

Internal Model Industry Forum:

# Model Change

March 2019

Internal  
Model  
Industry  
Forum

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# Foreword

In order to gain approval for the use and maintain the approval of an internal model, Solvency II, and indeed other regimes, requires insurers to have a process for managing changes to that model. The rationale is fairly straightforward: regulators do not want to approve a model and then find that it gets changed straight after approval. There needs to be a formalized system of change that incorporates appropriate regulatory oversight and reference, particularly where the change might be significant enough to change the capital requirements of the firm.

However, while that sounds reasonable and (perhaps) straightforward, the reality and challenges of implementing such a process are far from straightforward. As a result it is rare that I go to a gathering of my peers without the subject of “model change” entering the discussion at some point. And the debate can get quite heated.

This is exactly, therefore, the sort of territory and subject matter that the IMIF is seeking. If we are to be a group that helps to drive industry practice and consensus, then there is no point in avoiding difficult topics. So, feeling bold after the positive reaction to our last two papers on Operational Risk Insurance and Model Risk, this paper addresses the topic of Model Change.

It seeks to answer the questions:

- How should firms define a change to their Internal Model?
- What constitutes a major model change?
- At what point should an aggregation of minor changes become a major change?
- What is the most appropriate governance structure for overseeing model change?

I would like to thank the members of our project team for their extensive work researching and developing the thinking in this booklet. Our IMIF Steering Committee provided overall project guidance and peer review.

We are grateful to representatives from the Prudential Regulation Authority (PRA) and the Central Bank of Ireland (CBI), who have enabled us to maintain a continuous and positive dialogue between industry and the regulators on our work.

I would also like to thank PwC for their leadership on this paper. As a not-for-profit organisation IRM is reliant on enlightened industry support to help us publish documents like this. It is this kind of support that helps us maximise our investment in the development and delivery of world class risk management education and professional development.

Lastly, I would like to issue a call to all the recipients of the paper: We wish to continue to drive the IMIF and we are constantly seeking new ideas and new members who can contribute to our work. If you feel you can contribute, then please reach out to me or the IRM and we shall gladly accept your support.

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Chair IMIF  
Head of Model Validation and Risk Governance (including Operational Risk), AXA XL

# Executive summary

## Introduction

Effective management of model change is an area of regular debate within firms operating an Internal Model. Any model firm needs to manage a number of drivers of change in an evolving risk environment within regulatory, practical and operational constraints. To support the industry with this challenge the Internal Model Industry Forum (IMIF) working group on model change has developed the following paper.

On the back of a survey of industry practice, as well as the experience of the working group itself, we discuss the approaches followed in industry and guidance on resolving some of the difficult questions for practitioners.

For many firms in the industry the Internal Model is now well embedded. The model change process however is less well developed and many have tried to streamline the model change approach and establish a business-as-usual (BAU) change process. Uncertainty around the definition and approach to major model change has not helped and has led to inconsistent approaches across the industry. Although the PRA has recently released helpful guidance (PS20/18) on a number of areas, there remains significant uncertainty in other areas, such as around the definition of a major model change. This paper aims to explore these areas of uncertainty.

## Our approach

We were keen to first get a full understanding of how firms had approached model change and what challenges they had faced. Our objective was to gain insight into the following:

- The model change triggers, both qualitative and quantitative, used by firms to distinguish between major and minor model change.
- The approach to aggregation of minor model changes.
- The time and effort required for major model change and how firms resource this.
- What updates firms had made to the model change policy since approval.

We undertook a survey of the industry to investigate these areas. Ten internal model firms with full or partial approval responded to the survey. We then used the results of the survey to stimulate discussion amongst the working group to develop further insight.

## Highlights

Changes need to happen in the model as changes happen in the business and change is necessary to retain stakeholder trust in the model and its output – the model needs to remain fit for purpose. But firms need to balance this with the fact that too much change will undermine trust in the model and the operational constraints of costly analytical and governance processes around model change. We investigated how well the industry was striking this balance. From our survey and through the working group discussions, we identified a few areas of consistent practice but there were a number of areas where the best approach was not clear. We have called out, in the table below, the highlights of our discussions:

- **Use stakeholder expectations to guide the principles for defining model change.** Some consistent areas of model change arose from the survey, however it was also clear that it was ambiguous whether certain sources of change should be defined as a model change or not. For example, should a standard parameter update from a year of additional data be considered a model change? An exhaustive list of possible model changes is not practical. Consistent with some firms in the market, we found that it helped to define key principles to guide the model change definition. One key principle is to define a change with respect to the level of stakeholder interest – if a change would be considered important by a model stakeholder then it should be considered a change. This is important in ensuring that a firm’s model change policy meets one of the main objectives of an effective model change process: retaining stakeholder trust. Applying these principles can help to clarify the ambiguous areas.
- **Major change threshold of 10%.** Based on the survey respondents, the market has settled on a level of 10% of the one year SCR as a quantitative definition of major change. There were examples at 5% and 15% but the majority had selected 10%. There was some evidence, from our survey, that firms with a higher trigger had applied for fewer major changes since IMAP (and vice versa with regards to lower triggers) although this is based on a small number of respondents.
- **Unrelated minor changes aggregated on an absolute basis and related changes on a net basis.** The majority of firms in the survey aggregated minor model changes on an absolute basis, that is, positive and negative changes do not offset each other. The preferred approach of the IMIF steering committee was to aggregate unrelated changes, for example, between risk components on an absolute basis but there may be situations where aggregating related minor changes on a net basis could be appropriate. An example might be when there has been a change in the data used to determine a parameter as well as a methodology change that is necessary to align to the change in data, such as moving from annual to quarterly historical data points. These changes are related changes and offsetting the impact of these changes could be appropriate.
- **Allocate responsibilities for model change.** There was significant variation in our survey, from an operational perspective, in how major model changes are resourced. Managing resources for model change is difficult when the scope of model change is uncertain each year. We did note however that the number of major change applications averaged one per year. For some firms it has been helpful to establish roles in the organisation dedicated to model change to align to an expected demand of one major change a year.

# Introduction

For many firms in the industry the Internal Model is now well embedded. The model change process however is less well developed and many have tried to streamline the model change approach and establish a business-as-usual (BAU) change process. Uncertainty around the definition and approach to major model change has not helped and has led to inconsistent approaches across the industry. This paper aims to help provide some clarity on the approach followed across industry, covering questions such as:

- How should firms define a change to their Internal Model?
- What constitutes a major model change?
- At what point should an aggregation of minor changes become a major change?
- What is the most appropriate governance structure for overseeing model change?

In December 2017, the PRA issued a consultation paper CP27/17 aimed at consulting with firms to understand the effectiveness of certain aspects of the internal model change process. The CP covered four key aspects of firms' model change processes:

- (1) Introduction of annual reset of minor model change accumulations.
- (2) Request for further clarification required around scope of model change policies.
- (3) Reporting of minor model changes.
- (4) Introduction of standardised minor model change reporting template.

