Credit Risk Model Validation solution

Regtech initiative

July 2018

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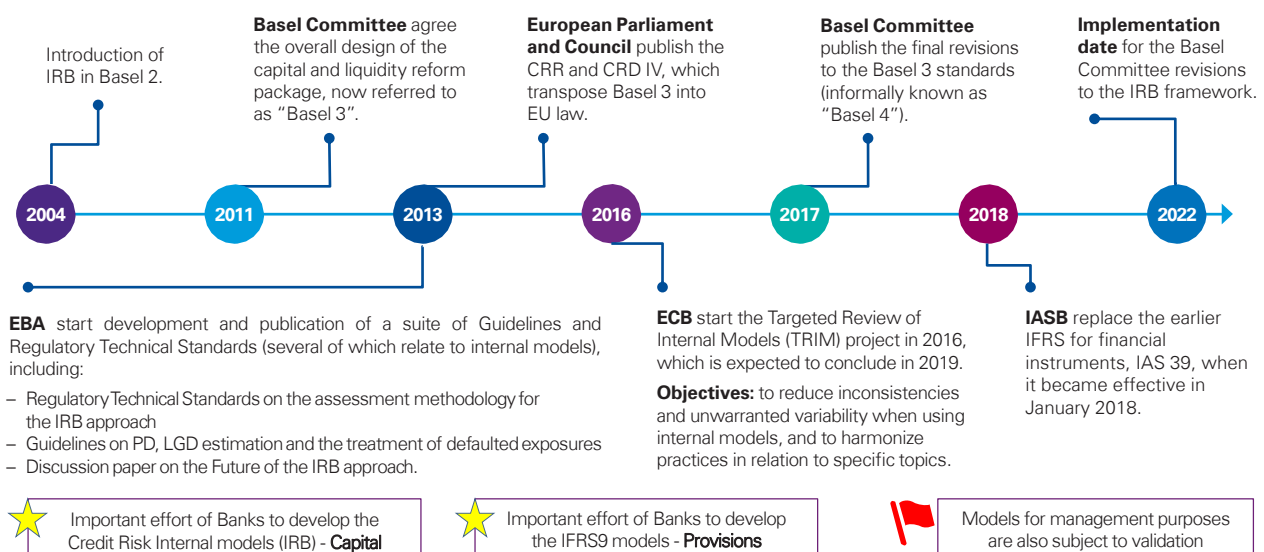
"The Regulator has increased the regulatory pressure in recent years in order to guarantee the quality of the models of financial institutions .... "

01 Regulatory landscape

Exposure to credit risk has been one of the leading sources of problems in the global financial crisis. Banks should now have a keen awareness of the need to identify, measure, monitor and control credit risk as well as to determine that they hold adequate capital against these risks and that they are adequately compensated for risks incurred.

- **IFRS 9 and Basel IRB – From January 2018, banks are under IFRS) regime, so many entities are now facing notorious impacts** on the balance sheet, along with their accounting systems and processes. Likewise, Basel requirements for Internal Rating Based IRB approach for Credit Risk requires that at least models are validated yearly.

- **TRIM or Targeted review of Internal Model** details out European Central Bank's (ECB) one such effort which aims to assess the **Pillar 1 internal risk models used for Credit Risk**, Market Risk and Counterparty credit risk are in compliance with regulatory requirement.

- **Model Risk and 3 lines of defense –** Governance and other qualitative requirements have become increasingly demanding for banks, such as the review of models by 2nd and 3rd lines of defense (as well as external auditors).

Figure 1: Selected events and regulatory activities affecting credit risk models

Introduction of IRB in Basel 2.

2004

Basel Committee agree the overall design of the capital and liquidity reform package, now referred to as "Basel 3".

2011

2013

European Parliament and Council publish the CRR and CRD IV, which transpose Basel 3 into EU law.

2016

Basel Committee publish the final revisions to the Basel 3 standards (informally known as "Basel 4").

