Oracle Financial Services
Enterprise Modeling
User Guide

Release 8.0.4.0.0
January 2017

ORACLE
FINANCIAL SERVICES

ORACLE

Oracle Financial Services Enterprise Modeling
User Guide

Release 8.0.4.0.0
January 2017

Part Number: E69408-01

Contents

APPENDIX A   *References* *139*

APPENDIX B   *User Groups* *153*

APPENDIX C   .... *Command Line Utilities 159*

Contents

List of Figures

List of Tables

Preface

The *Oracle Financial Services Enterprise Modeling User Guide* explains the concepts of Oracle Financial Services Enterprise Modeling and provides step-by-step instructions for navigating through the application.

This chapter discusses the following topics:

- [Audience](#)
- [How this Guide is Organized](#)
- [Related Documents](#)
- [Conventions Used in This Guide](#)

Audience

The *Oracle Financial Services Enterprise Modeling User Guide* is designed for various users of Oracle Financial Services Enterprise Modeling. This guide is intended for the following users:

- **Business Analysts** (BA) who are instrumental in solution designing and creating statistical models using historical data.
- **System Administrators** (SA) who are instrumental in maintaining and executing batches, making the application secure and operational, and configuring the users and security of the application.

How this Guide is Organized

The *Oracle Financial Services Enterprise Modeling User Guide* includes the following topics:

- Chapter 1: About Oracle Financial Services Enterprise Modeling provides an overview of the Oracle Financial Services Enterprise Modeling, its features, the workflow, user roles, privileges, and actions.
- Chapter 2: General Features, explains the general features of Oracle Financial Services Enterprise Modeling. These are the common User Interface (UI) features that are found across all modules.
- Chapter 3: Getting Started explains how to access and login to the application.
- Chapter 4: Managing Sandbox gives detailed information on Sandbox module, user roles, creating Sandbox definitions, maintaining the Sandbox, and so on.
- Chapter 5: Managing Techniques describes techniques registration, creating, authorizing, editing, and deleting a technique.
- Chapter 6: Managing Variables explains about creating, editing, viewing, and deleting variables.
- Chapter 7: Managing Modeling gives detailed information about creating, editing, viewing, and deleting models. It also explains how to execute and deploy models.
- Chapter 8: Managing Stress Testing describes about creating, editing, viewing, and deleting stress definitions. It also provides information about scenario management, the variable shock library, and so on.

Related Documents

This section identifies additional documents related to OFS AAAI Application Pack. You can access Oracle documentation online from the [Oracle Help Center (OHC)Documentation Library](#).

- *Oracle Financial Services Advanced Analytical Applications Infrastructure (OFS AAAI) Application Pack 8.0.4.0.0 Installation and Configuration Guide*

- *Oracle Financial Services Analytical Applications Infrastructure Environment Check Utility Guide*

- *Oracle Financial Services Analytical Applications Infrastructure User Guide*

- *Oracle Financial Services Analytical Applications Infrastructure Administration Guide*

To find additional information about how Oracle Financial Services solves real business problems, see our Web site at www.oracle.com/financialservices.

Conventions Used

Table 1 lists the conventions used in this guide.

Table 1. Conventions Used in this Guide

Convention	Meaning
Italics	• Names of books, chapters, and sections as references • Emphasis
Bold	• Object of an action (menu names, field names, options, button names) in a step-by-step procedure • Commands typed at a prompt • User input
Monospace	• Directories and subdirectories • File names and extensions • Process names • Code sample, including keywords and variables within text and as separate paragraphs, and user-defined program elements within text
<Variable>	Substitute input value

CHAPTER 1

About Oracle Financial Services Enterprise Modeling

This chapter provides an insight to Oracle Financial Services Enterprise Modeling. This chapter includes the following topics:

- Overview
- Concepts of Oracle Financial Services Enterprise Modeling
- Components of Oracle Financial Services Enterprise Modeling
- User Groups and Entitlements

Overview

The core of Financial Institutions Models is Risk, Marketing, Financial Crime and Enterprise Performance Analytical Applications. These models include traditional statistical techniques, modern machine learning methods, computational and simulation models. Oracle Financial Services Enterprise Modeling leverages popular statistical platforms such as the R platform and presents a framework for developing, deploying and managing models at the enterprise level, for financial institutions.

As an enterprise modeling toolkit, Oracle Financial Services Enterprise Modeling enables an institution's IT policies to be enforced while providing flexibility and freedom that Data Scientists and Statistical Modelers desire. Administrative users grant analysts and modelers access to sandboxes - particular analytical subject areas of interest along with a subset of production data - for model building. Validated and approved models may then be promoted from sandboxes to the enterprise model repository. Models in the repository may then be woven into in analytical application flows crafted by mixing data management tasks, model execution and deterministic business logic.

As the use of models proliferate and as modeling becomes a self-service idea within financial institutions, authorized modelers may publish techniques -- parameterized templates of models that serve as building blocks or standardized blueprints for models - so that the best ideas from experienced modelers are captured and reused within the firm. Oracle Financial Services Enterprise Modeling supports techniques developed using R, C++ or Java or Python script languages.

Unique to the needs of large and medium sized financial institutions is the need to project capital levels under a variety of macroeconomic conditions, in order to assess the institution's financial strength under different stress scenarios. The Stress Testing Framework within Oracle Financial Services Enterprise Modeling enables risk and finance officers to define various shocks and scenarios and to apply these conditions uniformly across different model execution runs.

Data lineage and traceability are central to a Financial Intuition's governance process. Oracle Financial Services Enterprise Modeling Application together with the pre-requisite Oracle Financial Services Analytical Applications Infrastructure Application provides a toolkit for developing complete end-to-end analytical applications with data lineage and traceability enabled at every step along the analytical workflow.

Key Features and Advantages

The key features and advantages of Oracle Financial Services Enterprise Modeling are:

Table 2. Features

Model Registry	Centrally Manage and Control all in the enterprise
Statistical Technique Library	Catalog and publish best modeling practices via reusable templates, which are to be used as building blocks for models
Track model usage across applications	Real-time view of dependencies such as which applications use which models; which variables are used a model, etc. Perform what-if impact analysis for changes to data sets, variables and models.
Modeling Sandboxes	Provision sandboxes with subsets of production data for modelers giving modelers complete freedom to build, test and calibrate models using production data, while keeping production environment locked-down for security and compliance needs. Readily deploy built models to locked down production via a built-in workflow.
Integrated Platform (With Oracle Financial Services Analytical Applications Infrastructure)	Statistical modeling, Data management and application deployment integrated in a unified platform so that models may be deployed for use within analytical applications quickly
Execute Models local to data	In-database (Oracle) execution of statistical models for high performance and scalability.
Foundation for Enterprise Stress testing	Centrally define variables and shocks. Catalog Stress scenarios for use in stress testing. Enable baseline and stress executions of models defined within the platform

Enterprise-R support with Oracle Financial Services Enterprise Modeling

Oracle Financial Services Enterprise modeling application leverages the R statistical platform. R is an open source statistical programming language and environment for computing and graphics. For more information about R, see the R Project for Statistical Computing at http://www.r-project.org. Oracle R Enterprise (ORE) is an in-database implementation of the R platform. ORE is a component of the Oracle Advanced Analytics Option of Oracle Database Enterprise Edition. ORE enables running R models within the Oracle Database Environment. For more information on ORE, see the Oracle R Enterprise User Guide.

Oracle Financial Services Enterprise Modeling Application supports ORE based models and techniques, that is, models defined and registered within the platform may be executed on an ORE instance. R models may be scripted within the platform or may be imported into the platform from previously existing R scripts.

Concepts of Oracle Financial Services Enterprise Modeling

Oracle Financial Services Enterprise Modeling is built specifically to meet many of the needs of large Financial Institutions where external regulatory and internal governance policies.

Models may only be built and tested in a sandbox environment. A sandbox has to be provisioned and authorized for use (usually by an administrator) before it is visible to modelers. Any number of sandboxes may be provisioned, but generally, an enterprise may provision a sandbox for each department or analytical team. For e.g, there may be an LGD sandbox consisting of data needed to build and validate LGD models, and a separate one for PD modeling. Such segregation of modeling teamwork areas is desirable in practice, but it is not a requirement: here may be as few as a single sandbox for the entire organization

Sandboxes are provisioned along with data required for modeling. Tools are provided to aid administrators in provisioning sandboxes with subsets of production data. Datasets and variables abstract physical data sources from the modeler, and data in the sandbox is exposed to modelers using via datasets and variables. Models are built against datasets and variables not physical data tables and columns. i.e, the underlying data is exposed as a logical dataset within the application, and modelers need not write any database specific queries to obtain data for modeling.. It is generally an administrative task to define datasets, and have a menu of datasets available for the modelers. When a sandbox is provisioned, one or more datasets can be associated with the sandbox.

Models in a sandbox can be changed (created/ edited) by anyone with access to the sandbox. Model versions are preserved in the sandbox along with execution and output histories. Once a model has been validated in the sandbox environment, the modeler may request that model to be promoted to the locked-down "production" environment, and once promoted, the promoted model cannot be altered.

Modelers may create new models by using a registered technique from the technique library, as a template. A technique is simply a parameterized and reusable script. An enterprise may publish a menu of techniques and require that modelers use those techniques as the foundation for models. The act of model building is then reduced to selecting an appropriate technique, binding the technique to the appropriate dataset and variables and providing runtime parameters to the script. Generally, a central data sciences team within an enterprise or a department is responsible for publishing techniques.

Not all models can be built using published techniques, and so an alternate way to build a model is to write an R script 'from scratch' and execute the script as a model. Regardless of how the model is built, the model must be bound to dataset and variables before it can access data.

 A business analyst may decide to include a published model (that is a promoted model) in an application flow. For e.g., a capital computation application flow may include many steps, some of which may be steps to execute statistical models for computing PD and LGD. As the Oracle Financial Services Enterprise Modeling application is fully integrated with the Oracle Financial Services Analytical Applications Infrastructure (AAI), models promoted from Oracle Financial Services Enterprise Modeling application are available as tasks in AAI, and so can be included in any orchestrated execution of tasks (application run). Note that within a sandbox, executable models are also made available as tasks private to the sandbox, and so can be included in sandbox specific orchestration of tasks.

