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Effective Documentation in Model Risk Management

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One of the critical elements in effective model risk management is the development and maintenance of documentation that is responsive to the needs of those charged with implementing and maintaining model integrity.

Perhaps the most authoritative guidance on model risk management is found in FRB SR 11-7/OCC Bulletin 2011-12. This was jointly developed by the Office of the Comptroller of the Currency and by the Board of Governors of the Federal Reserve System.[1] This document addresses all aspects of model risk management, summarized in the following three areas:

- Model development, implementation and use
- Model validation
- Model governance, polices and controls

SR 11-7 is applicable to banks, insurers that own banks and insurers designated as "systemically important financial institutions." It is of interest to insurers not subject to its guidance because the framework for model risk management that it includes is considered by many to contain thought leadership on the topic.

Within the SR 11-7 framework, documentation is part of "model governance policies and controls." The attachment to SR 11-7 makes this statement regarding documentation:

> Without adequate documentation, model risk assessment and management will be ineffective. Documentation of model development and validation should be sufficiently detailed so that parties unfamiliar with a model can understand how the model operates. …
>
> Documentation takes time and effort, and model developers and users who know the model well may not appreciate its value. Banks should therefore provide incentives to produce effective and complete model documentation.[2]

Effective documentation is difficult! It is so difficult that the Fed recommends incentivizing model owners and developers to produce effective documentation.

The Fed does not provide any specific guidance on what effective documentation should look like. This articles discusses some of the specific documentation items that experience has taught are likely to be effective for model risk management.

GENERAL MODEL DESCRIPTION

Effective documentation includes a general description of the model. The general description should be of such a nature as to provide a high-level understanding of how the model fits the enterprise's business, of the risks inherent in the model and of the controls implemented to address these risks.

Some of the items useful in the model description include:

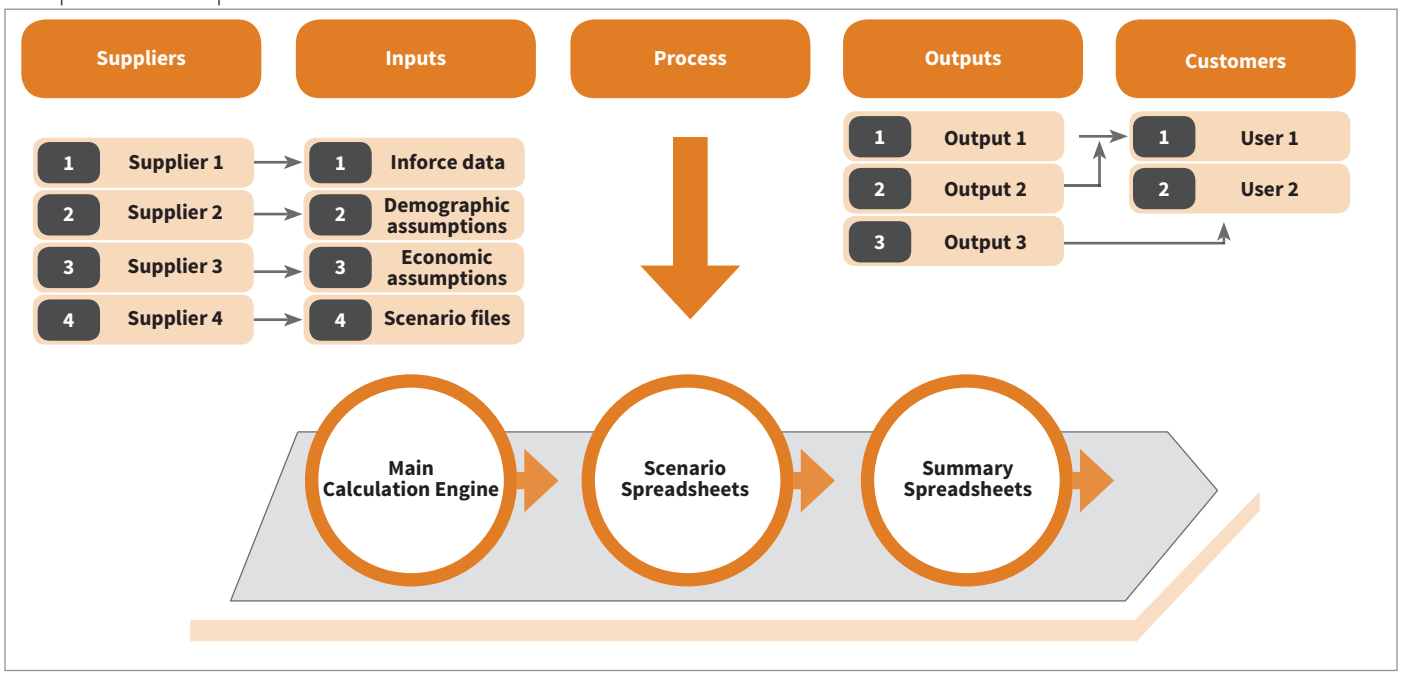
- Model purpose
- Significant model output and intended users
- Model methodology with extended commentary if the methodology is in any way considered unorthodox
- A summary of significant assumptions and their bases
- A summary of model testing
  - At implementation and at model revision
  - Ongoing testing
  - Validation testing, if applicable
- A summary of model controls and why they are considered effective and sufficient