2017

2018

Implementation date for the Basel Committee revisions to the IRB framework.

2022

EBA start development and publication of a suite of Guidelines and Regulatory Technical Standards (several of which relate to internal models), including:
– Regulatory Technical Standards on the assessment methodology for the IRB approach
– Guidelines on PD, LGD estimation and the treatment of defaulted exposures
– Discussion paper on the Future of the IRB approach.

ECB start the Targeted Review of Internal Models (TRIM) project in 2016, which is expected to conclude in 2019.
Objectives: to reduce inconsistencies and unwarranted variability when using internal models, and to harmonize practices in relation to specific topics.

IASB replace the earlier IFRS for financial instruments, IAS 39, when it became effective in January 2018.

Important effort of Banks to develop the Credit Risk Internal models (IRB) - **Capital**

Important effort of Banks to develop the IFRS9 models - **Provisions**

Models for management purposes are also subject to validation

02 Importance of automation

The level of automation is low across each stage of the validation process, in part due to the level of change seen over the past few years and relatively low levels of investment in technology and systems to support automation…

The introduction of a **new capital framework (Basel 4)** and the implementation of accounting standards such as **IFRS9** are likely to lead to a greater reliance on the use of increasingly complex models. This will require substantial model development resources, as well as appropriate resources within the independent model validation teams.

The **Internal Validation department** in a Credit Institution has a huge amount of manual and repetitive tasks in a daily basis. Some of the reasons which affect negatively in the analysts performance are:

- Significant amount of tests in the Validation Guide (made by the Internal Validation Department) that need to be coded and executed.

- Long waiting times during the test execution caused by the large volume of data that has to be processed.

- Portfolio comparisons with previous months validation results.

- Storage and results should be kept in a robust tech-environment.

The experienced gained during the development of internal validation processes has allowed us to develop methodologies focused on the **automatization of tests**. This enables the user to spend more time on the tasks with greater value like analysing the results, arriving to conclusions and generating a critical opinion.

There´s a clear intention from banks to invest in systems and tools to increase the level of automation across the validation process. It will be important that banks focus their automation efforts on key processes in order to improve timescales. Institutions must continue to increase the scope and quality of model validation standards to ensure robustness of existing models and to derive value from new models."
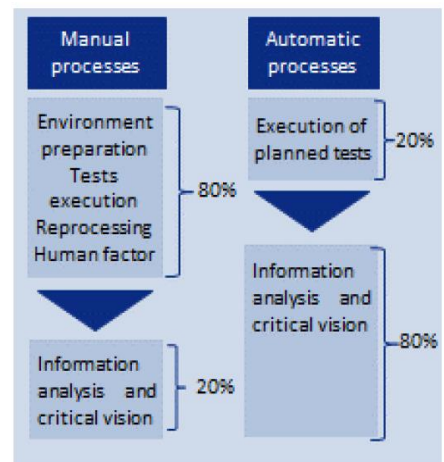
Figure 2

Key benefit of validation process automation…

1. Scalable
2. Accelerated results
3. Faster Time-to-Market
4. Higher Overall Test Coverage
5. Reduced Business Expenses
6. Higher Overall Test Coverage
7. Information security

Figure 3: Selected key benefits

03 Solution background

The level of automation is low across each stage of the validation process, in part due to the level of change seen over the past few years and relatively low levels of investment in technology and systems to support automation…

2007 – KPMG Spain engaged in **Top Tier banking institutions** credit risk validation projects:

- Covering wide range of portfolios & segments
- Performed both quantitative validation testing and qualitative developments (policies, procedures…etc)

At that time, KPMG Spain realized that a **model validation solution** would make our life and our client´s lifes easier, converting the validation process in an automated exercise → 2008 born the Credit Risk Model Validation tool v1.0

+10 Banks implemented the tool

> 40 Statistical test considered

Since then, KPMG Spain has made some enhancements adapting to client requests and especially to regulatory requirements such as **IFRS9**, Targeted review of Internal Model (**TRIM**) or other **Model Risk & governance** recommendations (i.e. 3 lines of defense).