On 13th July 2018, the PRA issued a policy statement PS20/18 containing its responses to feedback from the consultation. The PRA received four responses to the proposals in the consultation paper with respondents mostly welcoming of the PRA's proposal.

We also welcomed the PRA's efforts to simplify the model change process. The updated supervisory and policy statements in July 2018 (an updated SS 12/16 and PS 20/18 respectively) provided clear guidelines on the approach to be followed on minor model changes and the aggregation of such changes which should provide clarity to firms. The PRA has also provided further guidance on minor model change reporting timelines and the process for completing and submitting the reporting template. On the whole, the changes should be beneficial for firms and should ease the burden of compliance.

However, there remains significant uncertainty around the definition and approach to major model changes and there also remains scope for differences in interpretation, measurement and implementation of model change policy - this is no real surprise as we acknowledge that there can be no one-size-fits-all approach to model change. Our observations from the market are that there are a range of model change approaches which firms have adopted. We therefore conducted a survey of the market in September 2018 to understand the approach taken by Internal Model firms.

In developing this paper we found a useful reference in the PRA review of model change related processes, policies and reporting in 2017<sup>1</sup>. We encourage readers to reference the PRA pages for the latest regulatory information and guidance on model change.

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<sup>1</sup> <https://www.bankofengland.co.uk/prudential-regulation/publication/2017/prastatement-solvency-ii-pra-review-of-model-change-related-processes-policies-and-reporting>

# Internal model change: industry view

We undertook a survey of the industry to investigate model change. Ten internal model firms with full or partial approval responded to the survey. We used the survey results to stimulate discussion amongst the IMIF working group to develop further insight and to help formulate the views discussed later in sections of this report. This section covers our survey questions and responses.

## Approval year of participant's internal models

We asked firms when they received full or partial approval from PRA. The responses indicated that 8 out of 10 firms are wave 1 firms and so have had a number of years of experience of running their internal model, while 2 firms received approval in 2016.

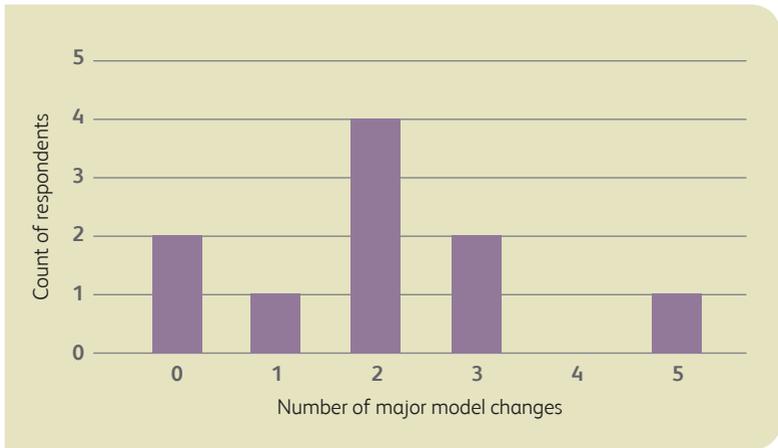
## Frequency of model change

We asked participants how many minor and major model changes they had made or applied for since having their Internal Model approved:

**Chart: 1 Number of minor model changes since approval**



**Chart 2: Number of major model change applications made since approval**



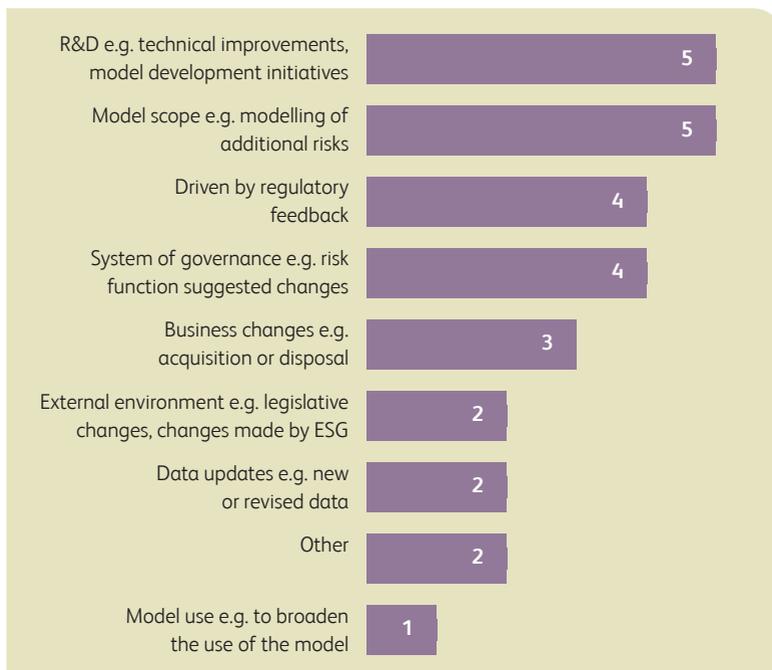
For minor model changes, there is significant variation in the responses. This is likely driven by a number of factors, including the size of the company, number of products modelled and also how minor changes are defined by respondents (e.g. some companies may group multiple model changes together as a single minor change if they relate to a single model issue).

For major model changes, the survey respondents had an average of approximately two major change applications per firm, or one per year since IMAP approval. This aligns with PRA expectations according to SS12/16 (where it notes, under section 2.6, that "The PRA expects firms to submit no more than one model change application per year"). However, responses range from no major model change applications at all since model change approval to as many as five. This may indicate the discrepancy in the way major model change thresholds are set by various firms from both a quantitative and qualitative perspective. We noted, perhaps unsurprisingly, a link between the firms with a lower quantitative thresholds for major model change and those that had made a higher number of major model applications.

## Model change triggers

We asked firms what the triggers have been for their major model changes. Respondents were able to select any options which were relevant. There were, in total, 28 triggers selected across the eight respondents who answered the question, the question was not relevant to the two firms that have made no major model changes. We grouped the 28 triggers into nine buckets as shown in the chart below.

**Chart 3: What have been the triggers for your major model changes?**



The survey indicates that the top two drivers of major model change have been R&D activities and model scope changes, followed by changes suggested by system of governance and regulatory feedback.

## Qualitative and quantitative triggers for major change

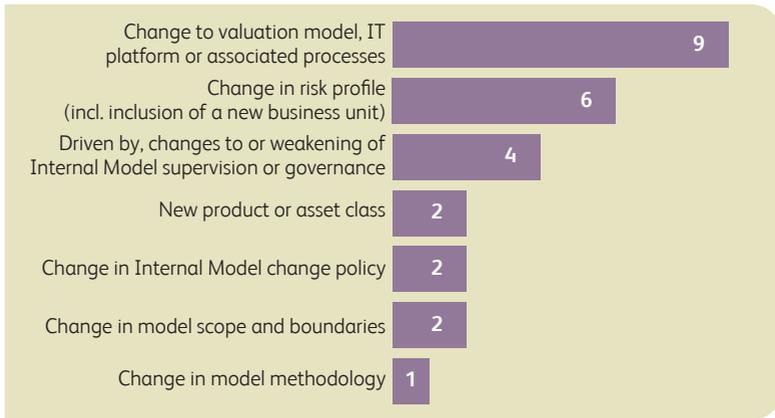
We asked participants what the thresholds for measuring major model changes were set in relation to. All participants selected the One Year SCR (no participants selected the alternatives of Ultimate SCR, both Ultimate and One Year SCR or other).