PROCESS MAP

A process map is a visual depiction of the model, including inputs, processing (calculations) and output. A good visual depiction is quickly understood and makes it easy to grasp the scope of the model.

The most widely used template for process maps is the suppliers, inputs, process, outputs and customers (SIPOC) template. A sample SIPOC diagram is shown in Figure 1.

Figure 1
Sample SIPOC Map



For actuarial models, inputs will consist of both data and assumptions. The process will consist of the calculation engine as well as any manual adjustments, overlays, topside adjustments or specialty items. The outputs are the results that are used in some other business process, and the owners of that other process are the customers.

One of the more subtle values of preparing a process map is that it forces us to consider the true extent and scope of the model. Stated like this, the problem doesn't sound difficult. However, one of the trickier items in model management is determining where a model starts, where it stops and what is included in between.

For example, consideration of all the processing that must be completed in order to obtain the output often results in manual items not included in the main calculation engine to be added into the map. Manual items often require special care and consideration in effective model management.

Some documenters also like to include control points in the SIPOC diagram, indicating where model control activities occur, with descriptions in the notes section that discuss each of the control points.

MODEL HISTORY/CHANGE LOG

Model history and change log documents are not as standardized as process maps. Because of their idiosyncratic nature, it is difficult to talk about "typical" documents. Anything that helps in providing a general understanding of the model is fair game to include in these documents.

The purpose of a history document is to provide the background and rationale for the model and any discussion that provides insights into the issues at model implementation and at times of model updates. Issues could include:

- Reasons for model implementation, including a discussion of any predecessor models, and why they were replaced with the current model
- Considerations relating to assumptions and data
- Technical issues
- Software considerations
- Dates and timing of implementation and updates
- Blocks of code or sections of spreadsheets that have been superseded and are no longer used in the model

The purpose of the change log is to provide technical descriptions of model changes, along with a discussion of the rationale relating to resolution of any technical issues associated with the changes.

In addition to providing a general understanding, model histories and change logs are good starting points when tracking down model errors, inefficiencies or anomalies since these documents provide a chronological view of the evolution of models.

MODEL PERFORMANCE METRICS

There are many aspects of model performance and output that are quantifiable. Some of these aspects are material to model utility. Documentation of these material aspects over time provides insight into how "good" the model really is. Metrics can cover various aspects of model performance. Some of these aspects are discussed here.

Model Run Time

Run time is material to production models since they are part of a larger process. Sometimes models occupy part of the critical path of the process—especially for valuation processes. In such cases, run time is a material aspect of the model. Documentation of run time provides information on model efficiency as well as insight on the viability of the critical path.

Real-Time Accuracy

All models strive for accuracy at some level. However some models are used for real-time decision-making, such as underwriting scoring models or pricing models. For this category of models, documentation of model output versus some form of "real world" result, such as market price, or independently scored underwriting category, can be used to determine continuing accuracy of the model.

Data Integrity

Models that process numerous records must have some way of handling data exceptions. A count of exceptions at each processing cycle provides valuable information on the integrity of the underlying data. In addition, this information gives an indication of the amount of manual work required to complete model processing.

MANUAL ITEMS

Manual items are those items processed or calculated outside the major calculation engine, even if they aren't precisely "manual." Typically, such items are handled through spreadsheets but other ancillary methods might be used.

