



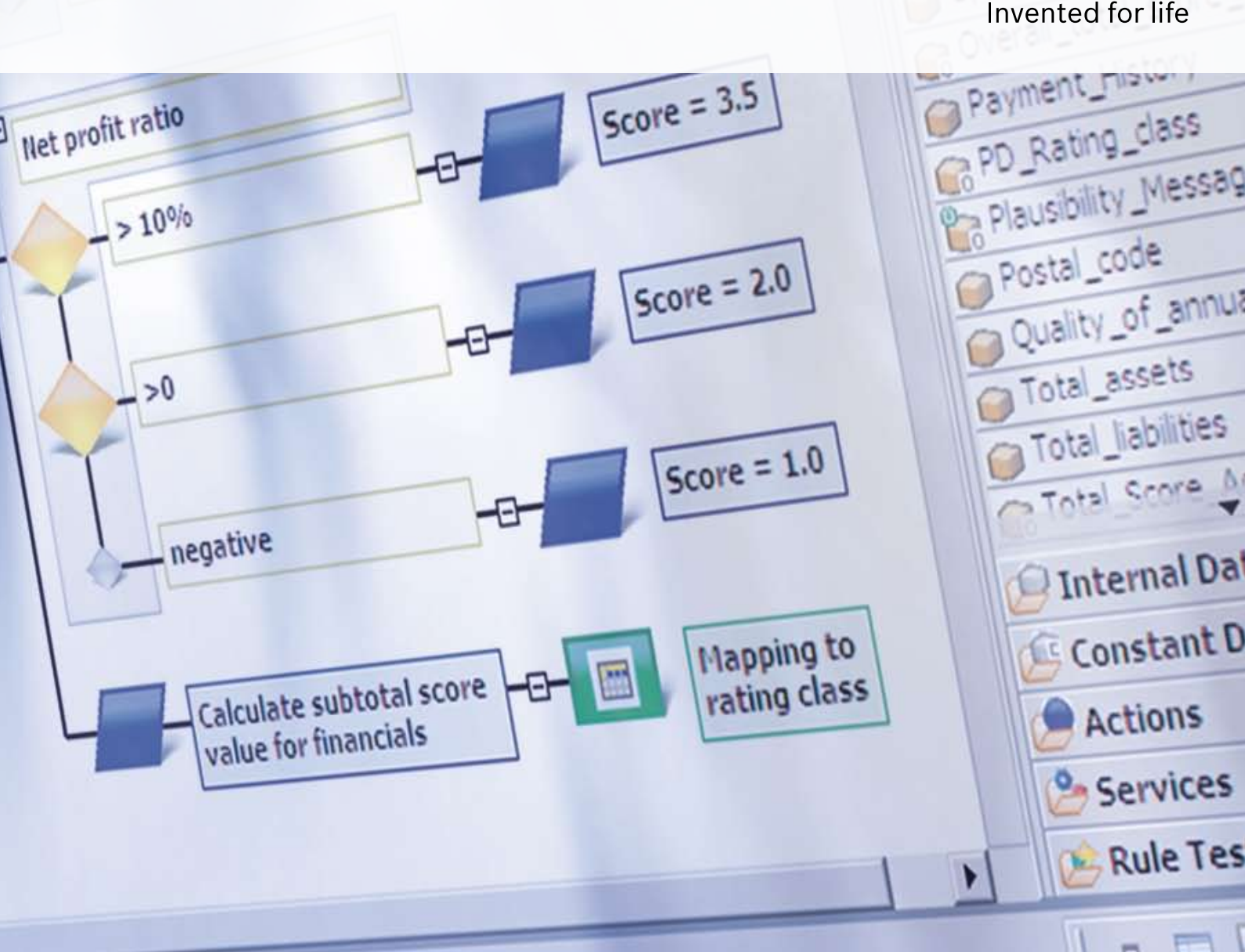
Credit Risk Rating Platform

# A Flexible and Transparent Basel II-Compliant Credit Risk Solution

Bosch Software Innovations



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# Mastering the Challenges of an Internal Rating System ...

Banks and financial institutions are continually striving to improve their risk management tools and methods. Likewise, they must ensure that all utilized approaches are compliant with regulatory requirements, such as the national implementation of the Basel II guidelines.

By integrating and enforcing credit policies, internal credit scoring and rating models execute credit decision

processes of financial institutions. Furthermore, internal rating models play an integral role for applying the Internal Ratings-Based Approaches according to the Basel II guidelines.