In order to gain further understanding of how the quantitative and qualitative triggers vary across the industry, we asked participants to provide the percentage movement in One Year SCR that would trigger a major model change and a few examples of qualitative changes that would trigger a major model change.

**Chart 4: Major model change trigger as a percentage of One Year SCR**



**Chart 5: Qualitative factors which could lead to a major model change**



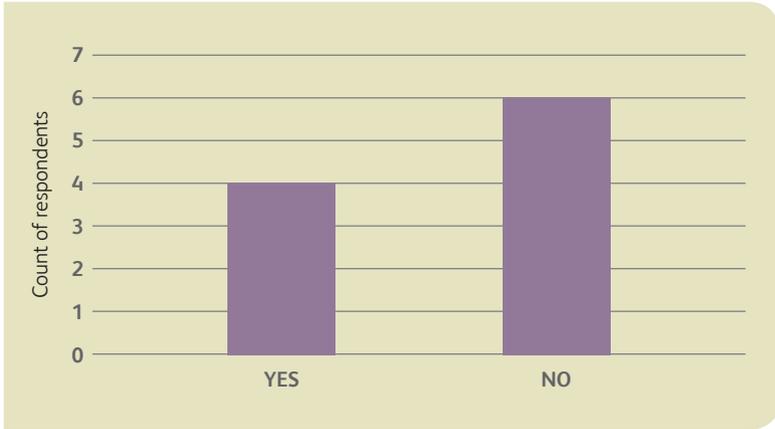
The survey results indicate that 6 out of 10 firms have defined 10% movement in the One Year SCR as a trigger of major model change, however there are firms which have thresholds as low as 5% and as high as 15%. The results point to the variation in the number of major model changes that we've seen across the industry (refer Chart 2). There is therefore broad consensus in the market for an appropriate major model change quantitative trigger level in terms of the One Year SCR.

We asked participants to provide 3 examples of qualitative changes that could, in theory, trigger a major change to their internal model. We received a range of responses which have been grouped into key themes in Chart 5. The chart suggests that changes to valuation model and risk profile are the major drivers of major model change. As expected, there is a significant range of qualitative factors that respondents believe could lead to a major model change.

## Granularity of major model change thresholds

We asked participants whether they set major model change thresholds by individual risk type, in addition to considering the impact on the one year SCR.

**Chart 6: Number of companies who define major model change thresholds by risk type**

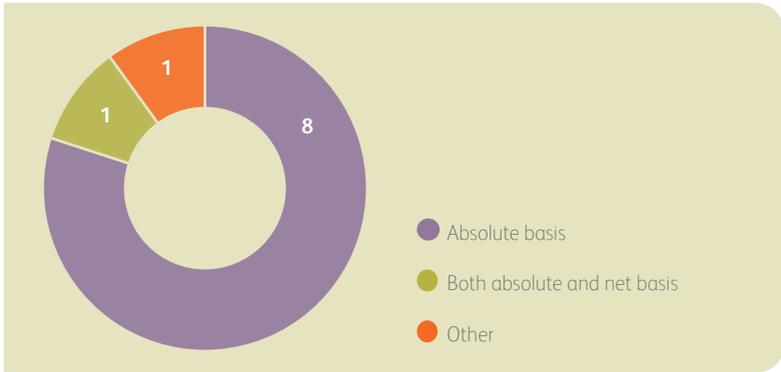


The majority of firms do not set major model change definitions by risk type. For those participants that do, there was an equal split between those that use quantitative measures only and those that use quantitative and qualitative measures. The quantitative measures used by the relevant firms were typically in line with or higher than the one-year SCR thresholds.

## Aggregation of minor model changes

We asked participants what approach they took to aggregating minor model changes for the purpose of assessing whether a major model change has been triggered.

**Chart 7: Aggregation approach for minor model changes for triggering a major model change**

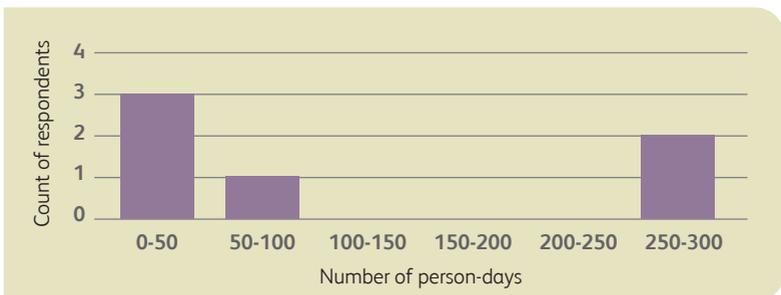


In the graph above, 'other' represents 'qualitative assessment' which was the response provided by one participant which may mean that the impact of minor changes is aggregated based on the type and complexity of change. The vast majority of respondents aggregate minor model changes on an absolute basis (e.g. a -5% impact and a 3% impact would sum to 8%).

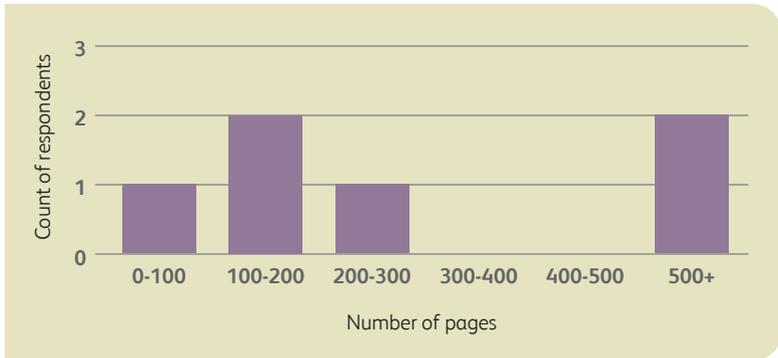
## Operational considerations of major model change

We asked participants how many person-days across all business units, approximately have been spent in preparation of the last major model change (pre and post application). We also asked participants the length (in terms of number of pages) of their last major model change application and how they resourced their major model change applications.