Oracle Financial Services Enterprise Modeling Workflow
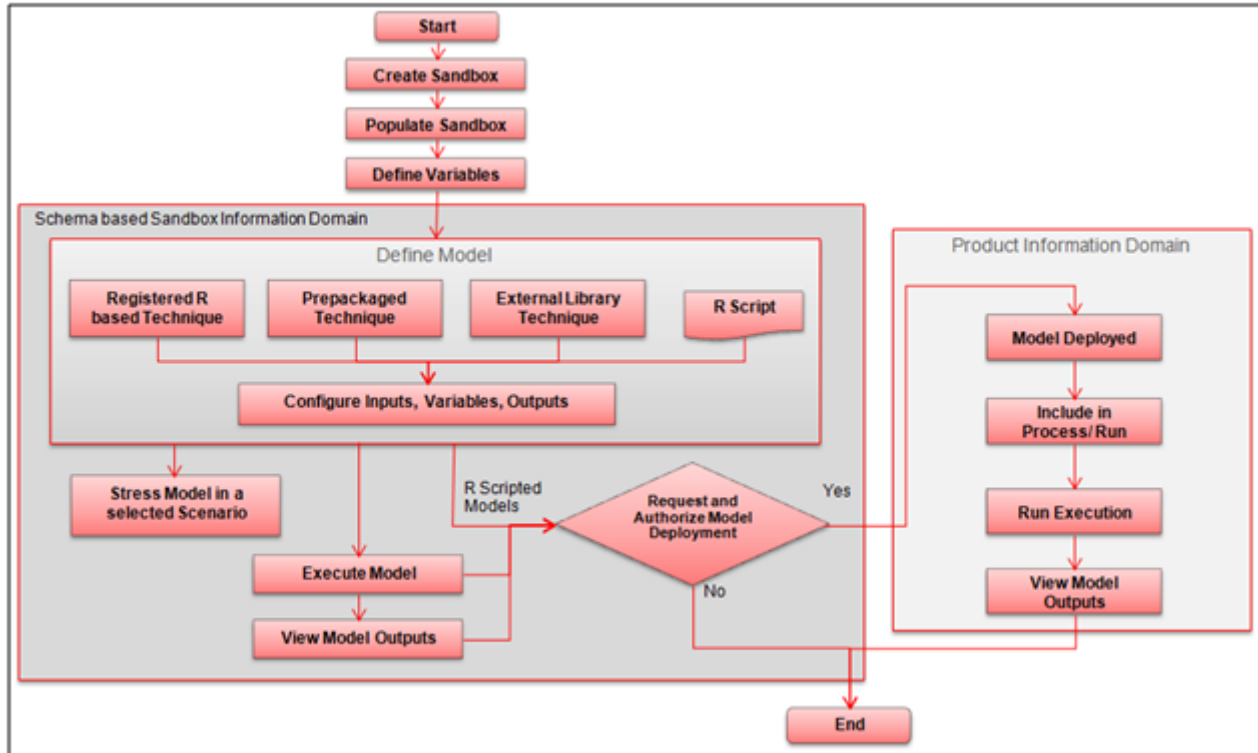
Figure 1. Oracle Financial Services Enterprise Modeling Workflow

Components of Oracle Financial Services Enterprise Modeling

This section describes the components of Oracle Financial Services Enterprise Modeling.

The following are the components of Oracle Financial Services Enterprise Modeling application:

- Sandbox

- Sandbox Maintenance

- Techniques Registration

- Variable Definition

- Modeling

- Stress Testing

Sandbox

Sandbox in Oracle Financial Services Enterprise Modeling refers to a restricted modeling environment, where the Data model is uploaded. It is implemented as an information domain.

The following information domains are required to perform operations in Oracle Financial Services Enterprise Modeling.

- **Sandbox Information Domain**: This information domain is used to create and execute business models. Based on the execution status and the generated output, you can verify the results and deploy the model into production.

You can create the following two types of Sandbox in the Oracle Financial Services Enterprise Modeling application.

- **Logical Sandbox**: A Logical Sandbox is a restricted environment within the Production information domain, where the data is uploaded to the logical sandbox within the Production information domain. You can create a sandbox as a Logical Sandbox, where data model upload or data population is not required. The logical sandbox refers to the set of tables present in the datasets you have selected during sandbox definition. After creating the logical sandbox definition, map it to the required user groups from the Sandbox Maintenance window. After the Users are mapped, you can create model definitions in the defined logical sandbox.

- **Physical Sandbox**: A Physical Sandbox is a restricted environment outside the Production information domain where there is actual movement of data from the production information domain to the physical sandbox. Creating a sandbox with multiple datasets eliminates the need for having a sandbox definition for each dataset. You can upload the data model while defining the sandbox, or upload it later using the Import Model option in Data Model Maintenance. When you save the sandbox definition, the required tables are created in the sandbox information domain. However, data present in the tables are copied only after authorizing sandbox population from the Sandbox Maintenance.

- **Production Information Domain**: This information domain allows you to request for model execution, and generate model outputs.

Note: Ensure the data model of the sandbox information domain should be a sub-set of the data model of the production information domain.

Sandbox Maintenance

Sandbox Maintenance helps you to populate the data to the tables in the Sandbox information domain, based on the dataset and the filters in the Sandbox definition. You have the option to do complete or incremental sandbox data population. However, for logical sandbox definitions, data population is not required.

The Oracle Financial Services Enterprise Modeling application enables you to synchronize the different versions of a Data Model which exists in a Production and Sandbox Information Domain through Incremental Data Model Upload. You can refresh the details and fetch the incremental data model changes from Production to Sandbox Information Domain.

Techniques Registration

Technique is a set of generalized statistical algorithms which can be used to build analytical models. Previously, the Oracle Financial Services Enterprise Modeling application was completely based on techniques developed by NAG and deployed. But now, it helps develop techniques using R script and ORE functions, prepackaged techniques, and external library techniques. An external library technique is based on third party algorithms, which can be a library or executable. At present, only C/C++ and Java programming languages are supported as Third Party Algorithms.

Variable Definition

Variable refers to a logical set of attributes that are likely to change based on the selected parameters. In a modeling environment variable plays a vital role in filtering the model parameters and to derive an estimate based on historical data. Variables are defined in production information domain.

Modeling

Modeling refers to the process of designing a prototype based on a structured data model, considering all the variables for statistical analysis and to simulate real events and processes.

You can use the Modeling utility to measure and quantify risk. You can use the pre-defined models to predict business trends and validate the existing models. You can use R scripting (using R functions as well as ORE functions) or Open R to create business models. Refer *Enterprise-R support with Oracle Financial Services Enterprise Modeling* section for more information.

Oracle Financial Services Enterprise Modeling enables you to run and execute R functions as well as ORE functions in the database, thereby greatly increasing scalability and performance.

You can create models in a Schema Based sandbox or Logical sandbox.

Note: For models created in logical sandboxes, the production and sandbox information domains are the same.

Stress Testing

Stress testing is an integral part of a bank's risk measurement system and plays an important role in estimating the effects of potential financial crises on a bank's operations. Stress Testing or risk estimation technique, refers to the

process of examining the stability of a system or entity in adverse conditions. It involves testing beyond normal operational capacity, often to a breaking point, in order to observe the results. It also helps banks conduct analysis to estimate the impact of movements in the variables on specific measures such as profitability and capital adequacy.

The Stress Testing utility supports the stress testing requirements across the entire suite of OFSAA products. It allows banks to define shocks and assess the impact of such shocks across multiple business areas.

The two commonly accepted forms of Stress Testing are:

- **Sensitivity Analysis**: Shocks are applied on a single variable.

- **Scenario Analysis**: A scenario is defined as a shock to a single variable or a collection of shocks on multiple variables. Scenario analysis involves applying simultaneous shocks on multiple variables to assess the impact of scenario on a measure or a set of measures. Scenarios are further classified into the following categories:

  - **Historical Scenarios:** These scenarios replicate the past events docket. They are defined by specifying shocks to variables such that they replicate the movement seen during historical events.
    For example, the user may define a scenario that replicates the movement in stock market indices as observed during the catastrophic event. This scenario can then be applied to the current trading book portfolio of the bank to estimate the loss that might be incurred if a catastrophic event occurs. However, the historical scenarios may not cover the entire range of potential adverse conditions

  - **Hypothetical Scenarios**: These scenarios are based on user judgment and addresses the other possible adverse movements in the variables.

User Groups and Entitlements

The following table gives the details about the User Groups in the Oracle Financial Services Enterprise Modeling Application.

Table 1. User Groups

User Group Name	User Group Description
Modeling Administrator	User mapped to this group will have access to all the menu items for Enterprise modeling and will be have authorization rights for sandbox population, model deployment and modeling technique authorization.
Modeler Group	User mapped to this group will have access to all the menu items for Enterprise modeling but will not have authorization rights for sandbox population, model deployment and modeling technique authorization.

CHAPTER 2 *General Features*

This chapter explains the general features of Oracle Financial Services Enterprise Modeling application UI. These are the common features that are found across the modules of Oracle Financial Services Enterprise Modeling. It describes the organization of the user interface and provides step-by-step instructions for navigating through the application.

This chapter includes the following topics:

- Home Page Components
- Acronyms
- Acronyms

Home Page Components

The Home Page contains the following sections.

- Top Menu/ Header Frame/ Header Frame
- Left Hand Side (LHS)
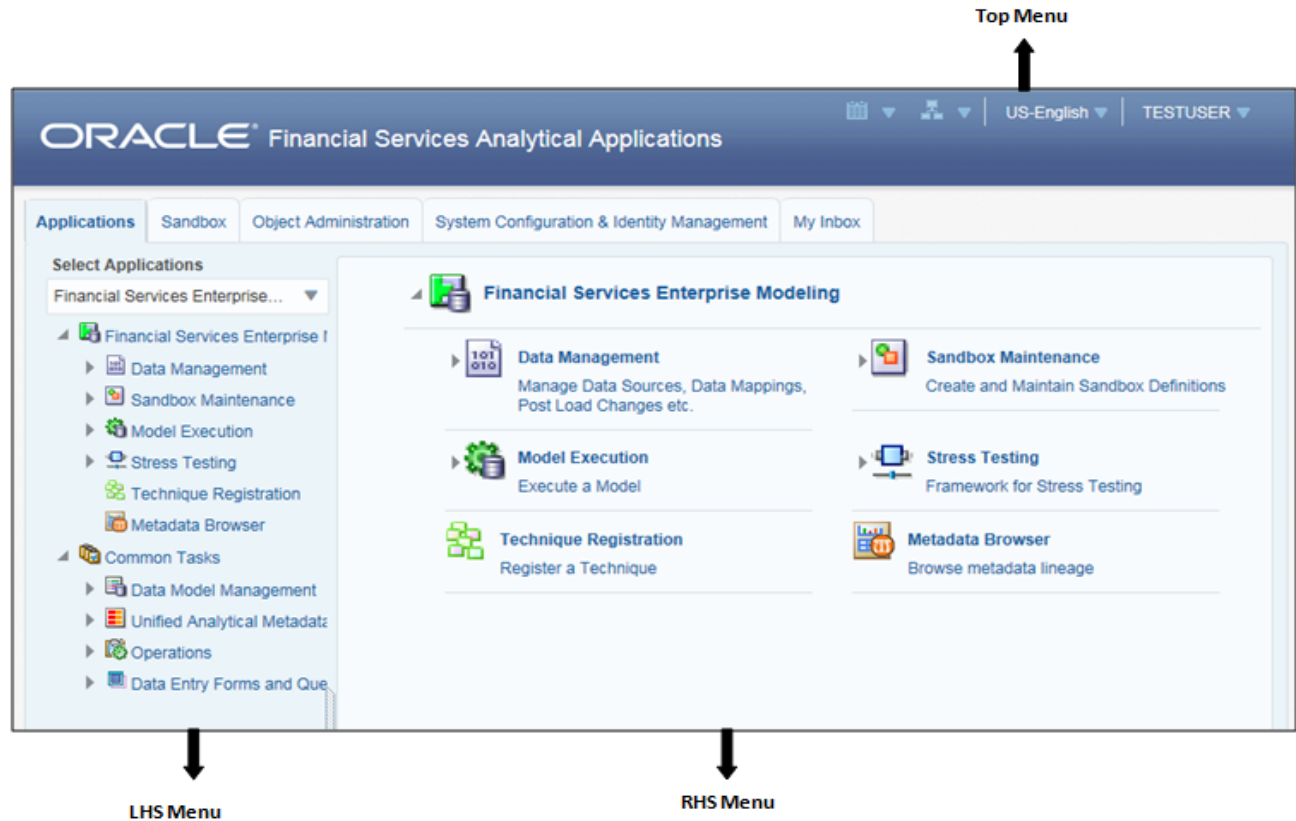- Tabs
- Right Hand Side (RHS)

Figure 2. Home Page

Top Menu/ Header Frame

The Header frame displays the logged in User information. It contains the following buttons:

- **Last Login Date**: This option allows you to view the last login date and time. It also displays the last failed login date and time.

- **Connected To**: This option allows you to view the Information Domain you are connected to and the Environment Details set in the Configuration page.

- **Language**: This option allows you to view the language selected.

- **User Name**: Displays the user name of the person logged in. Click the user name to view the following options:

  - **Preferences**: This option allows you to set the Home Page.

