

## **Guidance for model validation under Solvency II**

*The Solvency II legislation is not yet in force and it is therefore at the moment not possible to issue formal good practices based on these articles and requirements. However, the current pre-application process for internal models under Solvency II calls for guidance and it is the intention of De Nederlandsche Bank N.V. (DNB) to convert this guidance into a Good Practice in the future.*

### **Disclaimer**

This guidance is meant for undertakings under DNB's supervision, without restricting their room for interpretation of principle based regulation but aiming for transparency of the supervisory practice. This guidance expresses DNB's views, making it possible for undertakings to make it part of their considerations while assessing their particular circumstances. This guidance is not mandatory but does give an insight into DNB's expected line of thinking, is indicative and does not exclude other possible interpretations by undertakings.

### **Relevant regulations**

This guidance is based on the following regulations (which are not yet in force):

- EU Directive 2009/138/EC Article 44
- EU Directive 2009/138/EC Article 124
- Implementing Measures (level 2) Article 229 TSIM18

### **Introduction**

This guidance is relevant for undertakings that aim to use a (partial) internal model under Solvency II and that have been admitted to or want to enter the pre-application for the internal model approval process. This guidance sets out our intended good practices for model validation (MV), hereafter referred to as good practices.

Several topics regarding MV are included in this guidance, divided into the following chapters:

- Chapter 1: Introduction
- Chapter 2: Independence of Model Validation
- Chapter 3: External personnel and internal outsourcing
- Chapter 4: Reporting procedure, scoring and overall opinion
- Chapter 5: Model validation steps and frequency
- Chapter 6: Other

Chapter 2 to 6 include multiple good practices that are numbered and shaded. These good practices are often accompanied by an introductory or/and an explanatory paragraph.

### **Background**

Although Solvency II sets out several requirements for MV, effective execution of these requirements need some interpretation in practice. In more than two years of Solvency II reviews, whether aimed directly at the design and/or the functioning of MV or using the outcomes of MV to assess parts of the Internal Model (IM), we have experienced a wide variety of MV practices. Based on these experiences and our understanding of the Solvency II requirements, we have established a number of good practices as guidance for undertakings in the Dutch insurance market wishing to apply for an IM.

*These good practices reflect our current thinking. While undertakings might choose for other options, the underlying principles and requirements should be kept in mind.*

## Chapter 1: Introduction

In the opinion of DNB, the importance of Model Validation<sup>1</sup> (MV) with respect to IM for Solvency II can hardly be overestimated. MV not only plays an important role in assuring that the IM complies with the SII requirements, but it also serves to establish that the IM is fit to the business and its risk profile, conceptually sound and well-calibrated. Also it should be kept in mind that the scope of MV is rather broad, covering items such as (not exhaustive) statistical quality standards, model governance, use test and data.

Of course, regulators play a role in IM approval but first and foremost it is the company that needs to take the responsibility to produce well-validated models. Regulators need to be able to rely on MV because they lack the resources to repeat all the activities the validators have performed and regulators are also typically involved afterwards, when the IM is implemented or close to implementation. Moreover, once IM approval is obtained, MV has to continually validate the model. Therefore, MV requirements that have been set and will be upheld are important for both the short and long term.

## Chapter 2: Independence of Model Validation

Independence is laid down in Level 2 Article 229, stating that MV should be independent from development and operation of the internal model. This requirement seems clear, but the question is whether independence only relates to the place in the organization or also to the execution of validation tasks. Another question is how strong this independence should be. These questions and some others will be dealt with below.

### *a. Place in the organization and escalation*

MV is part of Risk Management (Level 1 Article 44), which is also responsible for model development, thus underpinning the need for independent MV. In order to resolve possible conflicts of interest that might compromise the independence of MV, we consider the following as good practice:

1. Within Risk Management, MV reports directly to a manager with overall responsibility for Risk Management. This is preferably the Chief Risk Officer or a responsible manager not more than one level below the Management Board.

2. Where MV does not report directly to a member of the Management Board an escalation line to the Management Board is present.

### *b. Reporting lines*

To strengthen MV independence it is important that it has ample means of communication. Therefore:

3. The validation reports are broadly distributed amongst all relevant stakeholders (at least model developers, model users, involved management and Internal Audit).

4. MV has the possibility to explain its findings and ratings in committees where they are discussed, assuring that they are properly understood.

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<sup>1</sup> The Solvency II regulations mention a validation process. Therefore, where we refer to MV it should not be understood that DNB requires a separate Model Validation department. However, from the point of independence and as may be apparent from this document we do strongly prefer a separate Model Validation department.

5. The Management Board and/or highest risk committee is informed directly and with a certain frequency (e.g. quarterly) about major validation findings and their status together with general information on MV (progress of validations, staffing issues etc.).