The underlying rating models and workflows are complex and subject to constant adaptations and optimizations and thus require a flexible and auditable process for modifying the underlying business rules.

All rating data must be housed and maintained in an auditable database that satisfies regulatory requirements. This central database is a prerequisite for establishing simulation processes for performing impact analyses and stress tests.

## ... Using the Credit Risk Rating Platform

Traditional approaches to implementing, deploying, and managing internal scoring and rating models – such as Microsoft Excel or hard-coded solutions – have proven to be too inflexible to meet evolving requirements.

With its Credit Risk Rating Platform, Bosch Software Innovations offers a powerful solution that allows for effective implementation and maintenance of rating models in the most transparent and flexible manner.

The unique graphical environment for implementing credit risk rating models is ideally suited for use by non-IT business professionals. Rating experts can visually model, test, execute and maintain risk rating models independently. This includes rating (business) logic and layout models for web-based user interfaces for operational risk assessment processes. Workflow models for consistent risk assessment and approval processes are included as well.

In addition to the operative scoring and rating processes, the Credit Risk Rating Platform also provides a simulation environment. It can be used for performing impact analyses and stress tests. In this environment, rating experts have the ability to analyze the impact of rating model changes, as well as re-rate the credit portfolio in different stress scenarios.

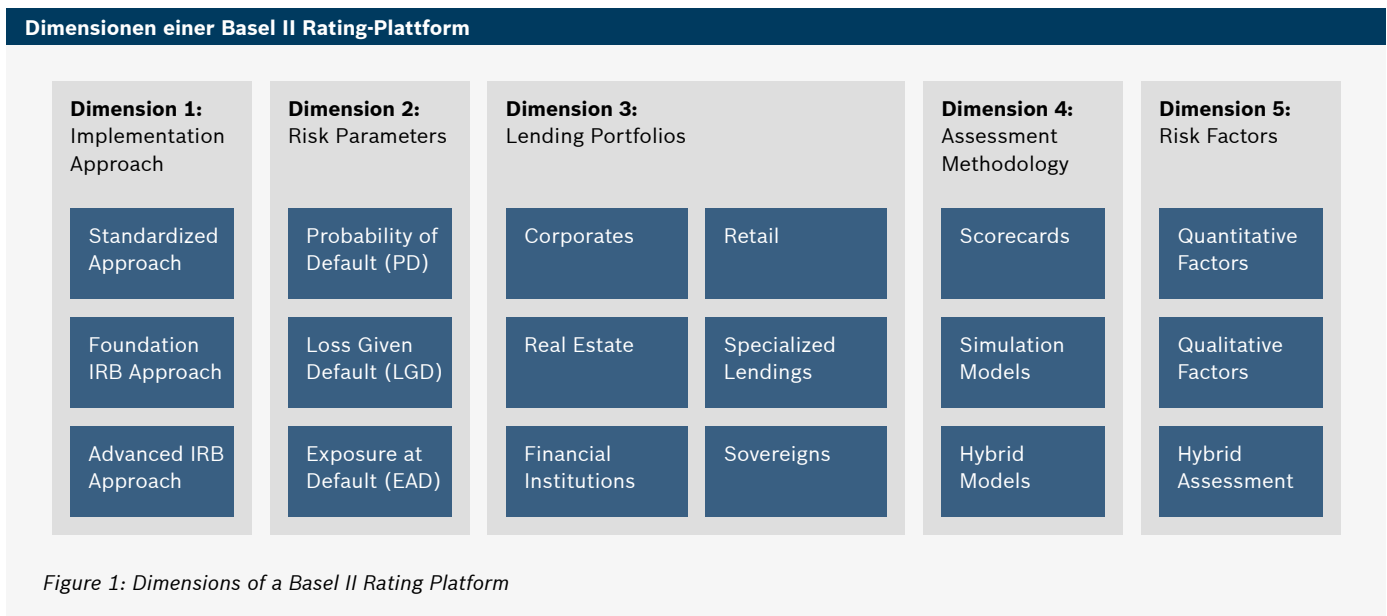
$$\begin{aligned} \text{Correlation (R)} &= 0,12 \times (1 - \exp(-50 \times \text{PD})) / (1 - \exp(-50)) + 0,24 \\ \text{Maturity adjustment (b)} &= (0,1852 - 0,05478 \times \ln(\text{PD}))^2 \\ \text{Capital requirement (K)} &= [\text{LGD} \times N[(1-R)^{-1} - 0,5 \times \text{G}(\text{PD}) \\ &\quad \text{PD} \times \text{LGD}] \times (1 - 1,5 \times b)]^{-1} \times 1 \times 1 \\ \text{Risk-weighted assets (RWA)} &= K \times 12,5 \times \text{EAD} \end{aligned}$$