The Dynamic Approach of the Credit Risk Model Validation Tool…

Starting point

2007

In addition to quantitative and qualitative assessment, KPMG improved the outputs (reports and graphs)

2008

Enhancements in quantitative assessment: some additional statistical tests are included

Credit Risk Model Validation solution

Solution

Continuous improvements

2018

New Tech environment, new functionalities and enhancements in data management and outputs.

2015

Some additional reports and improvements in parametrization

Figure 4: main enhancements and improvements performed

04 Solution differentiators

This increased regulatory focus has required significant effort by the financial institutions to develop and enhance their validation capabilities to meet the regulatory requirements

Internal validation is a compulsory prerequisite for supervisory validation. In internal validation, a specialized, sufficiently independent unit of the institution in question issues a technical opinion on whether the internal model is adequate to be used for the specified management purposes.

Nowadays the Regulator is focusing on internal models validation results and is very concerned of model risk which could arise from…

- IRB Models
- IFRS Parameters
- Stress Test
- Others (management purposes and EcCap)

This regulatory pressure has required more efforts by banks to enhance their validation processes to meet the regulatory requirements. An automated solution offers a wide range of differentiators and benefits…

Automated supply

- Enriched seed data and **automated data captured**.
- **Structured data** sources.
- Based on the **bank's internal data**, the tool extracts the relevant information in order to run different statistical tests
- **Multiple other input** fields available to enhance the quality of the validation (variables segmentation, qualitative & quantitative, etc.)
- **Traceability**: Ability to replicate and perform test for external stakeholders, such as regulators regarding data quality

End-User customization

- **Role-based user experiences** allow executives to engage with their tool, in a way that is tailored to their role and responsibilities.
- **Flexibility and customization** by the user such as the incorporation of additional statistical tests, thresholds parametrization, quick filters, etc.
- **Current tech-environment** allows the users to make enhancements according to their needs and regulatory requirements trends. Open-code.

Automated validation process

- **Model Time To Market** - the model analysis and validation is executed in reduced timings, helping to shorten the processes for new models or review of existing models.
- **More time for insightful**, review, analysis, engagement and active management related to the validation process.
- **Engine under SAS environment** which allow to run different statistical tests simultaneous for different models at the same time.
- The tool can be **easily executed** by unexperienced stakeholders, obtained directly a set of results for each model.

Enhanced reporting layer

- **Interactive reporting**, with meaningful metrics and agreed thresholds.
- **Single, integrated and holistic** views bringing together data into user friendly, visually rich dashboards that provide holistic views for validation processes.

Figure 5: Key differentiators.

"The main purpose of the solution is the automation of all the tests required for the validation of Credit Risk Models…"

05 Main features

The Credit Risk Model Validation solution makes the life our clients easier, but at the same time complying with regulatory demands providing an automated solution to perform the validation exercises in an efficient and robust environment…
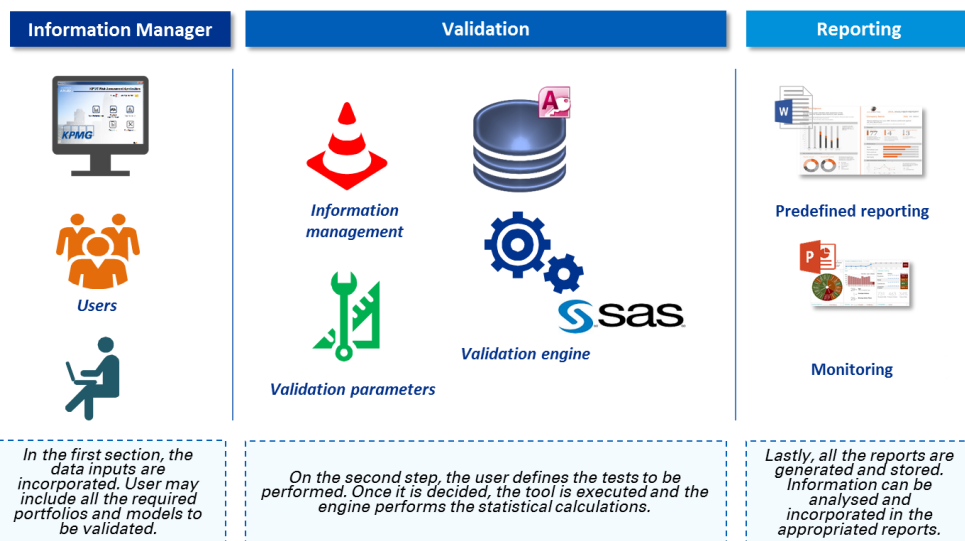
Governance and stakeholders