  - **About**: This option displays the copyright information.

  - **Change Password**: This option opens the Change Password window.

  - **Logout**: This option allows you to log out of the application.

Left Hand Side (LHS)

This section displays the menu which allows you to navigate to the required module. The items displayed in the Menu depend upon the access rights of the logged in user.

The LHS menu changes depending on the application selected from the **Select Application** drop-down list. For more details, refer to the *Oracle Financial Services Analytical Application Infrastructure User Guide.*

Tabs

The landing page is divided into multiple tabs and each tab has specific links to OFSAA Infrastructure and/ or Application modules. Depending on the OFSAA Application being accessed and the access roles mapped to the logged in User, the Tab and links would be displayed.

The following tabs are displayed in the Home Page:

- Applications Tab
- Sandbox Tab
- Object Administration Tab
- System Configuration & Identity Management Tab
- My Inbox Tab

Applications Tab
The following menu items are available in the Application tab:

- **Financial Services Enterprise Modeling**

    - Data Management
      For more information, refer to the *Oracle Financial Services Analytical Applications Infrastructure User Guide 8.0 Releas*e.

    - Sandbox Maintenance

    - Workspace Maintenance

    - Model Execution

    - Technique Registration

    - Stress Testing

    - Metadata Browser
      For more information, refer to the *Oracle Financial Services Analytical Applications Infrastructure User Guide* .

- **Common Tasks**
  For more information, refer to the *Oracle Financial Services Analytical Applications Infrastructure User Guide.*

    - Data Model Management

    - Unified Analytical Metadata

    - Operations

    - Data Entry Forms and Queries

Sandbox Tab

Select the required Sandbox from the **Select Sandbox** drop-down list. The following menu items are available in the Sandbox tab:

- Modeling
- Model Creation
- Model Execution Status
- Model Output
- Model Deployment

Note: The Sandbox options in the Select Sandbox drop-down list are available only for the enabled applications.

Object Administration Tab

Select the required Information Domain from the **Select Information Domain** drop-down list. For more information, refer to the *Oracle Financial Services Analytical Applications Infrastructure User Guide*.
The following menu items are available in the *Object Administration* tab:

- Financial Services Analytical Applications Infrastructure> Object Administration
    - Object Security
    - Object Migration
    - Translation Tools
    - Utilities
    - Metadata Browser

System Configuration & Identity Management Tab

Expand **Financial Services Analytical Applications Infrastructure** in the LHS menu**.** The following menu and sub menu items are available in the *System Configuration & Identity Management* tab. For more information, refer to the *Oracle Financial Services Analytical Applications Infrastructure User Guide*.

- Administration and Configuration
    - System Configuration
        - Database Server
        - Application Server
        - Web Server
        - Database Details
        - OLAP Details
        - Information Domain
        - Configuration

      ◆ Manage OFSAA Product Licenses

      ◆ Create New Application

- Identity Management

- Processing Modeling Framework

My Inbox Tab

The following menu items are displayed in the *My Inbox* tab.

- My Task

Right Hand Side (RHS)

This section displays user options available for the application selected.

Acronyms

The following table describes the acronyms commonly used in this application.

Table 2. Acronyms

Acronyms	Description
BA	Business Analysts
Infodom	Information Domain
LHS menu	Left hand side menu
OFSAAI	Oracle Financial Services Analytical Application Infrastructure
OFSAA	Oracle Financial Services Analytical Applications
Production Infodom	Production Information Domain
RHS menu	Right hand side menu
Sandbox Infodom	Sandbox Information Domain
SA	System Administrator
URL	Uniform Resource Locator

Getting Started

This chapter explains different steps to login to the Oracle Financial Services Enterprise Modeling application.

The following sections are included in this chapter:

- Logging into the Oracle Financial Services Enterprise Modeling Application
- Changing Password

Logging into the Oracle Financial Services Enterprise Modeling Application

Once the application is installed and configured, you can access Oracle Financial Services Enterprise Modeling Application.

To access Oracle Financial Services Enterprise Modeling, follow these steps:

1. Enter the OFSAAI URL in your browser. The Login windows is displayed.

Figure 3. Oracle Financial Services Enterprise Modeling Application Login Page

2. Select the **Language**.
3. Enter your **User ID** and **Password**.

4. Click **Login**.

5. Select **Oracle Financial Services Enterprise Modeling** from the **Select Applications** drop-down list. The Enterprise Modeling Application Home Page is displayed.
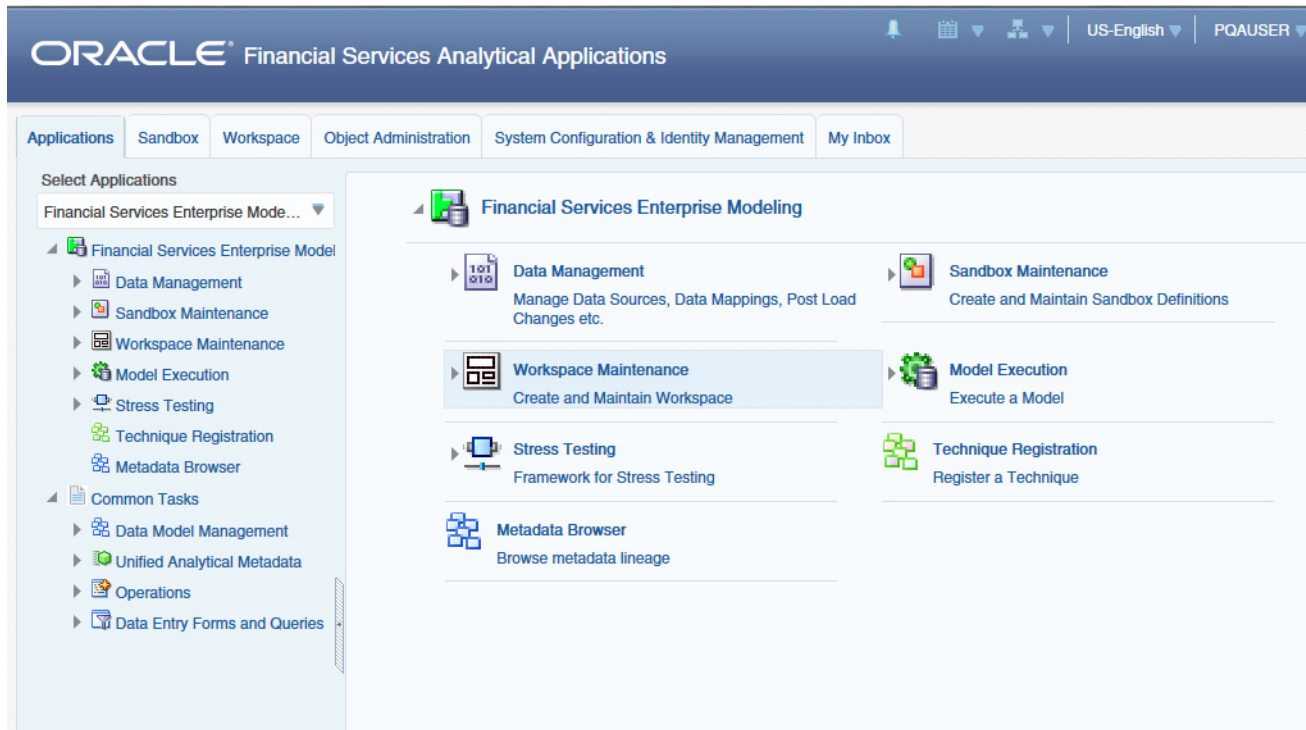

Figure 4. Home Page

Changing Password

The first time you log in to the application, the *Change Password* window is displayed. Alternatively, you can also choose to change the password at any time.

To change password, follow these steps:

1. Click **Change Password** in the Top Menu and the Change Password window is displayed.

Figure 5. Change Password Window

2. Enter the **User ID**.

3. Enter the **Old Password**.

4. Enter **New Password** and re-enter in the **Confirm Password** field.

5. Click **OK**.

Note:

- Passwords are displayed as asterisks while you enter. This is to ensure that the password is not revealed to other users.

- Ensure that the entered password is at least six characters long.

- The password must be alphanumeric with a combination of numbers and characters.

- The password should not contain spaces.

- Passwords are case sensitive and ensure that the Caps Lock is not turned ON.

- By default, the currently used password is checked for validity if password history is not set.

- The new password should be different from previously used passwords based on the password history, which can be configured. If you encounter any of the following problems, contact the System Administrator:

  - Your user ID and password are not recognized.

  - Your user ID is locked after three consecutive unsuccessful attempts.

- Your user ID has been disabled.

- Guest user cannot change the password.

CHAPTER 4 *Managing Sandbox*

This chapter provides information about Sandbox in the Oracle Financial Services Enterprise Modeling application and step-by-step instructions to use this section.

This chapter includes the following topics:

- About Sandbox
- Workflow
- User Roles
- Managing Sandbox

About Sandbox

Sandbox is a restricted environment in which you can analyze the data on trial and error basis and come up with actual analysis that helps predict the risks and business opportunities for banking institutions. You can create a sandbox by selecting the required datasets and the information domain which you want to implement as the sandbox.

Workflow

This section explains the workflow of Sandbox.

There are two types of Sandbox.

- Logical Sandbox
- Physical Sandbox

Logical Sandbox Workflow

The following image gives a detailed workflow of Logical Sandbox.
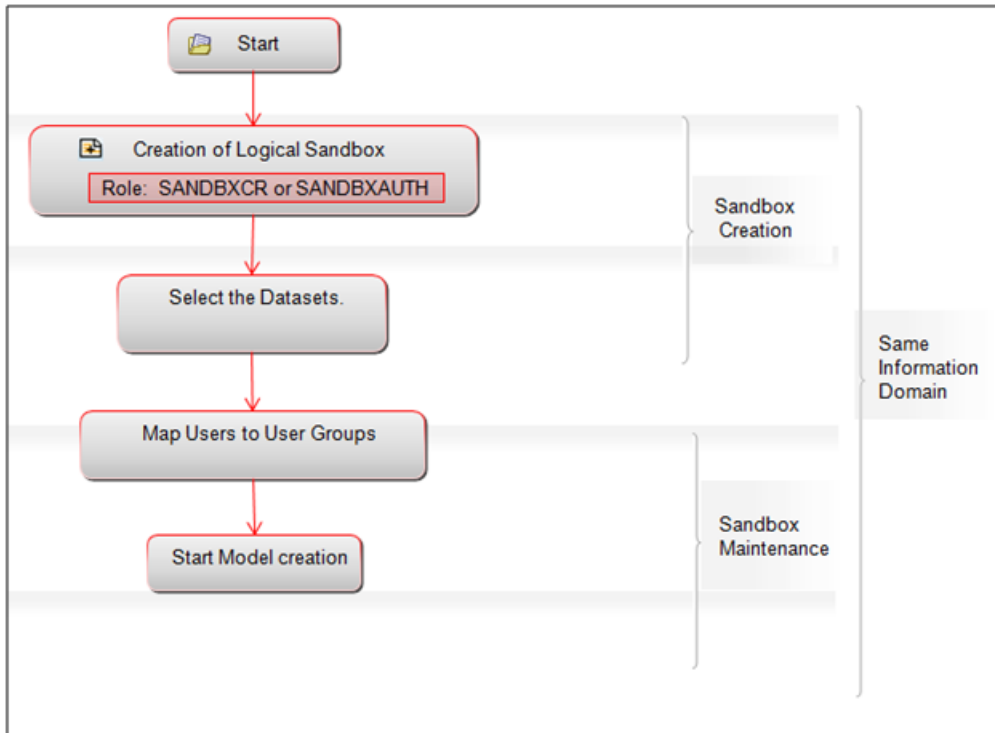
Figure 6. Logical Sandbox Workflow