# Credit Risk Rating Platform Dimensions

The Credit Risk Rating Platform is a robust and scalable solution for the implementation and deployment of internal rating models. With a single,

central platform, rating models can be mapped in any number and level of complexity. The following classifications are based on Basel II require-

ments. They illustrate the various deployment options offered by the platform (figure 1).



## Five Dimensions – One Platform

### Implementation Approach

The Credit Risk Rating Platform is ideally suited to implement and maintain internal rating models for IRB Approaches. There are no limits to the complexity of computational and decision-making logic that the platform can handle. Thanks to the graphical modeling approach, rating logic can be implemented and maintained by rating experts.

### Risk Parameters

Probability of Default (PD), Loss Given Default (LGD), and Exposure at Default (EAD) can be implemented into the rating models for the calculation of core risk parameters.

### Lending Portfolios

To enhance the quality of the rating criteria when determining risk parameters, financial institutions use the Credit Risk Rating Platform to apply any number of lending portfolio-specific rating models. This includes models for retail scorings, ratings of corporations or financial institutions, or project finance.

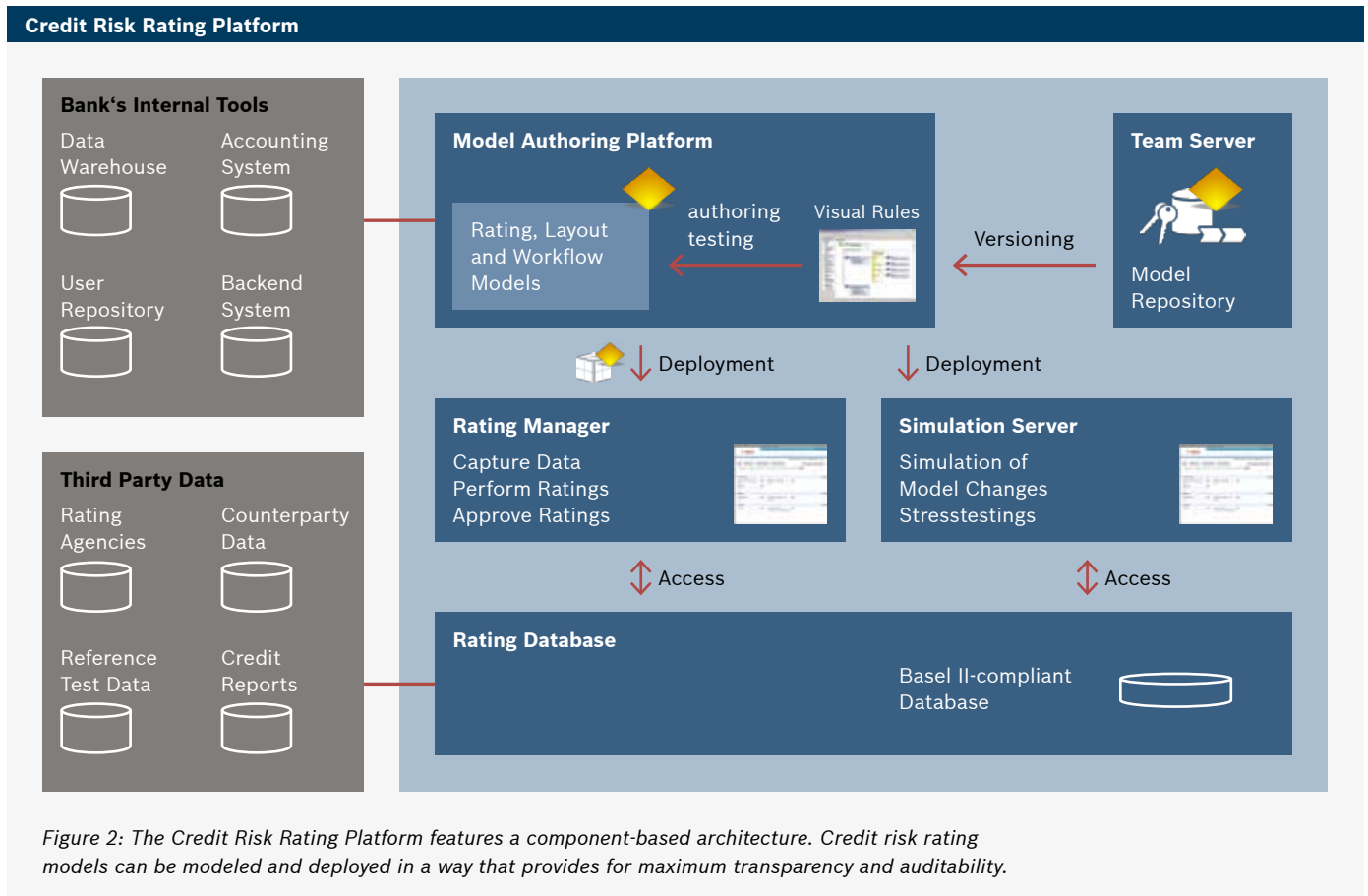
### Assessment Methodology

Basel II risk rating models are generally implemented using scorecard-based methodologies. However, for some lending portfolios, such as real estate and project financing, simulation-based models (e.g. cash-flow projections) are applied.

### Risk Rating Factors

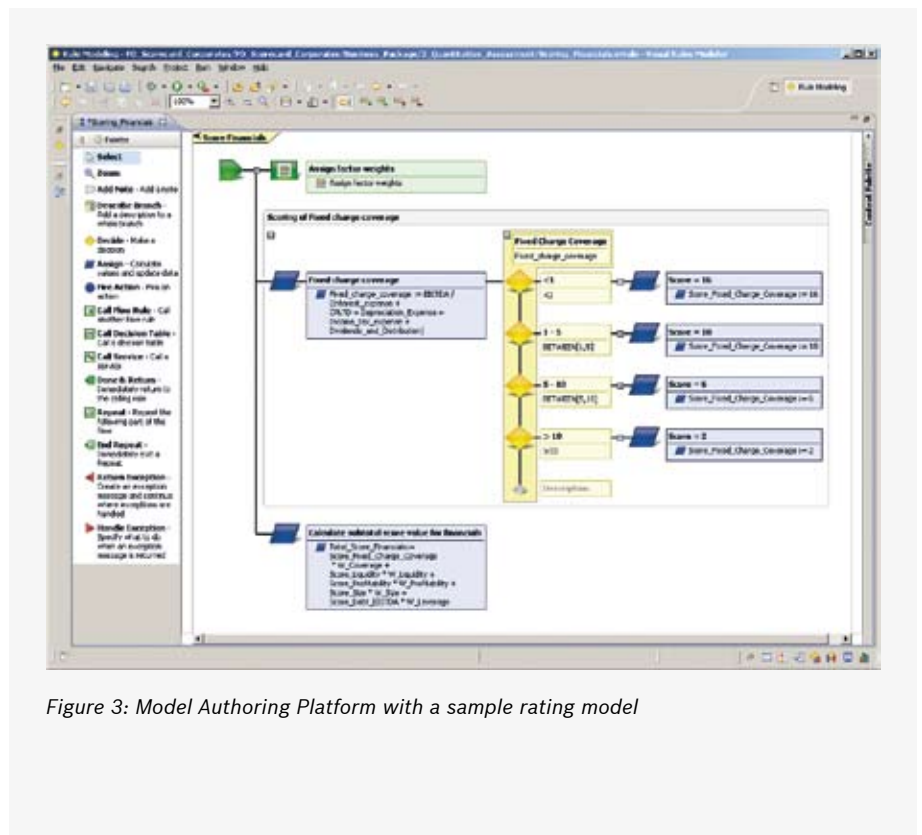
Basel II risk rating models often include the assessment of both quantitative and qualitative risk factors. Quantitative risk factors may include the counterparty's master data and key financial figures, such as the balance sheet. Qualitative risk factors, such as management quality, are evaluated by a credit analyst in a web-based user interface. It is dynamically generated from risk rating models. Credit managers need the ability to rapidly deploy new subjective risk factors. By eliminating software development lifecycles, the Credit Risk Rating Platform provides the needed flexibility to adopt these changes.

