



Automating a Model Revalidation

An introduction to revalidations and automation

The number and complexity of models in scope of model risk management (MRM) functions is increasing yearly leading to significant additional workload. At the same time, the degree of automation in most MRM functions is still low. The same applies to the use of new technologies. Here we discuss why the revalidation process is an ideal starting point of an automation initiative and advise how to go about it.

What in a revalidation can you automate?

SR 11-7 states that there are three core elements in an effective validation within a model risk framework. These components are evaluating the conceptual soundness of the model, ongoing monitoring, and outcomes analysis (including backtesting). Some validation components, such as conceptual analysis, require expert knowledge and input that inhibits them from being automated. In this article we focus automating specifically the two areas of ongoing monitoring and outcome analysis within a revalidation.

Why should you automate a revalidation?

An initial validation establishes if a model is fit for use before implementing it in production. Regular revalidations ensure continued performance & compliance of the model and can be performed to different depths. The tests required in a revalidation are often a subset of the initial validation.

The repetitive nature of revalidations makes them an ideal starting point for any automation initiative within an MRM function.

What are the benefits?

- Reduced time spent performing the revalidation.
- Increased consistency in the approach to the revalidation.
- Improved quality due to a structured approach across all models.
- More efficient preparation of validation reports.
- More time for the overall assessment of the analyses carried out.
- Reduced operational, and specifically key man, risk.

Reducing repetition in your validation process

Revalidation structure

A revalidation can be split into three sections:

1. Preparing for the revalidation.
2. Performing the revalidation tests.
3. Documenting revalidation results.

The revalidation can benefit from automating each of the above three sections in isolation, however this is likely to lead to a fragmented system that repeats information and processes. A more considered and beneficial approach is to define an overarching target state and to derive the individual work packages consistently from it.

Leveraging the initial validation

An automated revalidation process requires setting up reusable test code, creating document templates, and populating test metadata into the test schema database. The best time to do this is during the initial validation when a lot of this information is already produced.

Some of the main components that can be adapted from the initial validation are:

- *Test metadata*: This can include the purpose of the test, the expected outcomes from the test, and whether the test is performed in a revalidation.
- *Test scripts*: Work will be required to generalise any scripts created during the initial validation to be able to use them again.
- *Document template*: The initial validation document may be altered and repurposed to form a template for future revalidations of the model.

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Test schema database in the revalidation

Below we show how data from an initial validation can be stored in a test schema database and used again during revalidations. To demonstrate this we have included two example test records for an IRB probability of default (PD) model, though the idea can be generalised to any set of models.

Example records from test schema database

Model ID	Model Name	Test ID	Test Name	Test Description	TLT Boundaries	Initial Validation	Revalidation	Test Environment	Test Script Path
12	Corporate PD	103	Absolute Gini Test	The Gini coefficient test asses the model's rank ordering power ...	{x <= 0.45: 'Red', 0.45 < x < 0.6: 'Amber', 0.6 <= x: 'Green'}	TRUE	TRUE	Firms Standard Python 3.7 Anaconda venv	risk.pd. model_tests.abs_gini.py
12	Corporate PD	104	Information Value	The information value quantifies the significance of a variable ...	{x < 0.1: 'Red', 0.1 <= x < 0.2: 'Amber', x <= 0.5: 'Green'}	TRUE	FALSE	Excel, Risk Sharepoint	Risk\Prob_Def\ model_test\ info_val.xlsx

Preparing for the revalidation

The first step requires selecting tests and performing initial data quality checks on the input data.

Test Selection

With a test schema database selecting tests is a simple process of filtering by **model ID** and whether the test is included in the **revalidation**.

MRM would be responsible for keeping the test schema database up-to-date. This can be done by performing a short review of the current inventory of tests before the revalidation.

Data quality reports

Data quality reports are another excellent tool that can easily be automated using simple scripting languages (such as Python, R or MATLAB).

Performing the revalidation tests

The second step is to run the validation tests and persist the results.

Running tests

From the previously selected tests we can identify the implementation of each test using the **test environment** and **test script path**.

These tests can either be ran manually by a member of the MRM team or via an automated job (using a tool like cron in Unix).

Persisting results

Test results from the test script can be compared against the **TLT boundaries** to produce a **test outcome**. **Test results** and **outcomes** should be persisted to be include in the revalidation document, but also for future reference and comparison.