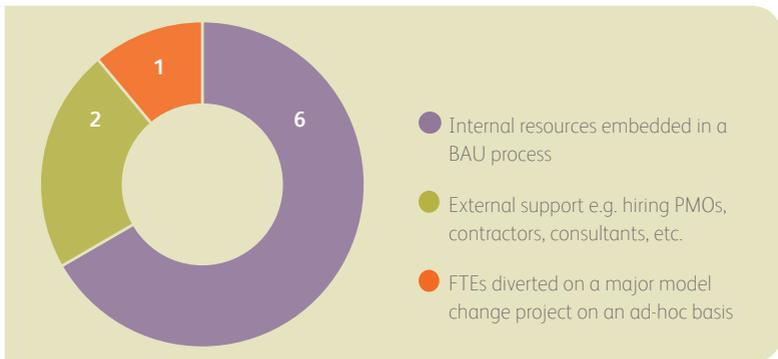
**Chart 8: Person-days spent in preparation for the last major model change**



**Chart 9: Number of pages of documentation submitted in last major model change application**



**Chart 10: Resourcing of major model change**



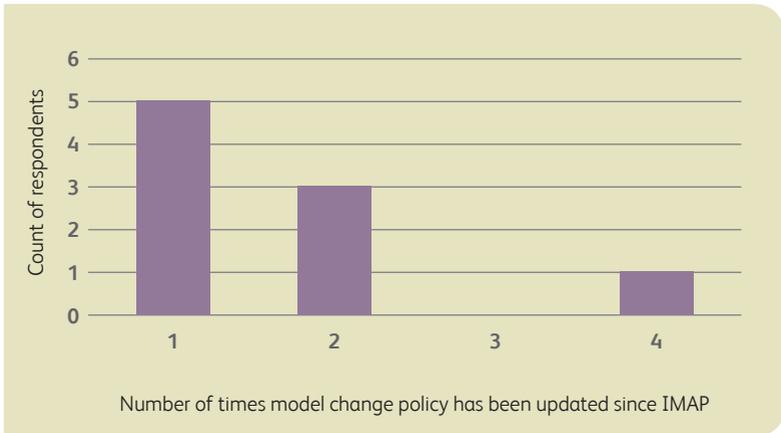
The survey results indicate a level of variation in the amount of effort required by different firms for their major model change application. The amount of documentation can vary between 25 to 500+ pages and the number of person-days spent in major change application can vary between 30 to 300 person-days. It is likely that the complexity and type of major model change would also be a major determinant of the effort required.

The survey also highlighted that most of the firms, resource their major model changes internally with these resources embedded within a BAU processes. It is also worth noting that the higher end of responses, in terms of effort required, typically selected “external support” or “FTEs diverted on a major model change project on an ad-hoc basis” when answering the question in chart 10.

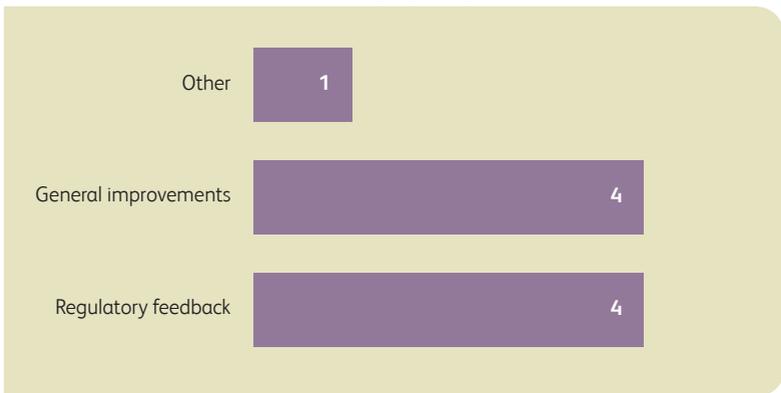
## Revision of model change policy since first approved

We asked participants how many times they updated their model change policy since first approved and what the key drivers of the model change policy updates were:

**Chart 11: Number of time model change policy has been updated since IMAP**



**Chart 12: Drivers of model change policy updates**



The 'Other' in Chart 12 was provided by the respondent as 'regular review of documentation & updated to be consistent with corporate transaction.' We also note that a significant number of firms have received regulatory feedback on their IM policies which has led to changes.

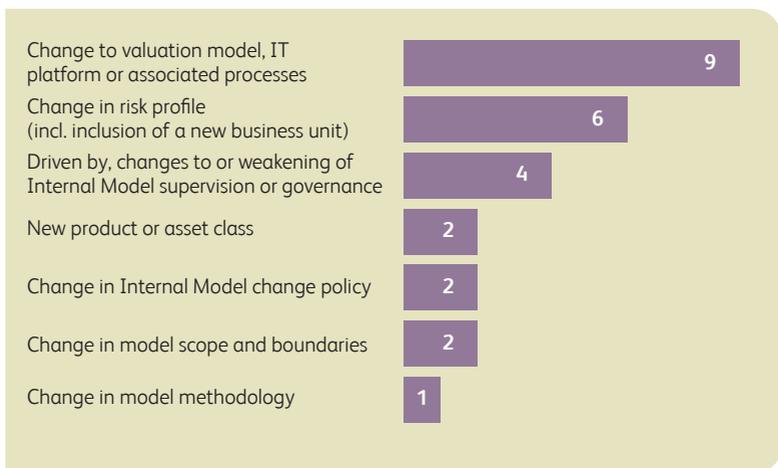
# Internal model change: our findings and views

Within this section of the report we have documented our views in relation to internal model change, building on the survey responses discussed in the preceding sections with the discussions held as part of our Internal Model Industry Forum (IMIF) working group meetings.

## Definition of model change

Identifying a clear definition of a model change is challenging, something many firms in the market have been grappling with. Internal models are used across a variety of areas in the management of insurance businesses, beyond the setting of the SCR, and are affected by a variety of sources of change within the business. As a consequence, many firms have struggled to define to their satisfaction the changes within their business that would necessitate a model change or to define it in unambiguous terms. From our survey results, particularly our question on qualitative sources of model change (chart 5), it is clear that there's a range of views from across the market of what can constitute a model change:

**Chart 5: Qualitative factors which could lead to a major model change**



The PRA's latest policy statement on model change (PS20/18) provides limited guidance around the definition of a major model change. For example, there is no specific guidance on the approach which should be followed for setting a threshold for major model changes or how firms ensure that their model change policies meet EIOPA guidelines<sup>2</sup> on the use of internal models. Firms may find it difficult to gain comfort that their major model change policy fully aligns with the regulatory requirements as a consequence and there may be significant variance in industry practice as a result. This could prove inefficient for firms, in that they may focus too heavily on areas that are not aligned with the regulator's expectations leading to more supervisory interaction.

## Principles of the definition of change

The variety of levers available to change the environment in which the internal model operates or the results of the internal model means it is difficult to succinctly define an internal model change. Changes need to happen in the model as changes happen in the business and change is necessary to retain stakeholder trust in the model and its output – the model needs to remain fit for purpose. But firms need to balance this with the fact that too much change will undermine trust in the model and, from a practical perspective, firms will want to minimise the number of formal model changes as a formal change will generate costly analytical and governance processes. Some of the tougher questions arise when deciding whether a change should not be classified as a formal change – deciding it is not a change at all (more on this below).

To ensure the model remains fit for purpose, an internal model change can be thought of as a change which:

- (1) in some way alters or changes how risks are measured in the model (including aggregation of risks) or allows for additional risks, assets or products not currently measured, or;
- (2) alters how the internal model is calibrated, run, reviewed, governed and controlled, or;
- (3) alters how the model outputs are ultimately used to make decisions within the business.

