purchasers, but also the appetite to underwrite such insurance whilst the market is still in its relative infancy.

The most pressing consideration in the near-term however is going to be regulatory response to the models which have been developed. It will be vitally important to use feedback received constructively and utilise it as a means of effective engagement with the regulator to gain more insight into expectations of firms in their approach to modelling operational risk under the Solvency II regime.

## Our project team

We would like to thank the following people and their employers for their work on this document:

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The IMIF steering committee comprises:

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# The Internal Model Industry Forum

This document has been produced by the Internal Model Industry Forum (IMIF). The Institute of Risk Management (IRM) set up the IMIF in 2015 to address the key questions and challenges that insurers face in the use, understanding and validation of internal risk models. It is designed to work in a collaborative way to develop and share good practice to ensure that these models add value to the organisation and support regulatory compliance. IMIF now has over 300 members and we have run a series of Forum meetings to explore key issues. A number of workstreams are also undertaking research and we aim to publish the results along with other useful resources and guidance.

As the leading organisation promoting education and professional development in all aspects of risk management, IRM is pleased to be able to support this industry initiative to share good practice

**More information about the IMIF and its work can be found on the IRM website [www.theirm.org](http://www.theirm.org)**

## Who are the IRM?

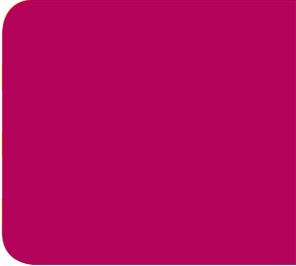
This work has been supported by members of IRM, which has provided leadership and guidance to the emerging risk management profession for over 25 years. Through its training, qualifications and thought leadership work, which includes seminars, special interest and regional groups, IRM combines sound academic work with the practical experience of its members working across diverse organisations worldwide. IRM would like to thank everyone involved in the IMIF project.

## Who are ORIC International?

Founded in 2005, ORIC International is the leading operational risk consortium for the (re)insurance and asset management sector globally. The consortium currently consists of 40 members with accelerating international growth.

ORIC International is a not-for-profit organisation dedicated to helping its members enhance the capabilities of their operational risk functions. We facilitate the anonymised and confidential exchange of operational risk intelligence between member firms; providing a diverse, high quality pool of quantitative and qualitative information on relevant operational risk exposures.

As well as providing operational risk event data, ORIC International also provides industry benchmarks, undertakes leading edge research, sets trusted standards for operational risk and provides a forum for members to exchange ideas and best practice. Our comprehensive offering is designed to empower operational risk professionals to help the business and their Board in the identification, assessment, management/measurement, monitoring and reporting of operational risk.



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## Our supporters

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