# Platform Components



## Model Authoring Platform

The Model Authoring Platform (fig. 3) is the central component for implementing and maintaining credit risk rating models. It is an industry innovator as it is the only fully graphical solution on the market. The graphical modeling approach offers a consistent and uniform environment. It supports the entire rating model lifecycle from creation to testing (fig.5). Any level of logical complexity can be structured and modeled clearly. Then, it can directly be executed within the Model Authoring Platform. The graphical development environment is used to transparently implement and maintain the layout for dynamic web-based user interfaces. It also allows for the implementation and maintenance of workflow rules for complying with the bank's credit policies and approval processes.



## Team Server

Models for determining rating logic, web-based user interfaces, and workflows are stored and managed in a central versioning system. With a comprehensive role-based identity management concept, the timestamp, author, and content of all modifications are stored in an audit trail. Likewise, changes to rule models can also be viewed graphically in a comparison view.

## Simulation Server

Within the Simulation Server, changes to rating models can be analyzed prior to their deployment for productive usage. For this purpose, modified versions of rating models can be run against historical data sets. Portfolio-level reports, such as on movements in the risk rating distribution, help analyze the impact of model changes.

In addition to model changes, the Simulation Server supports the performance of stress tests. The first step in this process is to determine the impact of a stress scenario – economic downturn, for example – on the input factors of an internal rating model. Based on the modified input factors, the credit portfolio is then re-rated to assess stressed credit risk parameters.

The impact of rating model changes or stress tests can be analyzed by comparing the ratings of simulation runs to the original values. Key analyses include the calculation of Probabilities of Default, modified Risk-Weighted Assets (RWA) and Minimum Regulatory Capital Requirements in a stress scenario. The Simulation Server satisfies a key requirement of Basel II for stress testing.

## Rating Manager

The Rating Manager is a web-based application (figure 4) for performing and managing ratings by credit analysts. This application offers a consistent and uniform environment for the entire credit decision process. From data collection and risk calculation to the final approval of rating results and/or credit applications (figure 6). The user interface elements are dynamically generated from the layout models created with the Model Authoring Platform.

Risk rating models can be performed manually by credit analysts or processed automatically by the system. In environments demanding high-volumes of decisions, such as retail credit decisions, the capability to instantaneously execute scoring models automatically is vital and provides a critical competitive advantage.

## Rating Database

The Basel II-compliant Rating Database is used to store all requisite input and output data. Other important metadata are stored, including date and time of rating, the identifier of the credit analyst, and the rating model used. The data is stored in a relational database and can also be used for extensive reporting by third-party business intelligence tools.

## Interfaces

The Credit Risk Rating Platform can be integrated with both internal and external systems using standard interfaces. This feature allows for existing data, such as an obligor's master data or transactional data on a credit facility, to be seamlessly imported into the rating process.