The tool can be used for different key stakeholders:
- 1st line of defense:
    - **Model owners & developers** → With the tool, they can easily identify/detect some incidences or inconsistencies of the model.
- 2nd line of defense:
    - **Model validation** → This area is they main user of the tool, being in charge of the overall validation of the credit risk models.
    - **Risks** → Assures that there is a control framework in place and identifies potential risk of the credit risk model.
- 3rd line of defense:
    - **Internal Audit** → Assess that the model has an adequate effectiveness, complying with the business and regulatory requirements.

Data architecture and technological environment

Front-end developed in VBA connected with a SAS engine using an Access DB as back-end

Information Manager	Validation	Reporting
Users	Information management / Validation parameters / Validation engine	Predefined reporting / Monitoring
In the first section, the data inputs are incorporated. User may include all the required portfolios and models to be validated.	On the second step, the user defines the tests to be performed. Once it is decided, the tool is executed and the engine performs the statistical calculations.	Lastly, all the reports are generated and stored. Information can be analysed and incorporated in the appropriated reports.

Validation process

In order to validate credit risk models (control, monitoring and risk-measuring) different types of analysis need to be done. They can be classified as:
- **Quantitative Analysis**: The main purpose of the Quantitative Validation is to…
    - ✓ Check whether the methodology that has been chosen to develop the models is appropriate.
    - ✓ Analyse the screening capacity, robustness and stability of the models.
    - ✓ Ensure best practices have been while developing models.
- **Qualitative Analysis** aimed to assure all procedures related to Data quality and the documentation used for developing the model are adequate.
    - ✓ Wide range of tests that cover the following areas: analysis of the documentation, integrity, consistency and replicability which where used for the construction of the models.

TECHNICAL REQUIREMENTS

- Access to a SAS server / local , with Analytics Pro package license, or the individual components of the package (SAS Base, SAS/GRAPH y SAS/STAT).

- Complete office package including Access and PC Files interface for ODBC connector.

- Storage space in a shared location, it needs to be accessible for both the SAS server and local user.

- Appropriate infrastructure and resources due to the size of the inputs considered and amount of tests that are going to be executed.

KPMG

06 In-depth insights

The tool is a multiuser solution composed by a set of independent modules which can be tailored depending on the institution needs…

The global workflow of the tool is depicted in the next figure, followed by an overview of each of the steps to be followed. The **workflow** can be decomposed in:

Data Manager	Validation	Reporting	Configuration

The **first step is the 'Data Manager Loading'**. Based on the bank's internal data, the tool extracts the relevant information in order to run the validation process…

Data Manager

The data manager includes 2 main modules:

- **Information →** the user must upload the SAS database and all the data & model that will be validated considering models, area, sample and variables. Additional variables used for mapping and segmentation can be loaded as well. Supports massive portfolios.

- **Parameters →** the user can include filters, specific parameters, thresholds for each test, fields, scale, error parametrization, etc.