Documentation of manual items is important because these items are not usually subject to the same level of scrutiny at implementation as is the major calculation engine. There is also often casualness about the input and controls associated with the manual portion of a model.

Effective documentation for manual items will include:

- Rationale for not including this in the major calculation engine
- Materiality/significance of amounts determined through manual processes
- Major assumptions and data sources used
- Description of methodology used in calculations
- Description of controls

Make documentation proportional to risk. If manual items are insignificant, documentation of immateriality might be all that is required.

DATA SOURCES

Knowledge of model data sources is important for risk management because we need to know if the data is appropriate for the model. We also need to know if the data is transformed in any way or if it is used by the model in its raw form.

The data sources documentation should discuss these two issues, addressing the rationale for sources and why they provide appropriate information.

The documentation's effectiveness is improved by including a discussion of the extract process, with particular attention to any transformations. The purpose and propriety of these transformations should be discussed in the documentation.

ASSUMPTION SUMMARY

The assumption summary provides a more complete description of assumptions and sources than found in the general model description.

Effective documentation will discuss the source of each major assumption. Possibilities include experience data, experience from analogous situations, population data, expert judgment or industry data.

To properly understand the risks associated with assumptions, the documentation needs to highlight where judgment has been applied. This includes selection of analogous items and other indirect experience items as well as direct application of professional judgment to assumptions.

References, or even better, links to tables containing the assumptions, provide additional value to the documentation.

Sensitivity of assumptions is another item that assists with the analysis of risks relating to model assumptions. A well-designed sensitivity analysis points out which assumptions are critical to overall model results. If sensitivities can be combined with historical volatility of the assumptions, the value of the documentation is improved even further.

CONTROLS

One of the important determinants of model risk is the existence of effective controls. Controls are described as follows by the Committee of Sponsoring Organizations of the Treadway Commission (COSO), a joint initiative of five private sector organizations to provide guidance and thought leadership on governance, ethics, enterprise risk management, fraud, internal controls and financial reporting:

> Control activities are the policies and procedures that help ensure management directives are carried out. They help ensure that necessary actions are taken to address risks to achievement of the entity's objectives. Control activities occur throughout the organization, at all levels and in all functions. They include a range of activities as diverse as approvals, authorizations, verifications, reconciliations, reviews of operating performance, security of assets and segregation of duties.[3]

Part of effective model documentation is a discussion of model controls, the model risks that they mitigate and why the controls are considered sufficient.

If there are model risks that do not have associated controls, effective documentation will address the rationale for not having such controls.

This is an area in which many models could use improvement. Many controls are poorly considered. Some do not address the intended model risk in any direct way, or only in a cursory manner.

DOCUMENTATION LIFECYCLE

Most models are dynamic, undergoing changes and updates to reflect underlying business conditions. Effective documentation is similarly dynamic.

Effective model documentation is revised and updated whenever the model is revised and updated. Any other schedule runs the risk of incomplete or out-of-date documentation.

HOME SWEET HOME FOR DOCUMENTATION

The most common practice in the insurance industry is to have documentation reside with the model owners. This is a reasonable approach with several advantages, such as:

> "Without adequate documentation, model risk assessment and management will be ineffective."

- Convenience: simply save the documentation to a likely spot on the server, no need to go through any formal document log-in
- Accessibility
- Flexibility: this covers a number of aspects of documentation including format, content and distribution

However, this is not the only possible home for documentation. Since part of documentation is document management, shared services document management is another possibility. This approach allows for a more directed application of document management expertise in such areas as versioning, indexing, cataloging, document access control/distribution and document security.

This centralized approach may be preferable to actuaries since there are numerous anecdotes of lost documentation, version confusion and outdated documents. A centralized approach to documentation control allows actuaries to offload the tedium as compensation for handing over control of the documentation.

CONCLUSION

Effective documentation is an integral component of risk management. This article presents several examples of documentation that have proven to be effective in practice. Incorporation of some or all of these forms of documentation will facilitate model governance. ■

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ENDNOTES

1 The Bulletin can be accessed at *http://www.federalreserve.gov/bankinforeg/srletters/sr1107.pdf.*

2 This attachment can be accessed at *http://www.federalreserve.gov/bankinforeg/srletters/sr1107a1.pdf.*

3 From the document "Internal Control—Integrated Framework" on COSO's website at *http://www.coso.org/documents/990025P_Executive_Summary_final_may20_e.pdf.*