The materiality of the impact will drive whether a change is considered to be a major or minor change; major and minor changes are discussed later in this paper.

Most firms recognise that there can be a range of sources of change within the business that can drive changes to their internal model. Hence, the model change policy needs to be broad enough to capture a range of potential sources of change which could feasibly occur without attempting the impractical task of defining an exhaustive list. Some firms, therefore, have decided to provide a high level list of qualitative principles for defining model change in their policy, similar to the list above, supplemented by further guidance to enable an assessment on a case-by-case basis whether a change within the business should be considered as a formal change. This approach enables firms to have the required flexibility to assess potential sources of change, which can arise from a variety of areas of the business.

Despite the range of views from across the market provided in our survey, some consistent sources of model change arose in the responses. Some of these sources of change and whether they should be classified as a formal change are more ambiguous than others – this ambiguity is a key area of uncertainty for the industry. In our table below, we have outlined some possible sources of change and how these sources could be considered when determining a formal model change. This list is not meant to be exhaustive but to highlight that there are a significant number of areas that can drive model changes. It is important to distinguish between sources of change (areas which could feasibly require a change to the internal model), actions that constitute a change in the model and actions that constitute a formal model change, that is, a change that will be recognised in the model change log and other documentation relating to model changes.

Source of internal model change	Description of source	Considerations for internal model change definition
Change in risk profile.	A change in risk profile for the business such as the acquisition of a book of business, a new product or a new asset class.	<p>A change in the risk profile would usually be included as a source of model change. Most people would expect the acquisition of a book of business to warrant some specific changes in the model, for example.</p> <p>In other circumstances however, a profile change may not necessarily be a formal model change. For example, a change in the hedging structure using market instruments that are already modelled will change the risk profile but may not be considered as a model change. Stakeholders may be comfortable with this decision where there is relatively insignificant impact on the model output, however, where the impact is material then there may be an expectation that this is recognised as a formal change in order to be assured that any limitations in the modelling of the instruments do not become material under the new profile.</p> <p>In the example of a new product, the change in the model could be either via a pragmatic approach (whereby current model calibrations are used and the inaccuracy of this approach is calculated and recorded in the expert judgement log) or through a change in the model methodology to allow for the accurate modelling of the new risk. Either way, the fact that allowance is needed in the internal model results for the new risk means that an internal model change will have occurred.</p> <p>The appropriate approach will likely depend on the materiality of the change in risk profile (which for new business may be small in the first few years, but for an acquisition may be material) and whether the change would be material enough to trigger a major model change. Where a simplified approach is used to allow for the change in risk profile, this would require continuous monitoring to ensure the approach is materially accurate as exposure grows, which will likely eventually require a more sophisticated model change.</p>

Source of internal model change	Description of source	Considerations for internal model change definition
Outcome of model validation	Findings raised from model validation exercise require changes to the internal model methodology, assumptions, parameters, judgements or governance & controls	<p>Model validation is a clear source of model change. In particular, validation findings whereby the model is expected to be materially inaccurate (with materiality defined by validation testing thresholds) or where a group of findings are expected to be material would likely result in an internal model change to remediate these findings.</p> <p>It is worth distinguishing between ‘sources of model change’ and ‘model change’ when considering the process of reviewing model methodology and calculations. A model validation exercise would not typically be viewed as a model change by itself, but it could be a source of model change if it resulted in the discovery of material model improvements in the internal model methodology, expert judgements or controls around the models which were subsequently remediated in the internal model.</p>
BEL and Own Funds	Changes in Best Estimate Liabilities and Own Funds in the base valuation can have a knock on impact on the SCR calculation which may require an internal model change.	<p>Changes in BEL and Own Funds, for example, as a result of a year’s worth of liability experience on current business, would not normally lead to a change in the internal model provided that the approach to stressing the assets and BEL remains materially appropriate.</p> <p>It is, however, possible that a change in BEL or Own Funds could result in a simplification or expert judgement becoming materially inaccurate which could then require a model change. Hence, it is important that there is strong governance and validation procedures in place to assess whether the internal model continues to be appropriate following changes in the underlying BEL and Own Funds.</p>
External environment	Changes in the external environment could impact on the appropriateness of the insurer’s internal model	<p>Changes in the external environment (such as changes in external models) fall under the responsibility of the insurer when assessing the possible impact on internal models. Hence, these could represent sources of internal model change if the change in the external environment means that the internal model becomes inappropriate through its reliance on the external environment.</p> <p>For example, a change in the Economic Scenario Generator (ESG) used by the firm may require changes to how the market risk stresses are applied in the calculation of stressed stochastic liabilities which could represent an internal model change.</p>

Source of internal model change	Description of source	Considerations for internal model change definition
Compliance with a change in regulatory requirements	Ensuring compliance with regulatory requirements can be a source of change in the internal model.	<p>In general, most people would expect that a change driven by ensuring compliance with regulatory requirements would be classified as a formal model change.</p> <p>Testing compliance may form part of model validation and review, or it may be driven by regulatory changes or regulatory feedback which requires a model change to maintain compliance.</p> <p>However, if a weakness in compliance with the regulation is discovered, this does not necessarily lead to a model change as it depends on the severity of the non-compliance and the materiality of the issue which is an area of expert judgement.</p>
System of governance	A material weakening of governance can be a source of model change	<p>Changes in governance can be a qualitative factor of the internal model which represents an internal model change. However, firms may find it difficult to decide which changes in governance are significant enough to represent a change to the internal model. Whether a particular governance change is significant enough to constitute a model change will be open to interpretation.</p> <p>As with other changes, firms should provide examples in their policy document to give guidance to users and avoid overly onerous procedures.</p>
Data, Assumptions and Parameters	The updating of data used in the internal model calibrations or valuations could be viewed as an internal model change in some instances. Changes to internal model parameters or assumptions could also represent an internal model change in some instances.	<p>Many companies may view running updated data through existing internal model methodology (e.g. 'turning the handle' on the agreed methodology and updating the stresses accordingly) will not represent a formal change.</p> <p>However, we believe, changes in data source or approach to manipulating data could represent a model change. If we consider the principle that stakeholders would expect any material change to be recognised as a formal change, then there are circumstances that a standard data update can be a formal model change.</p> <p>The updating of parameters is similar to the updating of data. Running an additional year's worth of data through the parameter setting methodology, for example, may not be viewed as a model change. However, when material, it might be identified as a formal model change.</p>

Source of internal model change	Description of source	Considerations for internal model change definition
Model Corrections	Correct model errors could be viewed as an internal model change.	<p>Companies may differ in view as to whether correcting their model in order to comply with the approved methodology constitutes a model change. However, in practice, internal governance and regulators may have an interest in significant model corrections and the reason these were not captured as part of IMAP or model controls. Hence, significant model corrections may lead to model changes for more qualitative reasons.</p> <p>That said, some firms may view that the process of highlighting significant model corrections to the regulator should follow a process separate to the internal model change process, since the corrections technically do not represent a change in the agreed model methodology.</p>