06 In-depth insights

Validation & execution

The second step is the 'selection and validation process' where the user can create and manage the validation process…

Once the data and information has been loaded, the parametrization is ready and the models are set, the user can **define the statistical tests** that will be performed…

Model Validation and Management Tool
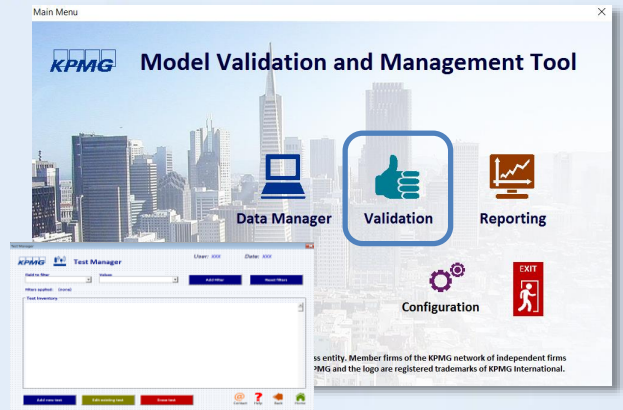
Quantitative Analysis

Variables

▪ **Stability:**
  ✓ Test *Chi-Square*;
  ✓ Frequency and monotony Analysis;
  ✓ PSI (Population Stability Index);
  ✓ Test *Kolmogorov*;
  ✓ *ANOVA*;
  ✓ Test *T - Student*

▪ **Screening Capacity:**
  ✓ WOE (*Weight of Evidence*);
  ✓ IV (*Information Value*);
  ✓ Gini;
  ✓ ROC;
  ✓ Kolmogorov Smirnov
  ✓ Correlation Matrix (Pearson, Spearman)

▪ **Concentration:**
  ✓ Frequency Analysis;
  ✓ Average Comparison;
  ✓ Kurtosis and Asymmetry
  ✓ Herfindahl

Back-testing

✓ Binomial Test
✓ *Hosmer-Lemeshow*
✓ *Brier score Test*

Model

▪ **Segmentation:**
  ✓ *Duncan*; *Scheffe*; *Tukey*;
  ✓ *Kruskal-Wallis*;
  ✓ *Herfindhal*;

▪ **Screening Capacity:**
  ✓ *Roc*
  ✓ *KS*;
  ✓ *Gini*;
  ✓ Descrimination Test

▪ **Stability:**
  ✓ Histogram;
  ✓ Frequency Analysis;
  ✓ *Box-Plot*;

▪ **Concentration:**
  ✓ Frequency Analysis;

▪ **Calibración:**
  ✓ Heterogeneity among scoring groups/tranches.
  ✓ Significance of sample sizes.
  ✓ Analysis of the exponential degrowth.

✓ Conditional Information Entropy Test
✓ Traffic Lights Binomial
✓ Backtesting Confidence Interval

Qualitative Analysis

Consistency

Includes all the statistical tests that need to be used to analyse the variables in the construction and validation tables used for developing the model. The analysis covers:

✓ Outliers.
✓ Missings.
✓ Concentration.
✓ Coherence.

Quality checks can be carried out enabling the user to detect errors in the data used to develop the models.

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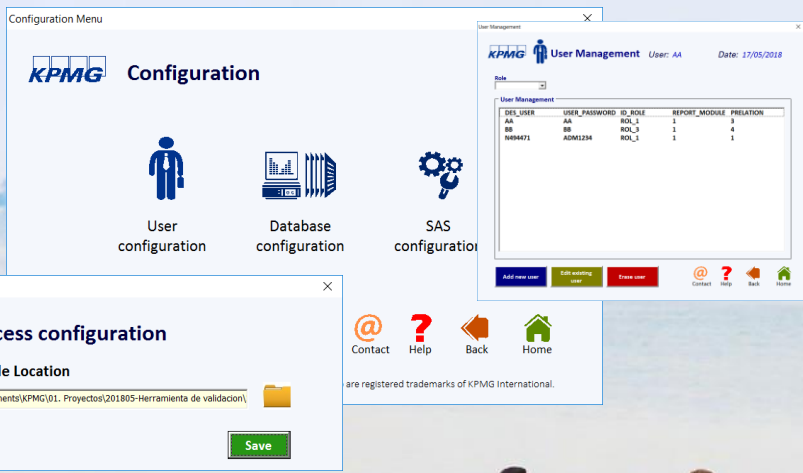
Configuration