Physical Sandbox Workflow

The following image gives a detailed workflow of Physical Sandbox.
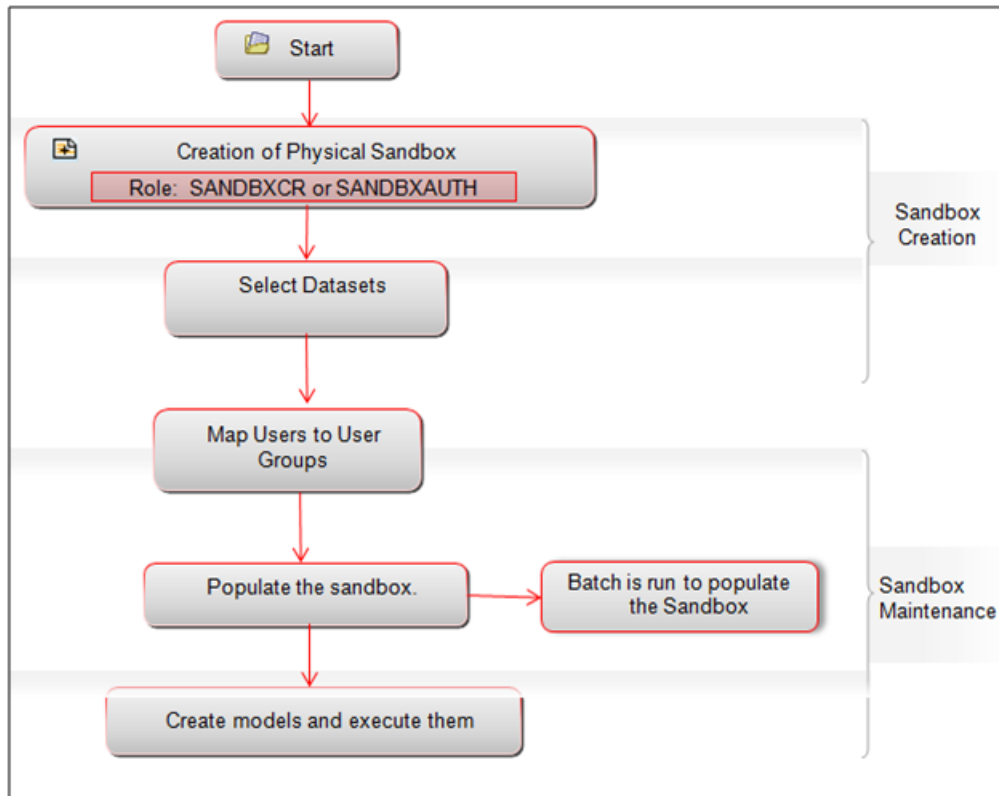
Figure 7. Physical Sandbox Workflow

User Roles

This section explains about the user roles required to define a Sandbox.

To create a sandbox, you must have the following use roles:

- SANDBXCR
- SANDBXAUTH

An authorizer must authorize the sandbox population and deletion.

To populate and delete a Sandbox, you must have the following user roles:

- SANDBXMOD
- SANDBXAUTH

Note: For more information on User Groups, refer to Appendix A, "References."

Managing Sandbox

This section explains how to manage Sandbox feature in Oracle Financial Services Enterprise Modeling application. This section includes the following topics:

- Accessing Sandbox Definition
- Creating Sandbox
- Viewing Sandbox Definition
- Modifying Sandbox Definition
- Searching Sandbox Definition
- Sandbox Maintenance

Accessing Sandbox Definition

You can access the Sandbox Definition page from the Oracle Financial Services Enterprise Modeling Home page. To access the Sandbox Definition page, follow these steps:

1. Login to Oracle Financial Services Enterprise Modeling. The *Oracle Financial Services Enterprise Modeling Home* window is displayed.

2. Select **Oracle Financial Services Enterprise Modeling** from the *Application*s tab.

3. Expand **Sandbox Maintenance** from the LHS menu and select **Sandbox Creation**. The *Sandbox Definition* window is displayed.

Figure 8. Sandbox Definition Page

Creating Sandbox

This feature allows you to create a sandbox where you can create and execute models.

Note: After creating a Sandbox you should refresh the screen, so that the newly created sandbox is displayed in the *Sandbox* tab.

This section includes the following topics:

- Creating Schema-based Sandbox Definition
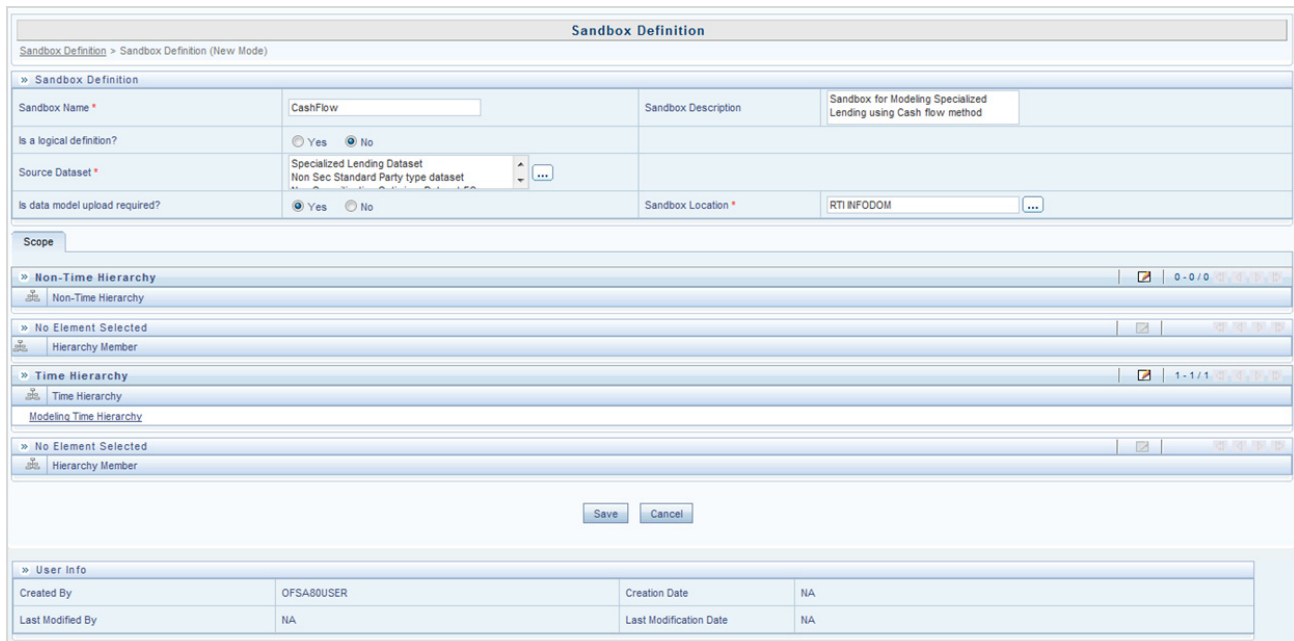- Creating Logical Sandbox Definition

Creating Schema-based Sandbox Definition

A Schema-based Sandbox is a restricted environment outside the Production information domain, where there is actual movement of data from the production information domain to the physical sandbox. A schema-based sandbox is also called a physical sandbox. A sandbox can be created with multiple datasets, which eliminates the need for having a sandbox definition for each dataset.

To create a schema-based sandbox, follow these steps:

1. Select ![icon] from the *Sandbox Definition* tool bar. The *Sandbox Definition* window is displayed.

   Note: The Add button is disabled if you have selected any checkbox in the grid.

Figure 9. Schema-based Sandbox Definition page

2. Enter the following details:

Table 3. Schema based Sandbox - Field Descriptions

Field	Description
Fields marked in red asterisk (*) are mandatory.	
Sandbox Name	Enter a name for the sandbox. **Note:** Ensure that there are no special characters like `, {,},'', ', ~, <,>, /, \, and multiple spaces. **Note:** Enter the alphabetical characters for the Sandbox Name in either uppercase or lowercase. If you enter the Sandbox Name in mixed case, then the EMF-R Execution fails with errors. For example, Sandbox Name can be **ofssdbox180** or **OFSSDBOX180**. If you have existing Sandbox Names in mixed case, then you must edit and update them from the **Database Details** window. For more information, see the **Database Details** section in the Oracle Financial Services Advanced Analytical Applications Infrastructure User Guide.
Sandbox Description	Enter a brief description for the sandbox.
Is a logical definition?	Select **No**.
Source Dataset	Select the required datasets. The datasets you want to select should match the Data Model of the sandbox. 1. Click ▭ and open the Source Dataset Browser. All the Authorized Datasets in the selected production Infodom are listed in the Hierarchical Browser. 2. Select the required dataset from the Datasets pane and click ↪ . To deselect a dataset select it from the Selected Datasets pane and click ↩ . 3. Click ▤ to view the details of the selected datasets. 4. Click ⊞ to create a dataset. For more details on creating a dataset, refer *Creating Data Set* section in *Oracle Financial Services Analytical Applications Infrastructure User Guide*. **Note**: The Datasets based on Derived Entities are not supported.
Is data model upload required?	By default, the Yes option is selected. ● Select **Yes** to upload the data model while saving the sandbox definition. ● Select **No** if the data model is already uploaded.
Sandbox Location	This is the information domain you want to implement as sandbox. 1. Click ▭ and open the Sandbox Location Browser. ● If Yes is selected for Is data model upload required? option, the Sandbox Location pane displays the list of the Information Domains where data model is not uploaded and sandbox has not been defined. ● If No is selected for Is data model upload required? option, the Sandbox Location pane displays the list of the Information Domains where data model is uploaded and sandbox has not been defined. 2. Select the required infodom and click ↪ . To deselect the infodom select it from the Selected Information Domain pane and click ↩ .

Table 3. Schema based Sandbox - Field Descriptions

Field	Description
Non Time Hierarchy	1. Click in the Non Time Hierarchy toolbar. The Hierarchy Browser displays all the Hierarchies/Filters from each selected Datasets. You can click "+" to expand the node to view the sub levels. 2. Select the required hierarchies and click . To deselect hierarchy by select it from the Selected Members pane and click . 3. Click **OK**. Note: Filter conditions are not considered while loading data in to the Hive based sandboxes. To load data with filters, you can use Data Mapping (T2T) to populate the sandbox. Otherwise, you can apply model level filters while modeling.
Hierarchy member	Click in the Hierarchy Member toolbar and specify the members or nodes in the Hierarchy browser. You can click "+" to expand the node to view the sub levels. When you select a hierarchy member, the data belonging to that hierarchy will be copied to the sandbox.
Time Hierarchy	1. Click in the Time Hierarchy toolbar. The Hierarchy Browser displays the available Time Hierarchies which are common across all the selected Datasets. You can click "+" to expand the node to view the sub levels. 2. Select the required time hierarchy and click to move it to the Selected Hierarchies pane. To deselect time hierarchies select from the Selected Hierarchies pane and click . 3. Click **OK**. **Note:** Time hierarchy selection is optional. However, if you do not select a time hierarchy, the following will occur: ● Time referencing will not be applicable for model definitions. ● For the model definitions, the variable browser will not show any variable definitions that has got filters. ● The shocking of transition matrix multi factor models will not work in sandboxes ● For models defined using techniques transition matrix - EWMA, MCEM, MC simulations, the execution may fail
Hierarchy Member	Click in the Hierarchy Member toolbar and specify the members or nodes in the Hierarchy browser. You can click "+" to expand the node to view the sub levels. Time hierarchy is used to group data based on time (year or month). When you select time hierarchy member, the data belonging to that time hierarchy will be copied to the sandbox.

3. Click **Save**. The tables of the selected dataset get populated in the sandbox information domain.

Creating Logical Sandbox Definition

A Logical Sandbox is a restricted environment within the Production information domain, where the data is uploaded to the logical sandbox within the Production information domain. This feature allows you to create a sandbox as logical sandbox, where data model upload or data population is not required.