# Setting thresholds for major model change

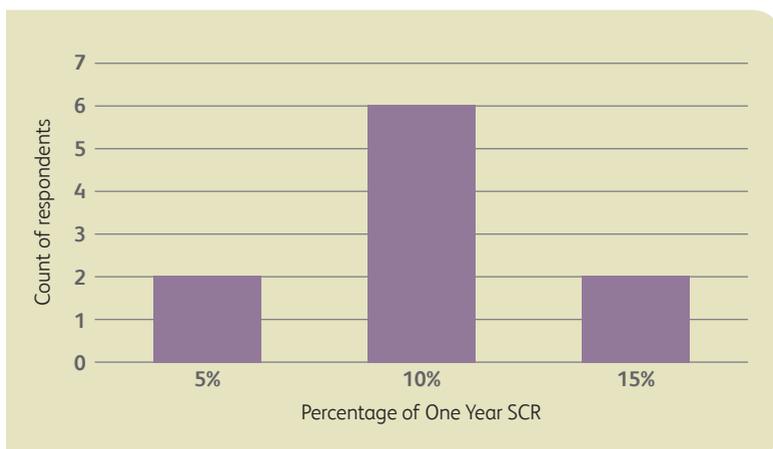
Model changes are typically categorised as either major or minor. There could be justification for having further categories of model change, however the use of major and minor is consistent with the description of model changes made by the regulator in the recent publication CP19/16.

A major model change is one which is viewed as significant and which has breached either a quantitative or qualitative threshold set by the firm in their PRA approved internal model change policy; major changes will generally be subject to full internal governance and would also require a major model change application to be submitted to the PRA. There is judgement on how model changes are categorised as major or minor since firms have flexibility in the choice of quantitative and qualitative thresholds which model changes are measured against. Some firms also split their minor changes into subcategories in order to provide a more granular response and facilitate differing levels of internal governance. At least one other category of minor change can be helpful in ensuring an appropriate level of governance and validation associated with the change. More than one additional category is likely to lead to unhelpful complexity.

## Quantitative thresholds

In our survey, we asked firms what quantitative threshold they used (in terms of the one year SCR) to assess whether a major model change had been triggered. The majority of firms used 10%, with a few firms using 5% and 15% (chart 4):

**Chart 4: Major model change trigger as a percentage of One Year SCR**



We also note that there appeared to be a trend in the survey responses, in that firms which had higher quantitative thresholds submitted fewer major model changes since IMAP. This is logical and unsurprising, since a higher threshold is less likely to be triggered.

The thresholds are set in increments of 5 %, which is likely due to any further granularity (e.g. such as selecting a threshold of 11 % or 12 %) being considered spurious. Based on our survey results, the market therefore appears to be broadly settled on 10 % being an appropriate quantitative threshold with regards to the one year SCR. The use of 5 % and 15 % may be more appropriate when a firm has a relatively low or high appetite for solvency risk, for example, when a firm targets a higher solvency ratio than its peers it may be reasonable that major change governance is triggered at a higher threshold.

It is also worth noting that the majority of firms do not have model change definitions/ thresholds set by risk type; for those that do, they use quantitative thresholds that are the same or slightly higher than those used for the one year SCR. For the firms that do set quantitative thresholds by risk type, they may find this a useful measure for assessing whether there has been a significant change in a risk type which may not be captured by the one year SCR threshold. In particular, firms may view risk level thresholds as a useful way of assessing whether a change affecting the capital applied to a particular product (for which a particular risk is most important) is appropriate. This may be important for maintaining the trust of users of the model at a risk or product level. Another example is where the effect of diversification means that changes to core insurance risks can get diluted and what many would consider a major change on qualitative grounds does not trigger the major change threshold at the aggregate SCR level.

However, many firms may prefer the simplicity of thresholds set at whole model level, arguing that applying quantitative thresholds at a lower granularity adds too much complexity to the internal model and moves away from ensuring material accuracy of the SCR as a whole. In particular, some firms may feel that the appropriateness of the calibration at risk-type level should be assessed as part of regular model validation or should have been flagged as part of the IMAP process. If there is a significant change required to the model at risk level, this could change the risk profile of the SCR, but this should then be captured by qualitative thresholds rather than separate quantitative thresholds. We note that, therefore, it will likely be on a case-by-case basis that changes need to be assessed to confirm whether a major model change has been triggered, but ultimately this should be against model level quantitative threshold and qualitative thresholds.

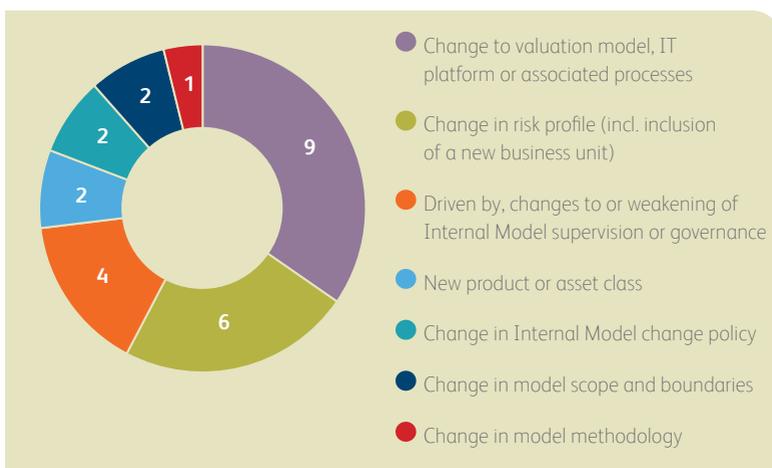
Many firms may find that quantitative thresholds do not drive major model changes in their business, rather that qualitative thresholds drive major changes. This is due to the fact that there are likely few, if any, model changes made in a year which breach the quantitative threshold. Further, with the resetting of aggregated minor model changes annually, aggregated minor model changes are now less likely to trigger the quantitative thresholds.

Overall, an appropriate quantitative threshold for major model changes appears to be 10 % of the one year SCR. The circumstances when a higher or lower threshold is viewed as appropriate are not clear.

## Qualitative thresholds

From our survey and as discussed above under the 'Definition of model change' section, it is clear that there are a range of qualitative drivers which can result in a major model change. In our survey, we asked participants to provide 3 examples of qualitative thresholds that can trigger a major model change. We received a range of responses which we categorised into broad areas. The key qualitative areas, or thresholds, which participants believed could in theory lead to a major model change mainly related to: changes in the valuation model, IT platform or associated processes; changes in risk profile; changes in the valuation model, IT platform or associated processes; changes in risk profile; changes in or weakening of supervision or governance.

**Chart 13: Qualitative factors which could lead to a major model change**



The responses received to this survey question aligned with responses received to our other survey question, where we asked participants what the triggers have been for their major model changes. The most common responses were R&D/technical improvements, model scope, regulatory feedback and system of governance. Hence, although, unsurprisingly, there will be a wide variety of qualitative sources of major model change (which will be driven by specific circumstances of each company), there was broad agreement across participants in terms of which are the most significant qualitative sources.