*c. Independence in mind*

Organization structure, escalation possibilities and reporting lines can only partially achieve independence. A very important component is the independence in mind of the model validator. This requires a professional skeptical attitude towards validation topics, not taking the adequacy of any relevant item for granted till proven so. Undertakings should appreciate this independence in mind and seek to hire professionals with this attitude.

6. An independent model validator is independent in mind and shows a healthy professional skepticism.

*d. Coordination*

7. The easiest design and a good practice for MV is to combine the activities in one department within Risk Management (Article 44) that has no responsibility for development and operation of the IM.

This department can develop the specific expertise needed and has a dedicated focus ensuring that resources are available and validation is performed in a consistent manner. However, the Solvency II regulations require a MV process and not necessarily a separate MV department, and we observe that in individual groups the validation tasks are distributed among several parties that also have an involvement with the development and/or operation of a part of the IM. The line of reasoning of these undertaking is that these departments have a more detailed knowledge of the matter than a Model Validation Department at remote distance and that there is always a tradeoff between independence and knowledge. In such a case we found that validation was organized in a way that the validation tasks for the different parts of the IM are performed by a department other than the one involved in the development/operation of that particular part of the IM, thus shifting the validation tasks between departments. We also observe that in some large groups validation may be split between different validation teams, e.g. a central or group validation team and local or regional validation teams.

Both these situations call for coordination, safeguarding independence, uniform standards and consistent execution:

8. When MV is not performed by a single department, there is a need for an appropriately informed and skilled single owner that has oversight over (but not limited to):
  - a) independence of the validators
  - b) development of a Model Validation Policy and Model Validation Tools;
  - c) validation and resource planning;
  - d) level of expertise for each specific case;
  - e) hiring of external resources;
  - f) performing validations consistently, meeting minimum quality standards;
  - g) reporting of the model validation findings
  - h) informing the Management Board of major findings and progress of MV activities;
  - i) follow-up of MV findings.

*e. Testing*

Solvency II requires certain validation tests (amongst others sensitivity testing and back testing) to be conducted. In practice, most model developers and sometimes model users already perform (several) tests as part of the model development process and validators tend to rely on those.

How can MV rely on these tests performed by model developers with enough comfort that they are adequately conducted? DNB has identified the following good practices in this area:

9. Before the start of the independent model validation, MV makes a test plan stating the full set of validation tests that have to be conducted as a minimum.

The test plan is meant to prevent that MV will be led too easily in the direction chosen by model development (or model users) and as an independent challenge of model development. It does not need to be elaborative (up to 2 pages) and should entail on a high level the set of tests to be performed (completeness) and most important aspects to be considered (ensuring appropriateness) for a particular model component. Furthermore, the test plan should also indicate the appropriate dataset that should be used in the tests. It is also possible that test plans are already incorporated in the Model Validation Policy, although we envisage that this will leave less room for a customized validation approach. Moreover, it remains possible to acquire new insights during the execution of the model validation and adjust the test plan accordingly.

10. MV performs checks to assure that:

- the model developer has duly conducted the complete tests as set out in the test plan (e.g. appropriate parameters and other input) and not only the ones originally planned by the developers;
- the test results can be reproduced;
- the model developer can satisfactorily explain possible deviations from the test plan.

11. MV forms its own independent opinion based on the model developer's test output.

12. Taking the IM as a whole, MV performs some of the tests itself<sup>2</sup>, randomly or risk based. Where MV decides not to conduct any tests on itself, the reasons for this are clearly stated in the model validation report.

Of course, if the model developers do not perform all the required tests (according to the test plan) or there is doubt about the quality of the testing, MV is expected to perform those tests itself or direct the rerun.

### **Chapter 3: External personnel and internal outsourcing**

#### *a. External personnel*

There can be many valid reasons for hiring external personnel, e.g. scarcity of or a limited need for a certain expertise. However, Solvency II's MV requirements for independence and expertise apply to hired external personnel as well. In DNB's view this implies the following.

13. To ensure that external personnel hired is sufficiently skilled and independent:

- The engagement with the external party is the responsibility of an independent function like MV; this independent function also keeps in close touch with the external party and bears responsibility for any follow-up.

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<sup>2</sup> Or direct the execution by the model developer.

- b) The terms of the engagement are free from restrictions or limitations (e.g. restrictions in working methods and test to be applied) that might influence the outcome. A realistic budget and timeframe are available to perform the services.
- c) The external party and the persons that will perform validation activities on its behalf do not have undue conflicts of interest, either in general or with respect to IM development in particular. The expertise of the persons who will perform validation activities on behalf of the external party is sufficiently<sup>3</sup> established.