To create a logical Sandbox, follow these steps:

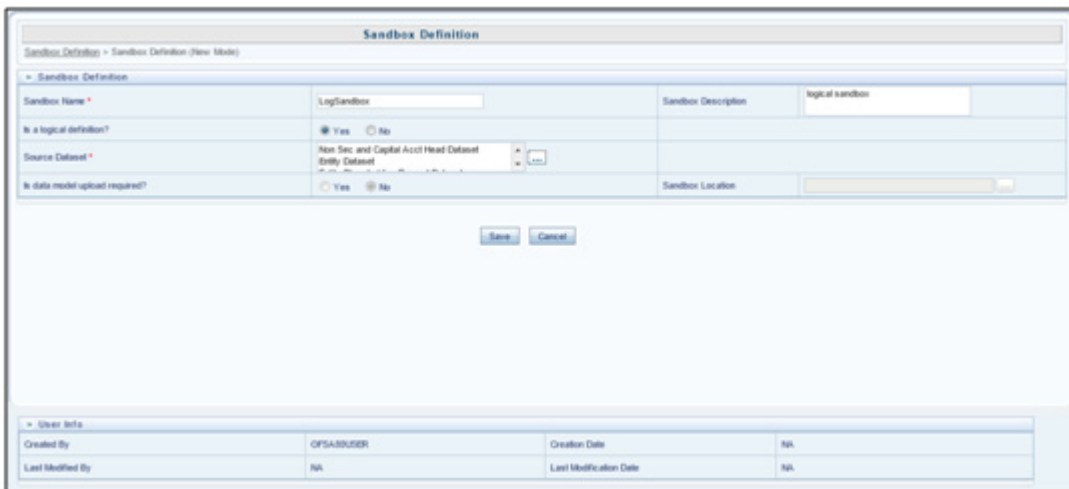1. Select from the Sandbox Definition tool bar. The Sandbox Definition window is displayed.

Figure 10. Logical Sandbox Definition page

2. Enter the following details:

Table 4. Logical Sandbox - Field Descriptions

Field	Description
Fields marked in red asterisk (*) are mandatory.	
Sandbox Name	Enter a name for the sandbox. **Note:** Ensure that there are no special characters like `, {,},'', ', ~, <,>, /, \, and multiple spaces.
Sandbox Description	Enter a brief description for the sandbox.

Table 4. Logical Sandbox - Field Descriptions

Field	Description
Is a logical definition?	Select **Yes**.
Source Dataset	Select the required datasets. The datasets you want to select should match the Data Model of the sandbox. 1. Click ⬚ and open the Source Dataset Browser. All the Authorized Datasets in the selected production Infodom are listed in the Hierarchical Browser. 2. Select the required dataset from the Datasets pane and click ↦ . To deselect a dataset select it from the Selected Datasets pane and click ↤ . 3. Click ▤ to view the details of the selected datasets. 4. Click ⊞ to create a dataset. For more details on creating a dataset, refer *Creating Data Set* section in *Oracle Financial Services Analytical Applications Infrastructure User Guide*. 5. Click **Ok.** **Note**: The Datasets based on Derived Entities are not supported.

3. Click **Save**.

Viewing Sandbox Definition

You can view individual Sandbox Definition details at any given point. To view the existing Sandbox Definition details in the Sandbox Definition window, follow these steps:

1. Select the checkbox adjacent to the Sandbox ID.

2. Click ▤ in the Sandbox Definition tool bar.
   The Sandbox Definition View window is displayed with the details such as Sandbox Name, Sandbox Description, Source Dataset, Sandbox Locations, Time, and Non Time Hierarchy and Hierarchical members.

Modifying Sandbox Definition

You can update only the description and Time Hierarchy Member (if it is selected in the definition) of an existing schema based Sandbox Definition. For a logical sandbox, you can add or remove datasets. However, it is not validated whether a model is already defined using the removed dataset.

To modify Sandbox Definition, follow these steps:

1. Select the checkbox adjacent to the Sandbox ID whose details are to be updated.

2. Click ▨ in the Sandbox Definition tool bar. The Edit button is disabled if you have selected multiple Sandbox IDs.

3. Modify the Sandbox Definition details as required. For more information, see the *Creating Sandbox* section.

Note: You can edit Time and Non-Time Filters in Sandbox Definition Edit page.

Searching Sandbox Definition

The Sandbox Definition page allows you to search the sandboxes that you want to view.

To search for Sandbox, follow these steps:

1. Navigate to the Sandbox Definition page.

Note: By default, the Sandbox Definition page displays all Sandboxes.

2. Enter the name of the sandbox you want to search.

3. Click ⬛ . The filtered list is displayed.

Sandbox Maintenance

The Sandbox Maintenance window is used to map user groups to the sandbox definition which enables the users to create models in the logical sandbox.

This section includes the following topics:

- Accessing Sandbox Maintenance

- Requesting and Authorizing to Populate Sandbox

- Requesting and Authorizing to Delete Sandbox

- Mapping Sandbox Definition User Group

- Incremental Data Model Upload

- Searching Sandbox Maintenance

Accessing Sandbox Maintenance

You can access the Sandbox Maintenance page from the Oracle Financial Services Enterprise Modeling Home page.

To access the Sandbox Maintenance, follow these steps:

1. Select **Oracle Financial Services Enterprise Modeling** from the Application tab.

2. Expand **Sandbox Maintenance** from the LHS menu and select **Sandbox Maintenance**. The *Sandbox Maintenance* page is displayed.

Figure 11. Sandbox Maintenance Page

Requesting and Authorizing to Populate Sandbox

Note:
1. This option is not available for Logical Sandbox.
2. The logical data type **Timestamp** is not supported during sandbox population.

To request and authorize to populate sandbox in the Sandbox Maintenance window, follow these steps:

1. Select the sandbox which you want to populate and click [icon] in the *Sandbox Maintenance* toolbar. The **Edit** button is disabled if you have selected multiple checkboxes. The *Sandbox Maintenance (Edit Mode)* window is displayed.

    Note: While populating a Sandbox both Time and Non-Time Filters can be edited in *Sandbox Maintenance* window.

2. In the *Request Action* tab, select **Complete** for **Populate Sandbox** to copy the required table data from the Production infodom to the Sandbox infodom based on the sandbox definition.

3. Click the **Authorize** tab, and select the **Populate Sandbox - Complete/ Incremental** checkbox to authorize sandbox population. This tab is enabled only if your user role is mapped to the function SANDBXAUTH.

4. Click **Save** to confirm changes.
    On authorization, a Sandbox-Populate batch is registered in the OFSAA Infrastructure *Operations* module. The batch will be available in the *Batch Scheduling* window with the Sandbox ID. This batch must be triggered from the *Batch Scheduling* window to complete the data population.

Requesting and Authorizing to Delete Sandbox

To request and authorize to delete sandbox in the Sandbox Maintenance window, follow these steps:

1. Select the sandbox which you want to delete and click [icon] in the Sandbox Maintenance tool bar. The Edit button is disabled if you have selected multiple checkboxes. The *Sandbox Maintenance (Edit Mode)* window is displayed.

2. In the *Request Action* tab, select the **Delete Sandbox** checkbox.

3. Click the **Authorize** tab, and select the **Delete Sandbox** checkbox to authorize the deletion. This tab will be enabled only if your user role is mapped to the function SANDBXAUTH.

4. Click **Save** to remove the Sandbox Definition.

Mapping Sandbox Definition User Group

Note: This option is available only for Logical Sandbox definitions. Only the users belonging to the mapped user group can use the Logical Sandbox definition.

To map a user group to sandbox definition in the *Sandbox Maintenance* window, follow these steps:

1. Select the logical sandbox definition and click ☑ in the *Sandbox Maintenance* tool bar. The *Sandbox Maintenance (Edit Mode)* window is displayed.

2. In the *Request Action* tab, select the **Sandbox Definition- User Group Mapping** checkbox. The *Sandbox Definition- User Group Mapping* pane is displayed.

3. Click ☑ in the tool bar. The *User Groups* window is displayed. All the user groups mapped to the information domain in which the logical sandbox is defined are displayed.

4. Select the user group and click ➡ to map user groups. To un-map a user group, select it and click ⬅ .

5. Click **Save**.

Incremental Data Model Upload

The **Increment Upload Required** column in the *Sandbox Maintenance* window displays the status as "Y" or "N" depending on the need for Incremental Data Model Upload for the Sandbox definition. The Incremental Data Model Upload button is enabled only when the model versions between Production and Sandbox information Domain are different.

Incremental Data Model Upload facilitates you to synchronize the difference of a Data Model which exists in Production and Sandbox Information Domain. You can refresh the details and fetch the incremental data model changes from Production to Sandbox Information Domain.

Note the following points:

- The **Incremental Data Model Upload** button will not be enabled for the sandboxes in which the *No* option is selected for the **Is data model upload required?** field, even though there is a difference between the model versions in Production and Sandbox information domains.

- Incremental data model upload is supported only when the difference in sandbox and production is at table level, that is, the sandbox schema has atleast one table less or more when compared to the production schema.

- Incremental data model upload is not supported for logical sandboxes and Hive based sandboxes.

To perform an incremental data model upload, follow these steps:

1. Select the checkbox adjacent to the Sandbox ID which has the **Increment Upload Required** status as "Y". The status will be Y only when there is a difference in the model versions between Production and Sandbox information Domain.

2. Click 🖼 from the *Sandbox Maintenance* tool bar. The *Incremental Data Model Upload* window is displayed with the selected Sandbox definition details inView mode.
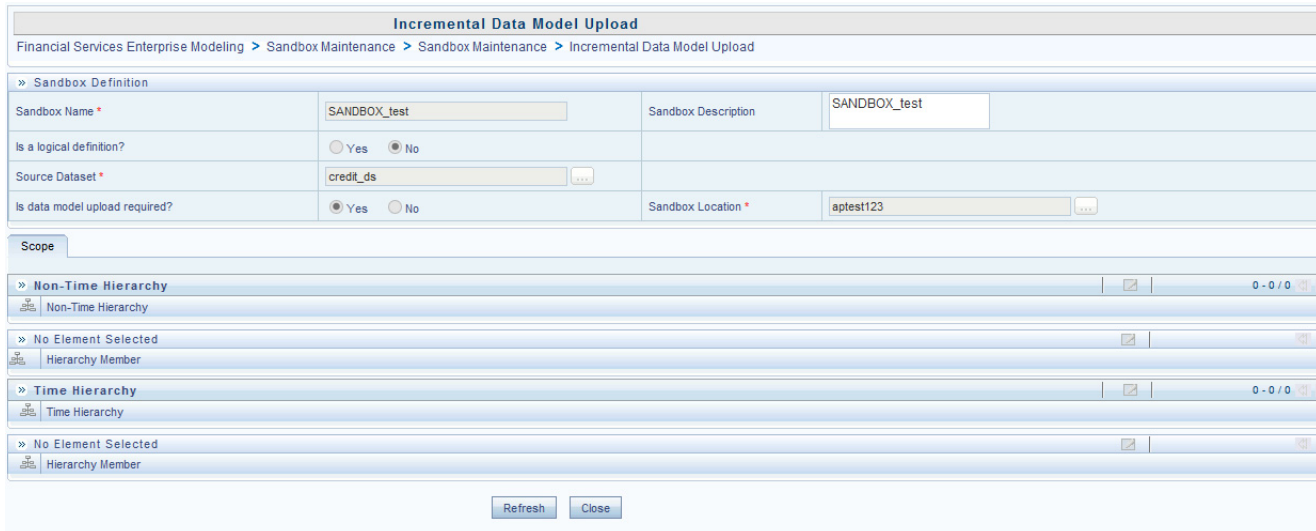
Figure 12. Incremental Data Model Upload

3. Click **Refresh**. The incremental data model changes are fetched and updated.

4. An information dialog is displayed confirming successful incremental data model upload. Click **OK**.

5. Once the Incremental changes are updated to the Data Model in the Sandbox Information Domain, you need to re-save the details in the Sandbox definition window. For more information, see the *Modifying Sandbox Definition* section.