It is more difficult to measure whether a qualitative threshold has been breached, such that a major model change has been triggered or is required. Although it may be possible to set quantitative thresholds alongside some qualitative thresholds (such as the % SCR impact of a change in risk profile) to help assess whether a major model change has been triggered, for other qualitative thresholds (such as those driven by systems of governance) it will likely require judgement on a case-by-case basis to assess whether the change is significant enough to warrant a major model change. Firms will likely need to have in place an agreed structure and process to assessing such qualitative changes as and when they arise.

## Aggregation of minor model changes

The PRA released an updated supervisory statement (SS12/16) earlier in the year following publication of policy statement PS20/18 which permits firms, under certain conditions, to reset their accumulated minor model changes at the end of an annual cycle (which firms may specify). Prior to this statement, the approach that was to be taken to accumulated minor model changes (in terms of the period over which they should be measured with regards to major model change triggers) was unclear.

Whilst this development is likely to be welcomed by firms, there is still judgement in the approach firms take to aggregating their minor changes and it is therefore likely that the approach will need to be discussed and agreed with the PRA when firms submit their first annual minor change report to the PRA (as discussed in PS20/18). PS20/18 notes in particular that 'Firms are encouraged to discuss accumulated minor changes with the PRA prior to resetting accumulations to zero in order to ensure a common understanding of the interaction between the various minor changes and the model as a whole'. The ability of firms to reset their minor model changes annually will likely prove helpful since it will reduce the number of major change applications arising from aggregated minor changes and will allow firms to focus on significant changes. Early discussion with the PRA on accumulated minor changes, to ensure a common understanding between the firm and the PRA, can help avoid restatements or republication of results should the PRA challenge the results of accumulated model changes.

Firms are required to aggregate their minor model change impacts together in order to assess whether, in aggregate, a major model change has been triggered. The key area of judgement relates to how the impacts of minor model changes are aggregated together. The results of our survey show a largely consistent approach across industry. The majority of firms surveyed aggregate their minor model changes on an absolute basis (e.g. the absolute impacts of minor model changes are summed together in order to assess whether a major model change has been triggered).

It might be appropriate that a set of changes made to the internal model that are closely related, for example, changes relating to the calibration of a single risk type may be classified as one minor change where the changes can be clearly shown to be linked. Expanding the example: changing the data source used to calibrate property valuation risk may result in a change in both the property growth and property volatility parameters. Firms may consider this to be a single minor model change (e.g. change in property risk data source) and hence may net off (if applicable) the impact arising from the consequent impact on the property volatility and property growth calibrations.

It is therefore important for firms to consider at what granularity minor model changes are defined and aggregated. A degree of netting off may be appropriate to make model change reporting practicable and tractable. One approach may be to aggregate changes between risk components on an absolute basis but within a risk component on a net basis where it can be shown that the changes are clearly related as described above. This would likely align with how risk capital is aggregated through the aggregation tool, such that minor changes within a component pre-aggregation are netted off but changes between components which are aggregated together (such as through a copula) are aggregated on an absolute basis. This was the most favoured approach amongst the IMIF working group.

## Model governance

Governance of internal model change has been one of the most challenging parts of the major model change application process experienced by the IMIF working group. There are various issues around model governance which were discussed by the working group:

- Committee structures - the number and nature of committees involved in oversight of the model.
- Involvement of the Board - what level of involvement by the Board in internal model change is appropriate.
- Transparency of using an unapproved SCR - how and whether firms should report the SCR produced by the internal model which is still awaiting approval e.g. during major model change application.

It is recognised within the industry that companies have multiple levels of governance before a major change application is made. Most companies would require three levels of governance i.e. approval from internal model governance committee and risk committee before it goes to the Board.

## Corporate governance structures

Discussion within the IMIF working group provided a couple of examples of different corporate governance structures. The first is where reliance is placed on individual representatives to sign off documentation relating to model changes, with this documentation then going directly to the Board and removing dependence on sub-committees; the second is the more traditional layered committee approval structure. The former is acknowledged to be quicker and increases the accountability of individuals, however it leads to an aggregation of risk that an individual can have a bad day. Approving changes through multiple committees is more time-consuming and can lead to lack of accountability of individuals.

IMIF working group members also noted that they believed the governance around internal model change should be pragmatic; in general, the level of governance required over internal model changes should be based on the significance and materiality of the change made to the internal model. Whatever the governance structure, standardising the reporting within that structure is important for ensuring it operates as efficiently as possible.

## Involvement of the Board

In October 2018, PRA issued a supervisory statement setting out its expectations from the firms around the role of non-executive directors. Whilst PRA doesn't expect board members to be technical experts in modelling techniques, it expects them to be able to understand key assumptions, strengths and limitations, and key sources of information the board relies on. It also expects the executive management to be able to explain the uncertainty around judgements to enable challenge and encourage accountability.

The working group shares the same views as the PRA and acknowledges that the skills required from the Board are more diverse but there is an expectation from them to have broader risk management experience and have previously held roles within regulatory engagements. This may require training and an enhancement of current skill sets.

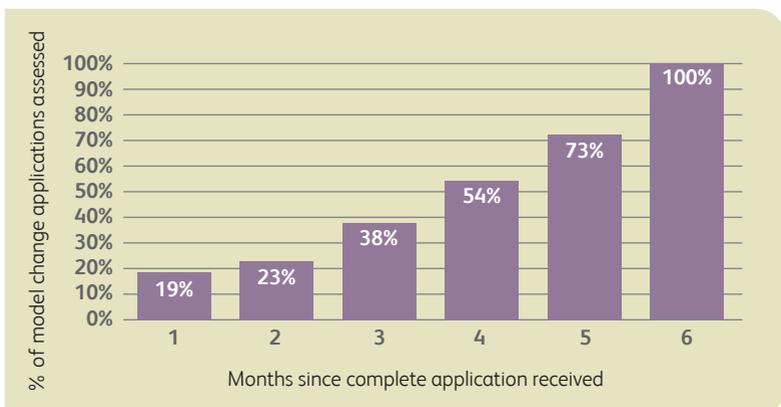
With respect to Board's approval of major model change, the discussion with the IMIF working group highlighted that the process of model change approval is fairly new and hence may not be mature enough at this stage to lead to challenges for the executive management to provide information to the Board at an appropriate level of detail. The industry has seen significant variation in terms of the amount and type of documentation produced for the Board to gain comfort. There are more mature functions within the company which do not have similarly arduous requirements such as internal audit which may be partly because of familiarity with the underlying processes.

The other challenging part of gaining approval from the Board is that it leads to timelines being squeezed leading to enormous pressure on the modellers to deliver the results and the accompanying documentation in order for approval to be sought from various committees before it reaches the Board.