Moreover:

- 14. The ownership of the validation performed clearly remains with the insurance undertaking:
  - a) The undertaking has sufficient internal knowledge/expertise available to direct the content of the validation activities of engaged external parties;
  - b) The Model Validation Policy of the undertaking is complied with;
  - c) MV is involved in the high-level execution of the validation (assessing the test plan and contributing knowledge about the company);
  - d) MV is involved in the reporting (forming the opinion, monitoring follow-up) of the findings of the external validator.

*b. Internal outsourcing and demarcation*

As mentioned before, MV has a broad scope. Most model validators tend to have a quantitative background; therefore, they are less equipped to validate topics such as governance, data accuracy and completeness, or IT. There may be other valid reasons (efficiency, shortage of validation staff) to perform validation activities elsewhere, as long as they meet the requirements in terms of independence and expertise. There should always be a clear rationale for such ‘outsourcing’; e.g. reallocation of the quantitative core activities or even the entire validation function elsewhere will be hard to justify. Moreover, reliance on others, for example an Internal Audit Department, to perform certain validation activities, requires a clear demarcation to prevent gaps and/or overlaps. This also applies to the situation that testing is performed by model developers on behalf of and under direction of MV.

- 15. In cases that MV is partially outsourced a demarcation document is drawn up showing a clear division of tasks, clarifying scope and deliverables.

This demarcation document promotes clear communication about what parties expect from each other. We have seen undertakings that laid down this demarcation in a Model Validation Policy but also a case where a demarcation letter was drafted.

**Chapter 4: Reporting procedure, scoring and overall opinion<sup>4</sup>**

In the context of this chapter, reporting means a written text in which MV accounts for the validation activities performed, including a clearly defined scope, the results of the activities in some detail, the findings and their scoring, potentially the follow-up on findings and the validator’s overall opinion. Scoring means the weights assigned to individual findings. An overall opinion is the outcome of a validation, not a mere aggregation of weighted findings.

<sup>3</sup> Which obviously should be more than for example “it is a big four company”.

<sup>4</sup> Where we mention overall opinion it is meant as the overall conclusion of a particular validation report, taking all underlying findings separate and in connection with each other into account. Overall opinion in this guidance does not refer to an opinion over the whole internal model.

*a. Level of comfort*

A validation report is the result of several activities and may cover several topics (e.g. methodology, assumptions and data quality). Therefore it may be a challenge to determine the value (the level of comfort) of a validation report and the corresponding overall opinion. The following good practices facilitate a clear view of the value of a validation report:

16. The validation report clearly states, for each validation:
- a management summary with the overall opinion for that validation, the key messages and important limitations
  - the topics that are covered and not covered in the particular validation (i.e. the scope);
  - the nature (interviews, desk research, tests etc.) and extent of the activities performed during the validation;
  - limitations in the validation activities performed;
  - circumstances where additional activities are deemed necessary
  - the full set of findings and their scoring as set out below

17. Any deviations from the Model Validation Policy are stated in the validation report. If any topics were out of scope, the undertaking takes measures to ensure that these items are validated at a later stage.

*b. Scoring of findings*

The weight assigned to a validation finding can be important. Management will not be overwhelmed by a low-risk finding, but one or more high-risk findings will draw their attention. The wrong weight can lead to false priorities or, worse, to false comfort from accepting an unsatisfactory model. Also, situations can occur where the findings of model validation may be debated by the model developer and a certain pressure may be exerted to soften wordings and findings. Therefore, a robust scoring methodology, facilitating consistent weighting of findings and prevent arbitrary decisions is required. Even though every scoring methodology will involve a degree of subjectivity, a best effort in making it as objective as possible can be achieved by substantiating the reasons underlying the subjective assessment.

18. A scoring methodology is developed which makes the scoring of findings as objective as possible.

*c. Overall opinion*

An overall opinion present the final result of a validation and summarizes the underlying findings. Much of what has been said about scoring findings also applies to overall opinions. Furthermore,

19. The methodology to arrive at an overall opinion is not merely a mathematical exercise presenting the average score.

Although in some instances the mathematical exercise might give a valid result, in other instances a single finding might be crucial on its own account or several high-risk findings may together be decisive. A good methodology takes this into account by, for example, allowing the possibility for substantiated 'overrule'.

A good methodology also sets limits on the number of qualified findings for a certain overall opinion (e.g.: do not allow more than one high risk finding or four medium risk findings are for a 'satisfactory').

20. The methodology to arrive at the overall opinion includes an option to overrule and sets limits on the number of qualified findings for a certain overall opinion.