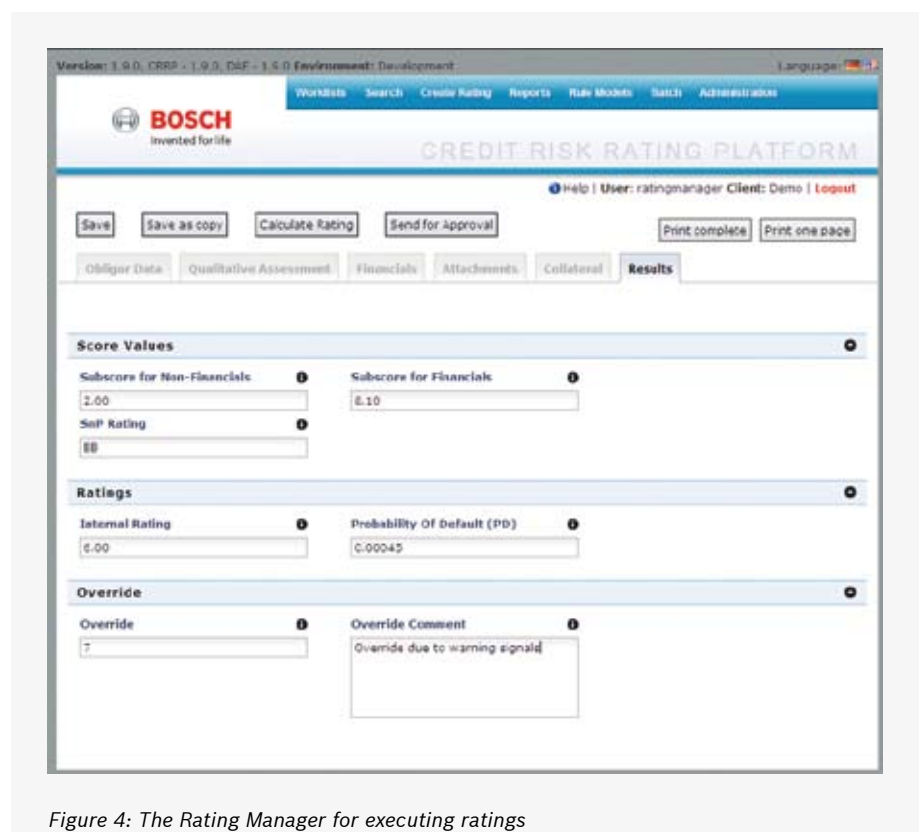


Figure 4: The Rating Manager for executing ratings

# Support Throughout the Entire Lifecycle

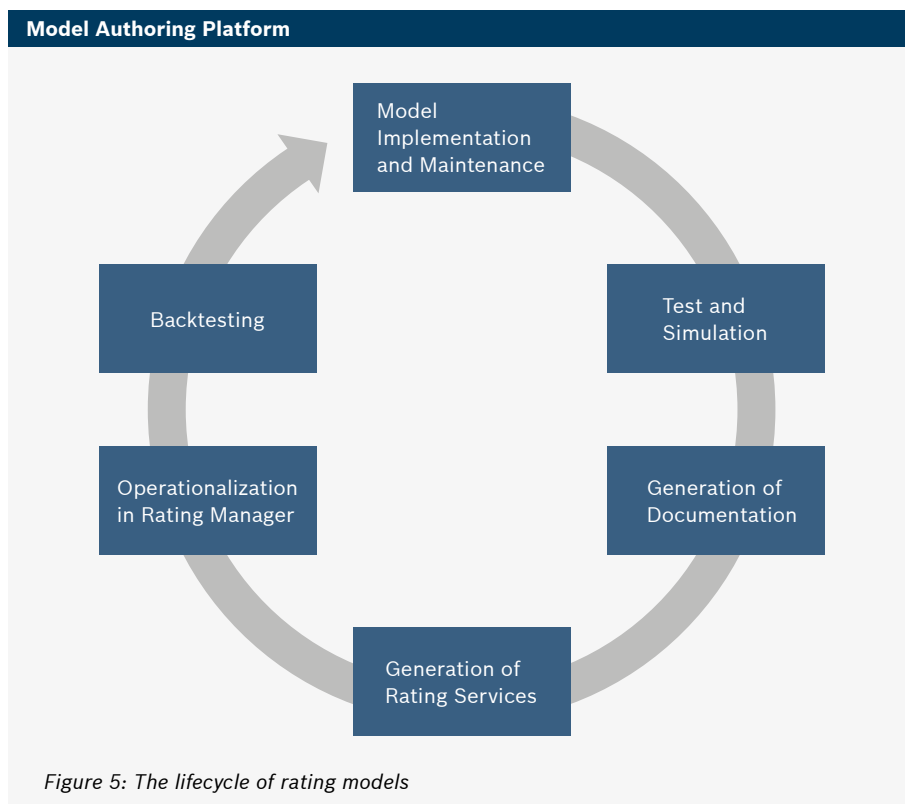


Figure 5: The lifecycle of rating models

## Implementing Rating Models with the Model Authoring Platform

### Model Implementation

Rating, workflow and UI models are graphically modeled in the Model Authoring Platform. The complexity of computational and decision-making logic can be unlimited. However, structured mapping empowers rating experts to maintain their rating logic without programming knowledge.

### Testing and Simulation

The Model Authoring Platform offers an extensive testing environment for the quality assurance of rating models. With the graphical test editor, test cases using input data and expected results are defined. Tests can then be executed immediately to validate the rating models. Only error-free and successfully tested rating models are deployed to production.

### Generation of Documentation

Complete documentation is automatically generated from the rating models including all risk parameters and complete computational and decision-making logic. The documentation corresponds at all times to the deployed rating models and can be used in internal communications or auditing processes with supervisory authorities.