Searching Sandbox Maintenance

The Sandbox Maintenance page allows you to search the sandboxes that you want to view.

To search for Sandbox Maintenance, follow these steps:

1. Navigate to the *Sandbox Maintenance* window.

2. Enter the name of the sandbox you want to search.

3. Click 🔍 . The filtered list is displayed.

CHAPTER 5   *Managing Techniques*

This chapter provides information about Techniques in the Oracle Financial Services Enterprise Modeling application and step-by-step instructions to use this section.

This section includes the following topics:

- About Techniques
- User Roles and Functions
- Managing Techniques

About Techniques

Technique is a set of generalized statistical algorithms which can be used to build analytical models. The Technique Registration module in Enterprise Modeling displays the techniques developed using R script and ORE functions, prepackaged techniques, and external library techniques. An external library technique is based on third party algorithms, which can be a library or executable.
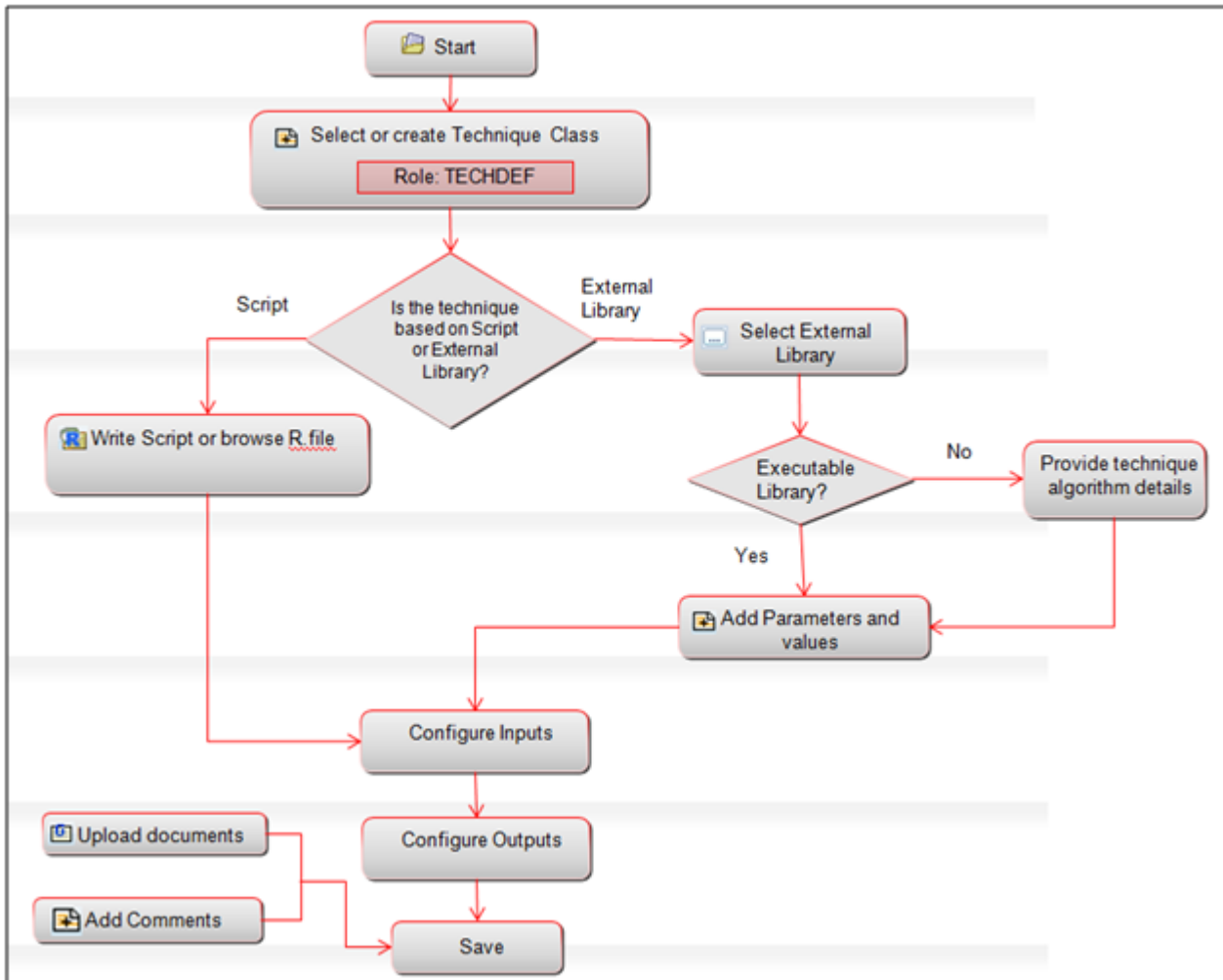
Technique Registration Workflow

Figure 13. Technique Registration Workflow

User Roles and Functions

The following functions should be mapped to the user to manage techniques:

- TECHDEF
- TECHAUTH

Managing Techniques

This section explains how to manage Techniques in Oracle Financial Services Enterprise Modeling application. The following topics are included in this chapter:

- Accessing Techniques
- Creating a Technique Based on Scripts
- Creating a Technique using External Library
- Authorizing a Technique
- Viewing a Technique
- Modifying a Technique
- Copying a Technique
- Deleting a Technique
- Searching Techniques

Accessing Techniques

You can access the *Technique Registration* window from the *Oracle Financial Services Enterprise Modeling Home* window. To access the Technique Registration window, follow these steps:

1. Select **Oracle Financial Services Enterprise Modeling** from the *Application* tab.

2. Click **Technique Registration**. The *Technique Registration* window is displayed.

Figure 14. Technique Registration

Note: The View and Copy buttons are enabled only for pre-packaged R techniques.
To see the list of prepackaged ORE techniques, refer to the List of Prepackaged ORE Techniques section.

Creating a Technique Based on Scripts

Oracle Financial Services Enterprise Modeling application enables you to create techniques based on scripts. The supported scripting languages are R or ORE. After registering the techniques, they can be used in model definitions. In the *Model Script* tab, you can write the script in your preferred language. The Declaration Block in the script is used to declare the input and output parameters. The format of declaration block and the content should not be altered. The scripting should start only from the line after the declaration block.

There are three types of input parameters which can be used in the script, namely Variable, Single Value Parameter, and Model Input. The input parameters can be defined from the Declaration block in the *Script Console* pane, or by right-clicking the parameter and selecting the Input type . The value of single value parameter is defined from the *Inputs* window. However, the value of variables and model inputs are mapped during the model definition in which the technique is used.

You can configure the numeric output by declaring it in the Declaration block (## Output -->), or by right-clicking the parameter and selecting the Output type. It is not required to declare output parameters for plots or graphical outputs.

The script should be a valid script. You can use ORE functions instead of R functions for better performance in R script. All the object names or functions used in the script should be syntactically valid names. Validation of the script is not done while registering the technique. If you already have defined a technique using R script and saved it in a .R file, you can upload it and register it as a technique.

To create a technique using scripts, follow these steps:

1. Click **Technique Registration** from the LHS menu. The *Technique Registration* window is displayed.

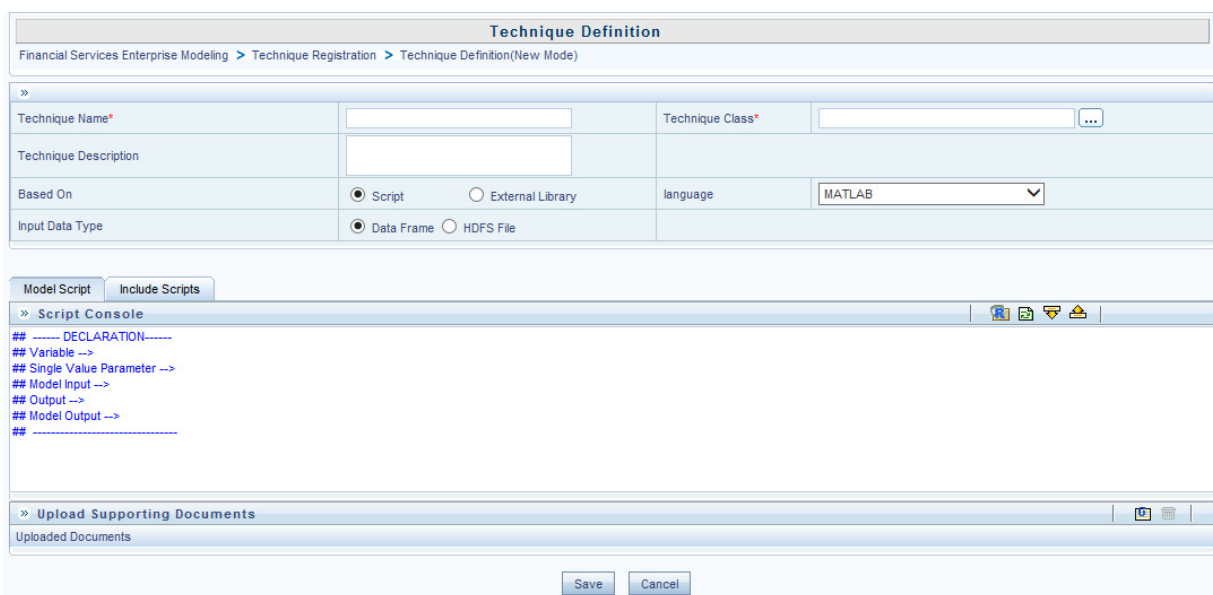2. Click from the *Technique Registration* toolbar. The *Technique Definition* window is displayed.
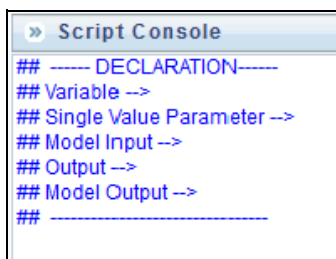

Figure 15. Technique Definition

3. Enter the details as described in the following table:

Table 5. R script based Technique Definition - Field Description

Field	Description
Fields marked in red asterisk (*) are mandatory.	
Technique Name	Enter a name for the technique. Ensure that there are no special characters like `, {,},", ', ~, <,>, /, \, and multiple spaces. **Note:** The prefix R_ is added for Pre-Packaged Techniques based on R/ORE script.
Technique Class	Technique Class is used for logically grouping the techniques. 1. Click ⬚ and open the *Technique Class Selection* window. 2. Right-click **Technique Classes** or the technique class name under which you want to create a technique class, and click **Add Technique Class**. Enter the technique class name in the *Add Node* window. 3. Expand the **Technique Classes** tree, select the required technique class and click ⬀ . 4. Remove a selected technique class by selecting the technique class and clicking ⬐ .
Technique Description	Enter a brief description about the technique.
Based On	Select the **Script** option.
Language	Select the scripting language. The options are: ● R ● ORE
Input Data Type	This option is available for Hive based Infodoms. For RDBMS based infodoms, the input data tpe is considered as Data Frame by default. Select the input data type. The options are **Data Frame** and **HDFS file**.

4. In the *Script Console* pane, enter the R script for the technique. For more information on how to use fitting and prediction, refer to the *Fitting and Prediction Using R Script* section.

Figure 16. Script Console

5. By default, the *Script Console* is displayed as shown above. Enter the following details:

- **## Variable -->** Enter the variables you want to use in the R script separated by commas. You should map these variables to the corresponding variables which are available in the Variable Management window, during defining the model.