## Unapproved SCR

As stated in the supervisory statement 'Solvency II: PRA review of model change related processes, policies and reporting', PRA must give a decision on a model change application within six months of receipt of a complete application. Between 1 January 2016 and 7 December 2018, the PRA approved 26 complete model change applications – all were assessed within six months, with the PRA taking an average of just under four months to reach a decision. Chart below provides a more detailed breakdown:

**Chart 14: Percentage of model change applications assessed in months since receipt of a complete application**



Source: Supervisory statement 'Solvency II: PRA review of model change related processes, policies and reporting'

One of the challenges for the firms during the application period is to determine the SCR that would be used for public disclosures or internally (say capital allocation assumptions for pricing). In some instances, firms may be in the process of applying for a change in their internal model which will impact on the SCR. The SCR produced from the internal model awaiting approval will effectively be unapproved. In such instances, IMIF working group members noted that the approved SCR (e.g. that produced using the approved internal model methodology) should be disclosed but that any disclosures should note the unapproved SCR (with an explanation around the internal model change in process), particularly where the unapproved SCR is expected to be greater than the approved SCR.

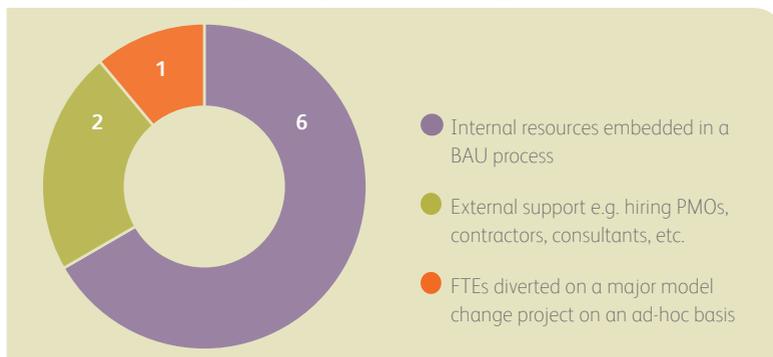
The working group recognises that there are obligations outside of model governance which impose requirements to protect the stakeholders e.g. requirements to disclose the risk profile changes. It is recognised that if a material model change is anticipated, most of the firms would internally be running the model in parallel to quantify the impact of model change ahead of time.

## Operational considerations

The major model change application process is considered particularly time consuming in terms of producing the documentation required and the allocation of internal and/or external resources. This section of the paper reflects on the various operational challenges that firms face. It is recognised that the industry struggles with what model changes should mean in practice. An uncertain level of model change makes it difficult to plan resources appropriately. Additional costs for external resource may be required to manage the model change process where there is insufficient internal resource. In our view, allowance should be made for one major model change application a year should be made while resourcing the modelling and validation teams. It will make it easier for firms to embed it into their BAU processes so that filing a model change application is not as extensive.

In light of the observations made by the working party, a few questions were included in the survey to get a wider industry perspective. The questions were around the additional amount of effort required for a major model change pre and post application, how are the major changes resourced, and the level of documentation required to make an application. We got varied responses from the participants which were then discussed by the working group.

**Chart 10: Resourcing of major model change**



Firms typically would resource minor model changes internally as they are not as complex or time consuming as a major model change application, minor changes also follow less stringent governance procedures. For a major model change application, the survey results suggested that the majority of firms would embed it into their BAU process:

Firms may resource a major change differently based on the type of change, the driver, complexity, timing or urgency of change and the impact that it has on the SCR. An average firm would potentially have one major change application per year. Some firms have been successful in managing major change as a project, deploying staff with specialist project management skills. This approach ensures the appropriate resources are dedicated to the process. Others have established teams whose roles include managing the change process as part of an annual cycle of activity.

Establishing areas of interest for different stakeholders before the major model change application is considered essential to effectively manage time and cost of the application process. Resource allocation might become more efficient by getting the high level view from validation team and other stakeholders early in the process so that the first line can identify the key areas and hence appoint more resource to these areas. Conducting gap analysis with the PRA to discuss and highlight areas that are impacted by the major change will also help avoid surprises at a later stage and will drive the focus of the pre and post application process.

Communication with the PRA would also help in identifying the level of documentation required and hence making changes to the documents only where they were impacted by the model change. The process can be made more efficient by making minor edits to the documents that were already submitted during IMAP and signposting the relevant model change documents.

Survey results show that the size of the documentation submitted during major model change varies significantly within the industry:

### Chart 8: Person-days spent in preparation for the last major model change



Introduction of a standard minor model change template (in the recent CP) will help make the minor model change documentation more streamlined but major model change application requirements remain open to interpretation by different firms and based on the complexity and type of major model change.

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We would like to thank those listed below for their work on this document. It should be noted that contributions have been made in a personal capacity and any views expressed are those of the individuals concerned and not their employers.

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# The Internal Model Industry Forum

This document has been produced by the Internal Model Industry Forum (IMIF).

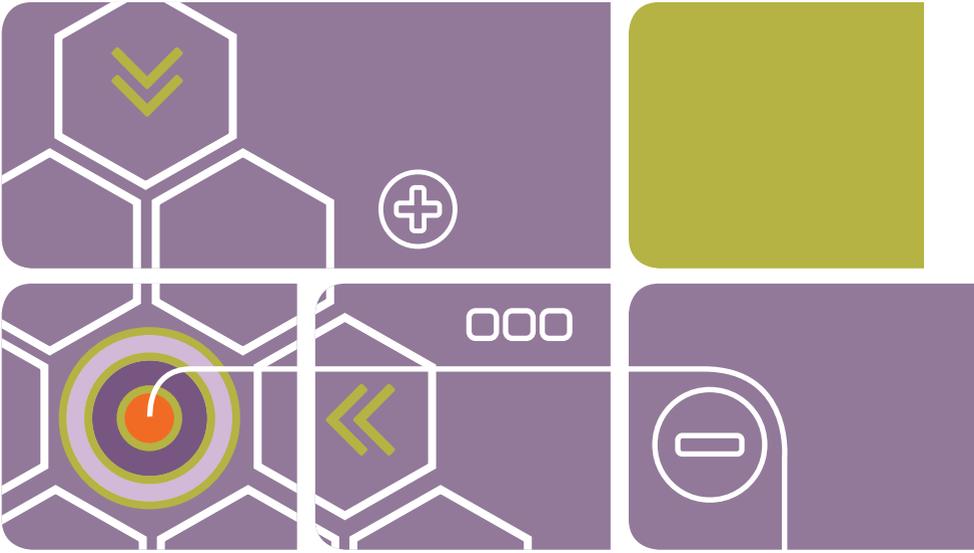
The Institute of Risk Management (IRM) set up the IMIF in 2014 to address the key questions and challenges that insurers face in the use, understanding and validation of internal risk models. It is designed to work in a collaborative way to develop and share good practice to ensure that these models add value to the organisation and support regulatory compliance. IMIF now has over 450 members and we have run a series of Forum meetings to explore key issues. A number of workstreams have undertaken 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)

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## Our supporters

As a not-for-profit organisation, IRM is reliant on industry support to publish guidance like this. We would like particularly to thank the following organisations who have made this publication possible:



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