To ensure the overall opinion is well understood by all stakeholders, we envisage that the overall opinion takes the form of a number (usually three or four types of overall opinions) clearly defined<sup>5</sup> outcomes. Preferably, a methodology states whether the IM meets the Solvency II requirements and whether it is fit for use. With this approach we aim for IM's that are conceptually sound and fit to the business for identification, measurement and management of risks, and meet the applicable Solvency II requirements. Said in other words: is it the right model for the particular undertaking and does it operate as it should.

21. The meaning of an overall opinion is clearly defined in terms of Solvency II compliance and of usability of the IM.

We observe that sometimes the materiality of the particular model component being validated within the whole IM is taken into account when determining the overall opinion for a specific validation. In our opinion this is not appropriate for the following reasons:

- It is the responsibility of MV to assess whether the IM is conceptually sound and fit to the business. It is not their responsibility to set priorities by taking the materiality of the particular component as a factor in the methodology. The first line should weight all the factors and decide which risks to accept (temporarily).
- A satisfactory rating based on the immateriality of certain model components, even though there may be significant underlying findings, can give the wrong signal and false comfort.
- A immaterial component at this point in time could become material over time.

Components or modules of the IM should therefore meet the criteria on itself. Materiality of a component or module only becomes relevant in the view of the total IM. The consideration whether a component or module is material or not is a management decision and should not be included by MV.

22. Lack of materiality of a module or a component of the IM is in itself insufficient substantiation for a (more) positive overall opinion for that part of the IM.

## **Chapter 5: Model validation steps and frequency of**

Level 1, Article 124 states there should be a regular validation cycle, indicating that a model needs to be validated repeatedly. We have seen a wide variety of steps in validation processes within undertakings, but several of these did not include all phases of the model's life cycle or not all parts of the internal model. A proper validation set-up must cover at least the following steps:

- a) methodology (theoretical basis and conceptual soundness; do we have the right model);
- b) calibration of parameters and statistical testing ;
- c) suitability of the model for the different business lines, portfolios etc. (fit to the business);
- d) implementation of the model (is the model that is operational the same model that initially has been validated);
- e) qualitative aspects of the IM (model governance, use, data, IT, documentation).

Sometimes these are combined into one validation, but most undertakings slit them into one or more different steps in the validation process. Implementation validation might be seen as a formal step. However, in practice knowledge gained after initial development and validation might be 'efficiently'

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<sup>5</sup> in terms of requirements to be met and of consequences

processed during the translation into computer coding. This may result in significant deviations from the originally approved model and, therefore, also in different outcomes.

23. MV distinguishes different steps in the validation of the IM, together covering all phases in the model life cycle and all parts of the internal model. The absence of one of the aforementioned steps could result in a material gap.

At a certain phase, continuous validation will become the norm, with a validation cycle in place. It is not mandatory to have every single part of the IM validated annually, but we would expect at least a regular frequency. There may also be good reasons to validate material or high risk parts of the IM more frequently. Also, there could be triggers to bring forward the next validation round. Such triggers could be model changes, changes in the risk profile or outcomes of certain tests such as P&L attribution.

24. A validation cycle includes a regular frequency, a risk based frequency and ad hoc validation based on certain triggers.

## **Chapter 6: Other**

We encountered several cases where MV was more or less chasing the follow-up of model validation findings. Although it is acceptable that MV keeps track of gap closure activities to properly assess the remediation, it should not become their responsibility to facilitate the first line of defence (i.e. model developers) and chase the problem owners. This would compromise the independence of MV and drain scarce resources.

25. The responsibility and accountability for recording the findings, setting priorities and chasing timely remediation have to be identified and allocated outside MV.

Given the importance of model validation to ensure internal models comply with the requirements, DNB expects MV to be part of the audit universe of Internal Audit.

26. The validation process should be periodically audited to ensure that validation is performed independently and in line with the undertakings Model Validation Policy. Internal Audit is best placed to perform these audits.

## Version control

Version	Date	Author	Change
0.1	13-12-2012	Ravi Bharos	First draft
0.2	17-12-2012	Ravi Bharos	Comments A. Deppe, L. Flink
0.3	20-12-2012	Ravi Bharos	Comments Internal Model Team
0.4	14-01-2013	Ravi Bharos	Comments R. Coppes, N. Honings
0.5	21-01-2013	Ravi Bharos	Comments translators
0.6	31-01-2013	Ravi Bharos	New format, comments C. Rensen, M. Markovtseva
1.0	19-02-2013	Ravi Bharos	Comments translators and C. Rensen
1.1	20-06-2013	Ravi Bharos	Comments Dutch Insurance industry, EIOPA discussion and from C. Vencatasawmy
1.2	26-06-2013	Ravi Bharos	Comments PRA (C. Vencatasawmy, C. Kerfriden and G. Hill) and L. Flink