This module allows to configure all the features:

✓ User parametrization
✓ Database selection
✓ SAS batch configuration

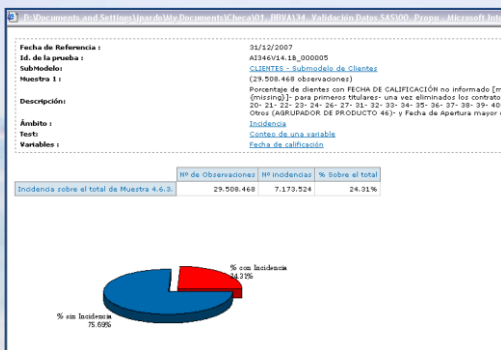# 06 In-depth insights

Reporting

Dynamic and **customizable dashboards** to enable Senior Management **drill down** through the information to **address** any **flagged issues**. The high level of **granularity** allows **cascading down** to all the levels of the validation process **easing the integration into the bank's management…**

Once the tool is executed, the engine generates an HTML Report which can be integrated in the institutions intranet or in a shared directory. The Reports follow a tree structure with folders and subfolders. There are two types of folders:

- **Individual Reports:** results to each test individually.
- **Summary Reports**: (Operational and High priority Operational)
  - Numeric and traffic light results are shown grouped by tables.
  - The threshold values for each test can be customized depending on the desired values.
  - In the high priority operational report we can find all the tests that have resulted in a red Traffic Light.
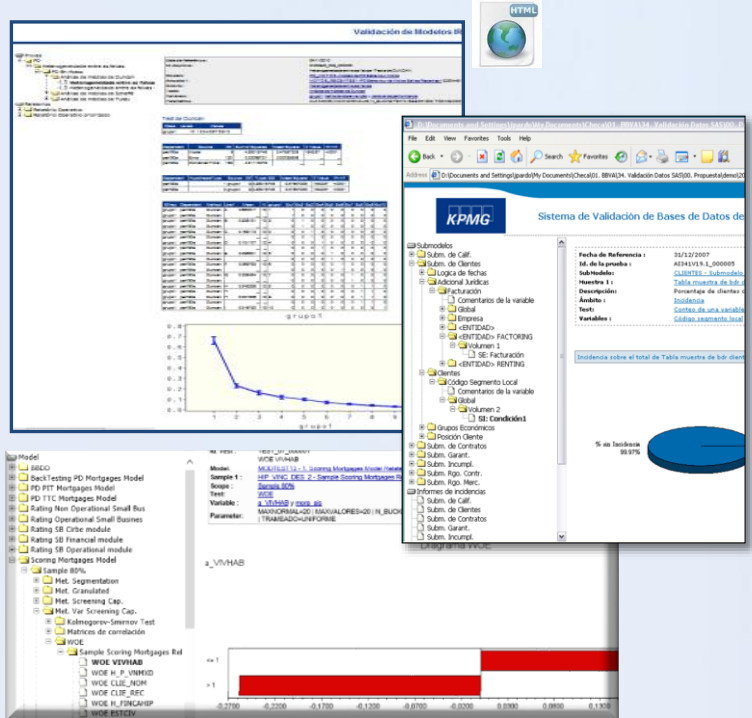
The purpose of the Op Report is to show in an aggregate format the results to the traffic light tests. This enables the user to have an overall picture of the test results.

In this report it is possible to review all the individuals reports…

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Our differentiators

#1

KPMG has developed strategic validation initiatives at a global level to be at the forefront and to lead the change in our clients.

We understand the issues and challenges involved in the validation process, and we will leverage upon this experience to deliver a seamless service to our potential clients.

We have a strong track record in projects related to Validation.

Strong Local Presence worldwide.

Global network with subject-matter specialists and support from several Centres of Excellence.