- ■ **## Single Value Parameter -->** Enter the input parameters you want to use in the R script.

- ■ ## **Model Input-->** Enter the scriptvariable names to which you want to load the output of another model in case of model chaining.

- ■ **## Output -->** Enter the output parameters you want to use in the R script.

- ■ ## **Model Output-->** Enter the output object names you want to persist.

Note: The variables and the input parameters are case sensitive. The same name cannot be used for both variable and input parameters.

6. Click ⬇ from the *Script Console* toolbar. The *Inputs* window is displayed.
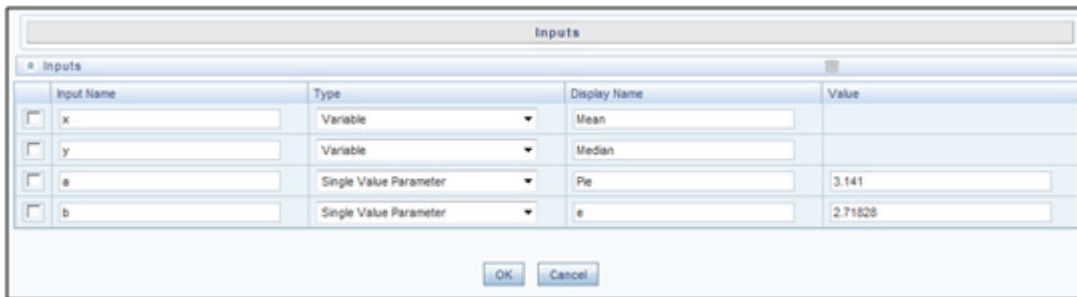
Figure 17. Inputs window

- ● Enter **Display Name** for the Variables or Model Inputs you defined. The mapping of variables is done during model definition.

- ● Enter **Display Name** and **Value** for single value parameters you defined.

- ● Select the parameter and click 🗑 to delete it.

7. Click ⬆ from the *Script Console* toolbar. The *Outputs* window is displayed.

Figure 18. Outputs window

- ● Enter **Display Name** for the output parameter you defined.

8. Click to browse and upload **.R** file. You can use this option if you have already defined a technique and saved it in an **R** file. Once uploaded successfully, the script is displayed in the script console pane.

9. Select the **Include Scripts** tab if you want to source already defined algorithms to your script.
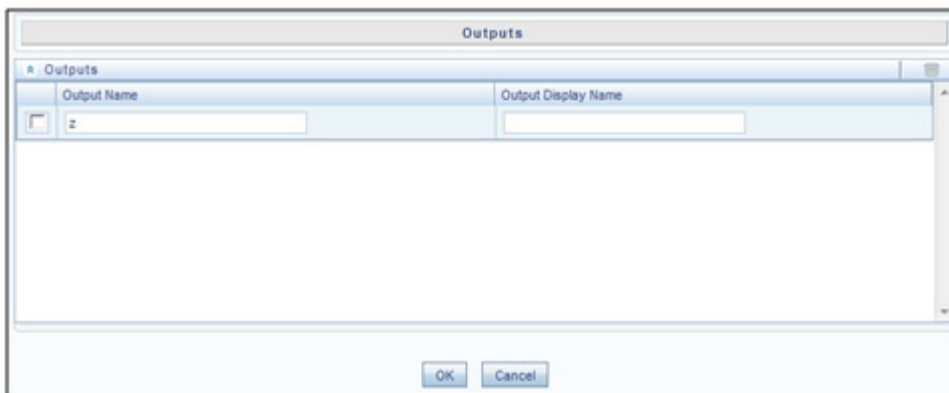
   ■ Select the required algorithms/ scripts from the *Scripts List* tree and click .

   ■ You can view the scripts by selecting the script and clicking .

   ■ After adding scripts, you can position the scripts as required by selecting it and clicking and .

10. Click from the *Upload Supporting Documents* toolbar.

   ● Click **Browse** and select the file you want to upload.

   ● Click to add additional row to upload more files.

   ● Click to remove selected/ uploaded file.

   ● Click **Upload Files**.

11. Click the *Comments* tab and click to add additional information, if required.

12. Click **Save**. If you have authorization privilege, then the technique is auto authorized and it can be used in creating models.

Creating a Technique using External Library

This option facilitates you to create a technique based on Third Party algorithms. The algorithms can be a library or executables.

The self executable libraries should be placed under `$FIC_DB_HOME/bin/MF_EXTERNAL_EXECUTABLES` folder. For non-self executable libraries, the libraries should be placed under `$FIC_DB_HOME/lib/MF_EXTERNAL_LIBS/lib` folder and the header files should be under `$FIC_DB_HOME/lib/MF_EXTERNAL_LIBS/include` folder.

To create a technique based on external library, follow these steps:

1. From the *Technique Registration* window, click . The *Technique Definition* window is displayed.

Figure 19. Technique Definition

2. Enter the details described in the following table:

Table 6. External Library based Technique Definition - Field Description

Field	Description
Fields marked in red asterisk (*) are mandatory.	
Technique Name	Enter a name for the technique. Ensure that there are no special characters like `, {,},", ', ~, <,>, /, \, and multiple spaces.
Technique Class	Technique Class is used for logically grouping the techniques. 1. Click [...] and open the Technique Class Selection window. 2. Right-click **Technique Classes** or the technique class name under which you want to create a technique class, and click **Add Technique Class**. Enter the technique class name in the Add Node window. 3. Expand the Technique Classes tree, select the required technique class and click ⮕. 4. Remove a selected technique class by selecting the technique class and clicking ⬅.
Technique Description	Enter a brief description about the technique.
Provider Name	Enter the name of the provider of the external library.
Based On	Select the **External Library** option.

Table 6. External Library based Technique Definition - Field Description

Field	Description
External Library Name	1. Select the external library dependent file for the third party technique by clicking ⊡ . The *External Library Selection* window is displayed. 2. Select the dependent file from the *External Library* pane and click ↪ . 3. Add a new dependent file name. 4. Right-click **External Library** and click **Add External Library**. 5. Enter a **Label for the new node** and click **OK**. Ensure that there are no special characters like `, {,},", ', ~, <,>, /, \, and multiple spaces.
Executable Library	Select the checkbox if it is a self executable library. Self executable libraries are executables(C/C++ or JAVA or Python script) which have a main function defined and need to be invoked directly by passing the run time parameters. Currently only those executables which have interactive or new line arguments are supported. For techniques based on executable library, only parameters can be provided.
Algorithm Details This grid will not be displayed if you have selected the **Executable Library** checkbox. Click 🔲 to add more functions. Select a function and click 🗑 to delete it or click ▪ to view the function declaration.	
Function Name	Enter the name of the function.
Return Type	Enter the return type of the function.
Class/ Include Header Names	Enter the class name or header names to be included for the function.
Parameters (It is not mandatory to pass parameters) Click 🔲 to add more parameters. Select a parameter and click 🗑 to delete it.	
Name	Enter the name of the parameter.

Table 6. External Library based Technique Definition - Field Description

Field	Description
Type	Select the parameter type from the drop-down list. The options are: ● **Variable:** Select this option if the input data to a function call has to be passed as a Variable. If the function call accepts array, select Data Pointer. If the call accepts input data to be stored in a file, select Data File. Based on the selection the framework passes the data as an array or stores it in a file and then pass the path of that file. ● **Single Value Parameter:** Select this option to define single value parameters. You can enter multiple single value parameters separated by commas. ● **Class Object:** Select this option to pass another function or class object to be passed as an argument/ parameter. The class objects need to be initialized before passing as an argument. Enter the initialization value that needs to be passed in the adjacent text box provided. Currently Class Object type is only supported for C++ libraries. ● **Multi Value Parameter:** Select this option to pass an array of values or matrix input to the function. If the function call accepts array, select Data Pointer. If the call accepts input data to be stored in a file, select Data File. Only .csv files are supported. You need to upload the file while defining the model. ● **Number of Observations:** Select this option for function arguments which need input data size. The number of records used in processing will be passed to this argument. ● **Number of Variables in:** Select this option to pass the number of input rows used for computing coefficient for functions like linear regression, which have multiple independent variables. Enter the variable parameter name whose size is assigned to this argument in the adjacent text box provided. ● **Plot path**: Select this option and enter the path of the plot.
Parameter Format	Enter the format of the selected parameter type.
Configured During Model Definition?	Select the checkbox if you want to configure the parameters during model definition. In case of Multi Value Parameter whose data is stored in a Data File, the checkbox should be selected.
Input- Output	Select the parameter type from the following options: ● Input ● Output ● Input- Output
Description	Enter a brief description of the parameter.

3. Click **Save**. After creating techniques based on non-self executable libraries, you must ensure that the techniques are compiled by executing a command line utility called TechniqueBuilder.sh, prior to executing the models. This utility is available under `$FIC_DB_HOME/bin` folder. For more information, refer to the *Command Line Utility for Compiling Non-Self Executable Libraries* section.

Note:

● In the *Model Definition* window, the parameters, for which the **Configured During Model Definition?** checkbox is selected, will only be displayed.

● Currently only static functions are supported for Java based external algorithms.

- The function return type should be primitive data types and be single value, that is, pointers or arrays are not supported.

Authorizing a Technique

An authorizer has to authorize a technique before it can be used for model definition. Users who have the function TECHAUTH mapped to their user role can authorize the technique. If the user who created the technique has authorization privilege, then the technique is auto authorized. An authorizer can reject a technique if required.

To authorize or reject a technique, follow these steps:

1. Click **Technique Registration** from the LHS menu. The *Technique Registration* window is displayed.

2. Select the technique and click   . The *Authorize Technique* window is displayed.

3. Enter a brief description in the **Comments** field. This is mandatory for rejecting the technique.

4. Click **Approve** or **Reject**.

Viewing a Technique

This option allows you to view the details of user defined as well as prepackaged techniques like technique name, class, description and the script.

To view the technique details, follow these steps:

1. Click **Technique Registration** from the LHS menu. The *Technique Registration* window is displayed.

2. Select the checkbox adjacent to the Technique ID and click   in the *Technique Registration* tool bar. The *Technique View* window is displayed with all the technique details.

Modifying a Technique

You can update the details of a user defined technique. If the technique is already mapped to a model or if it is a prepackaged technique, you cannot modify it. An alert message is displayed. You cannot modify the Technique Name and Technique Class. For techniques based on external library, you can modify External Library Name, function, and parameter details.

After modification, the technique should be authorized. If you have authorization rights, it will be auto authorized; else an authorizer has to approve it.

To modify a technique, follow these steps:

1. Click **Technique Registration** from the LHS menu. The *Technique Registration* window is displayed.

2. Select the technique you want to modify and click 　. This button is disabled if you have selected multiple techniques.

3. Modify the technique details. For more information, refer to *Creating a Technique Based on Scripts* section.

Copying a Technique

You can create a copy of a user defined as well as prepackaged technique with the required variants. The copied technique should be authorized. An authorizer has to approve or reject the copying of the technique. If you have authorization rights, it will be auto authorized.

To copy a technique, follow these steps:

1. Click **Technique Registration** from LHS menu. The *Technique Registration* window is displayed.

2. Select the technique you want to copy and click 　. This button is disabled if you have selected multiple techniques.

3. In the *Technique Definition Copy* window, you can:

● Create a new technique with the existing details. Specify a new Technique Name and click **Save**.

● Create a new technique by updating only the required details. Specify a new Technique Name and update the required details.

For more information, refer to section *Creating a Technique Based on Scripts*.

Deleting a Technique

You can delete a user defined technique which is no longer required. However, if the technique is already mapped to a model or if it is a pre-packaged technique, you cannot delete it.

An authorizer has to approve or reject the deletion of the technique. If you have authorization rights, it will be auto authorized.