Documenting revalidation results

The final step is to produce a skeleton revalidation document and fill out any manual components.

Skeleton document

We start with a template for the revalidation that already has filled out any sections that remain unchanged between revalidation reports. Next, for each test we populate the **test description** and **TLT boundaries** from the test schema database. Finally, we insert the **test outcomes** and **test results** produced during the second step.

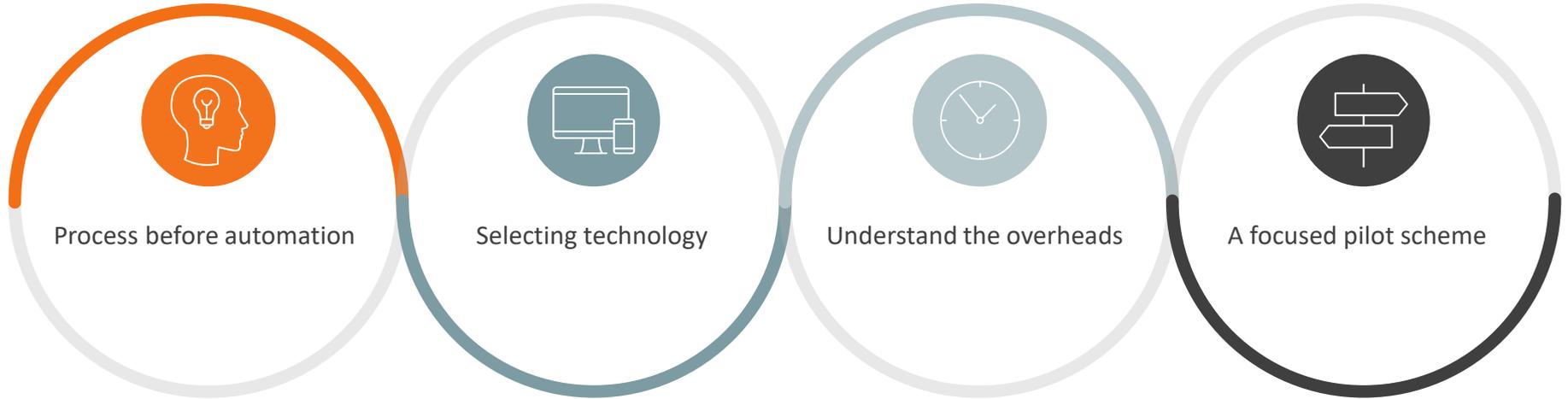
Completion and sign-off

All that is left for the validation team to do is flesh out the skeleton with detailed analysis and thematic commentary. The document can then be signed-off by MRM and sent to stakeholders.

Automating a Model Revalidation

Our guidelines to success

Automating a process is all about the details and as such it is often hard to predict where blockers will occur. To ensure the best chance of success for any new automation initiative we recommend following the four guidelines below. This comes from our 15 years and over 800 successfully delivered projects as a quantitative financial risk consultancy.



Automation only works on clearly defined processes. Therefore, before attempting to automate part of a revalidation best practice is to understand and document it fully to identify areas with strict logic that can be automated. In addition, this prevents the automation of faulty processes.

For a process where expert judgement and analysis is required, automation should focus on tools to streamline the manual work. A good example of this would be providing a unified platform that allows the user to access all required data for an analysis in a single place.

Adoption of new technology requires time and effort, and there are bound to be challenges to overcome along the way. You should consider the technical skills of your team and how they will be able to adapt to any new systems before choosing. Sometimes the better solution is to expand on an already used and well-known system.

Another approach is for the MRM to mirror the technology use of the developers, which will cause significantly reduced risks of incompatible software and hardware.

There is no such thing as a free lunch. Automation comes with overheads from multiple sources. The first overhead is the extra time required to create the inputs to the automated revalidation. This includes making your test scripts robust and reusable, and documenting test descriptions into a database.

Time and financial costs are also implicit in setting up the required technology to assist in automation. Yet another cost to consider is in training time for users within the MRM function.

A pilot study can be performed before fully adopting a strategic approach for automation across the whole MRM function. This will be a testing ground for your strategic approach and reduces the risk of fully committing to an unsuccessful automation programme.

The ideal model for a pilot scheme would be the model with the most frequent validations, but the simplest testing processes. Develop a template for automating this single model before considering how it may be abstracted to cover more models.



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