### Generation of Rating Services

Rating services are fully encapsulated as executable Java code and are generated from the graphical rating models with the click of a button. The rating services can be deployed to the Rating Manager or used by any other application. The deployment process into the Rating Manager is fully integrated within the system so that new rating model versions can be released to production by authorized users

### Operational Rating Process

The Rating Manager provides a comprehensive runtime environment for performing and managing operational risk ratings. Each rating model deployed to the Rating Manager includes the definition of the rating logic. Furthermore, it includes the user interfaces required for the data collection and creation of ratings by credit analysts. Structural changes to the rating model's data fields, such as additions of qualitative factors, are directly reflected on the analyst's web front-end after deployment. The result is maximum flexibility of both the rating models and the user interface.

### Backtesting and Model Modifications

As part of backtesting, rating models are constantly calibrated and validated in order to improve the quality of the rating criteria. Modifications to models resulting from the backtesting process are made by the business user in the Model Authoring Platform. Based on a defined test portfolio, changes can be simulated and their impact on the entire portfolio (such as historical datasets) is analyzed. All changes to the rating models are recorded in the Team Server to ensure a full audit trail of changes.

## Executing Ratings in the Rating Manager

### Data Collection and Import

The input data for operational rating processes can be automatically retrieved from internal or external systems or manually collected by a credit analyst in the Rating Manager. When data is collected, it is automatically reviewed for plausibility. The user interface elements needed for data collection and display are dynamically generated from the layout models. Included in the layout models are rules which update the user interface depending on rights and permissions of the user. Thus, the application provides each user with the exact information required for a specific task.

### Risk Assessment

The Rating Manager uses the deployed rating services to compute risk parameters (e.g., PD and LGD).

### Rating Approval Process

The Rating Manager supports user-defined credit decision and rating

processes which includes overrides and workflow-enabled, multi-level approval processes. The processes are based on the workflow models defined in the Model Authoring Platform.

### Administration and Monitoring of Ratings

The Rating Manager offers means for managing and monitoring rating documents. Credit Analysts are able to manage rating documents in personalized work lists. With the dynamic

user interface generation approach, displays and data are migrated across different model versions. Thus, a historic rating based on a previous scorecard can be displayed with the corresponding user interface. The rating data can also be exported standard data formats such as PDF, XLS or HTML.

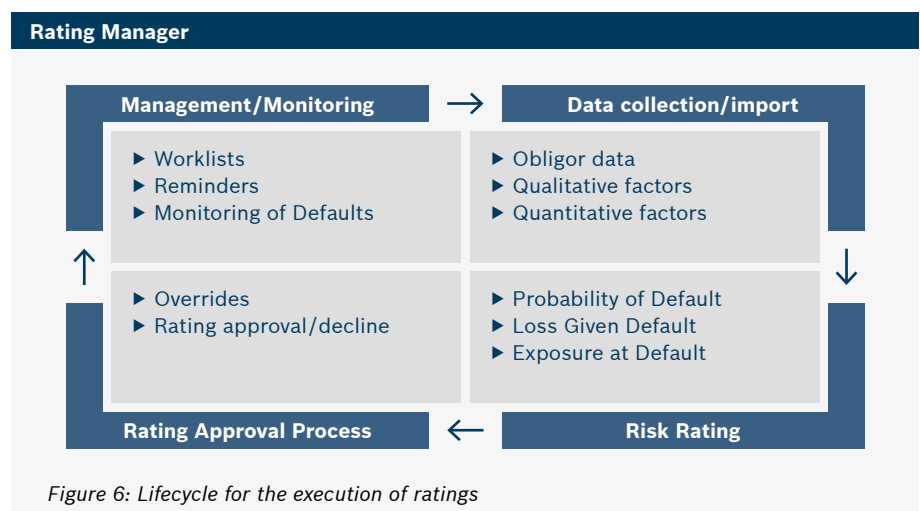


Figure 6: Lifecycle for the execution of ratings

## Credit Risk Rating Platform Quick Facts ...

- ▶ Rating models of all complexities are graphically created and maintained in an agile manner.
- ▶ Rating logic becomes transparent.
- ▶ Business users create and maintain rating models.
- ▶ Web-based user interface elements are generated dynamically.
- ▶ Workflow rules such as multi-level approval processes can be modeled.
- ▶ Test-driven approach is used for quality assurance of rating models.
- ▶ Consistent environment supports the lifecycle for creation, maintenance and execution of rating models.
- ▶ Simulation environment to simulate model changes and perform stress tests.
- ▶ Documentation and rating application are generated by the push of a button.
- ▶ Ratings are implemented and executed in conformity with Basel II.
- ▶ Third-party systems are seamlessly integrated.

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