To delete a technique, follow these steps:

1. From the LHS menu, click **Technique Registration**. The *Technique Registration* window is displayed.

2. Select the technique you want to delete and click 　.

3. Click **OK** in the information dialog to confirm deletion.

Searching Techniques

The *Techniques Registration* window allows you to search for the techniques that you want to view.

To search for Techniques, follow these steps:

1. Navigate to the *Technique Registration* window.

2. Enter the Technique Name and Technique Class you want to search.

3. Click .The filtered list is displayed.

CHAPTER 6 — *Managing Variables*

This chapter provides information about variables in the Oracle Financial Services Enterprise Modeling application and step-by-step instructions to use this section.

This chapter includes the following topics:

- About Variable Definition
- Managing Variables

About Variable Definition

Variable refers to a logical set of attributes that are likely to change based on the selected parameters. In a modeling environment, variables play a vital role in filtering the model parameters and deriving an estimate based on historical data. Variables are defined in the production information domain.

Managing Variables

This section explains how to manage variables in the Oracle Financial Services Enterprise Modeling application. The following topics are included in this section:

- Accessing Variable Management
- Adding Variable Definition
- Viewing Variable Definition
- Modifying Variable Definition
- Copying Variable Definition
- Deleting Variable Definition
- Searching Variables

Accessing Variable Management

You can access the *Variable Management* window from the Oracle Financial Services Enterprise Modeling Home page.

To access the *Variable Management* window, follow these steps:

1. Login to Oracle Financial Services Enterprise Modeling as a Business User. The *Oracle Financial Services Enterprise Modeling Home* page is displayed.

2. Select **Oracle Financial Services Enterprise Modeling** from the *Applications* tab.

3. Expand **Data Management** from the LHS menu and select **Datasets and Variables**.

4. Click **Variable Definition**. The *Variable Management* window is displayed.

Figure 20. Variable Management
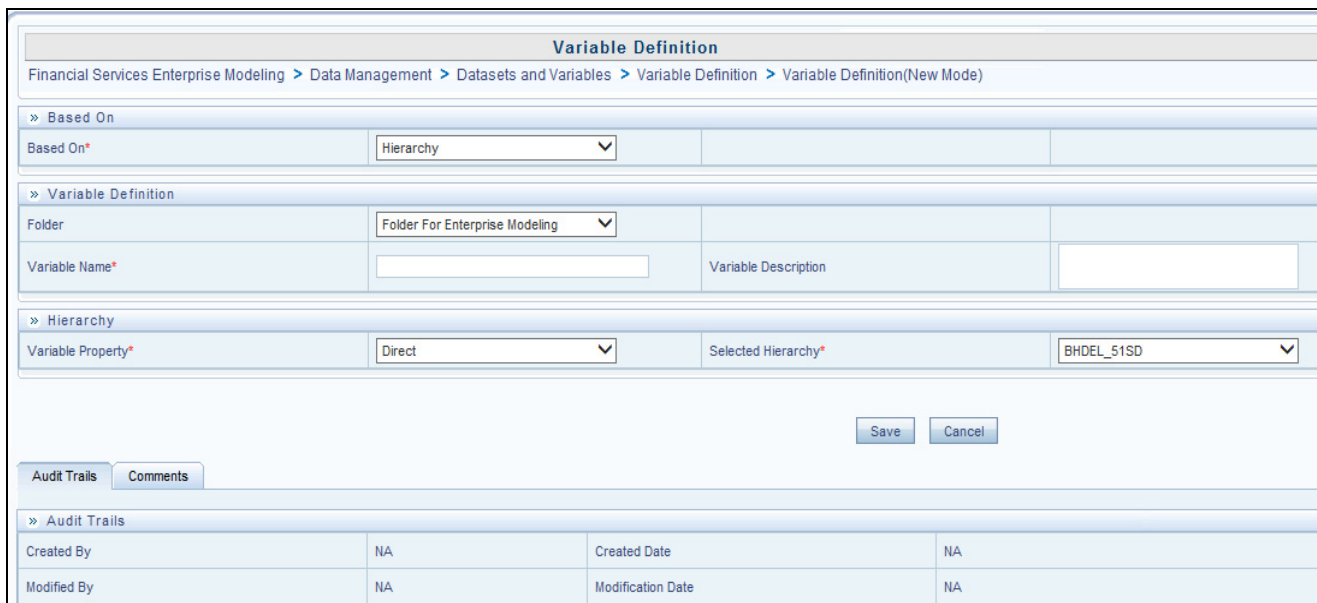
Adding Variable Definition

The Add Variable Definition feature enables you to add a variable by filtering through the required parameters. The options available to filter the data vary depending on the variable type selected.

Note: The variables created in the *Variable Definition* window are IDIOSYNCRATIC NUMERIC variables.

To add variable definition, follow these steps:

1. Select ⊞ from the *Variable Management* tool bar. The **Add** button is disabled if you have selected any checkbox in the grid. The *Variable Definition* window is displayed.

Figure 21. Variable Definition

2. Enter the Variable details as described in the following table:

Table 7. Variable Definition - Field Descriptions

Field	Description
Fields marked in red asterisk (*) are mandatory.	
Based On	Select any of the following options from the drop-down list, based on which the variable definitions are to be created. ● Hierarchy ● Measure ● Business Processor ● Entity
Folder	Select the folder in which you want to create the variable.
Variable Name	Enter a name for the variable. Ensure that there are no special characters like `, {,},", ', ~, <,>, /, \, and multiple spaces.

Table 7. Variable Definition - Field Descriptions

Field	Description
Variable Description	Enter the required description for the variable.
Variable Transformation	This feature is available for variables based on Measures, Business Processor, and Entity. 1. Click to define a transformation for the Variable. The *Technique Browser for Transformation* window is displayed. 2. Select the transformation you want to apply to the variable and click . The options are **Arithmetic**, **Exponential**, **Logarithm**, **Power**, and **Trigonometric**. 3. Click or to change the order in which the transformation has to be applied. Click **OK**. - If **Arithmetic** is selected, select the Operator (Addition, Subtraction, Multiplication, and Division) from the drop-down list and enter the **Operator Value**. - If **Logarithm** is selected, select the **Base** from the drop-down list. The options are 10, 2, and e. - If **Power** is selected, enter the value of Power. - If **Trigonometric** is selected, select the **Function** from the drop-down list. The options are Sine, Cosine, and Tangent. - If **Exponential** is selected, the exponential value of the variable will considered for transformation of the variable.

4. If the variable is based on Hierarchy, follow these steps:

- Select **Variable Property** as Direct or Dummy(variable in Binary form and used mainly in regression analysis).

- Select the required Hierarchy from the **Selected Hierarchy** drop-down list.

    Note: Hierarchy based variables cannot be created on multi-level Business Intelligence hierarchies.

5. If the variable is based on Measures, follow these steps:

- Select **Yes** adjacent to Apply Filters.

- Select the **Dataset** from the drop-down list.

    You can click to view the details of the selected datasets.

- Select the Measure from the drop-down list.

    You can click to add a new Business Measure. For more details on creating a Business Measure, refer to *Creating Business Measure* section in *Oracle Financial Services Analytical Applications Infrastructure User Guide.*

- Click in the *Filters* grid and the Hierarchy Browser window is displayed.

    ◆ Select the hierarchy member(s) and click **OK**. The selected members are displayed in the Filters grid under Hierarchy.

- Double-click a hierarchy member to invoke a grid with the member name.

● Click in the hierarchy member grid and the Hierarchy Browser window is displayed.

◆ Select the node(s) and click **OK**. The selected nodes are displayed in the Hierarchy member grid under Nodes.

6. If the variable is based on Business Processor, follow these steps:

● Select the Business Processor from the Selected BP drop-down list.

You can click to add a new Business Processor. For more details on careting a Business Processor, refer to *Adding a Business Processor* section in *Oracle Financial Services Analytical Applications Infrastructure User Guide*.

Note: Variables cannot be created based on Business Processor having placeholders.

7. If the variable is based on Entity, follow these steps:

● Click Entity to open the *Entity and Attribute* window. The available tables are displayed under the *Available Entities* grid.

● Select the checkbox corresponding to the table you want to select. The available columns in the selected table are displayed under the *Available Attributes* grid.

● Select the required attribute for which you want to create a varaible. You can select multiple attributes.

● Click **Save**. The selected attributes are displayed in the *Selected Attributes* grid.

8. Click **Save** to upload the new Variable definition details. The User Info grid at the bottom of *Variable Definition* window displays metadata information about the Variable definition created.

Viewing Variable Definition

You can view individual Variable Definition details at any given point.

To view the existing Variable Definition details, follow these steps:

1. Select the checkbox adjacent to the Variable ID.

2. Click in the *Variable Management* tool bar. The *Variable Definition View* window is displayed with all the variable details.

Modifying Variable Definition

You can modify only the Variable Description details if the variable is mapped to a definition. If the variable is not mapped to any definition, then all the filtering parameters can be modified.

To modify an existing Variable Definition, follow these steps:

1. Select the checkbox adjacent to the Variable ID whose details are to be updated.

2. Click in the *Variable Management* tool bar. The **Edit** button is disabled if you have selected multiple Variable IDs. The *Variable Definition Edit* window is displayed.

3. Edit the Variable Definition details as required. For more information, refer to section *Adding Variable Definition*.

4. Click **Save** to upload changes.

Copying Variable Definition

The Copy Variable Definition page enables you to quickly create a new Variable based on the existing variable parameters or by updating the required parameters.

To copy an existing Variable Definition, follow these steps:

1. Select the checkbox adjacent to the Variable ID whose details are to be duplicated.

2. Click [icon] in the *Variable Management* tool bar. The **Copy** button is disabled if you have selected multiple Variable ID(s).

3. In the *Variable Definition Copy* window, you can:

   ● Create new variable with the existing details. Specify a new Variable Name and click **Save**.

   ● Create new variable by updating only the required details. Specify a new Variable Name and update the required details. For more information, refer to section *Adding Variable Definition*. Click **Save**. The new variable definition details are displayed in the *Variable Management* window.

Deleting Variable Definition

You can remove the variable definition(s) which are no longer required in the system, by deleting from the Variable Management window. You cannot delete a variable which is mapped to any definition.

To delete a Variable Definition, follow these steps:

1. Select the checkbox adjacent to a Variable ID.

2. Click [icon] from the *Variable Management* tool bar. A confirmation dialog is displayed.

3. Click **OK** to confirm deletion.

Searching Variables

The *Variable Management* window allows you to search for the variables that you want to view.

To search for Variables, follow these steps:

1. Navigate to the *Variable Management* window.

2. Enter the name of the Variable Name you want to search.

3. Click [icon] .The filtered list is displayed.

CHAPTER 7 — *Managing Modeling*

This chapter provides information about Modeling in the Oracle Financial Services Enterprise Modeling application and step-by-step instructions to use features in Modeling.

This chapter includes the following topics:

- About Modeling
- Managing Modeling
- Model Chaining
- Model Execution Status
- Model Outputs
- Model Deployment
- Model Execution

About Modeling

Modeling refers to the process of designing a prototype based on a structured data model, considering all the variables for statistical analysis and to simulate real events and processes. Modeling module enables you to measure and quantify risk. You can use pre-defined models to predict the business trends and also to validate the existing models.

Models are built based on various techniques and related parameters based on the business purpose. Models thus built use various metadata objects such as Measures, Hierarchies, Filters, Datasets, and so on. The techniques can be inbuilt techniques, user defined script based techniques, or techniques based on External Library.

Oracle Financial Services Enterprise Modeling application supports developing statistical models using algorithms written in standard R and ORE. It also enables you to bring in already developed algorithms written in R or ORE for creating models based on them. Thus it provides a unified environment to build, host and execute models across risk categories and a common framework to manage stress scenarios.

Modeling Workflow
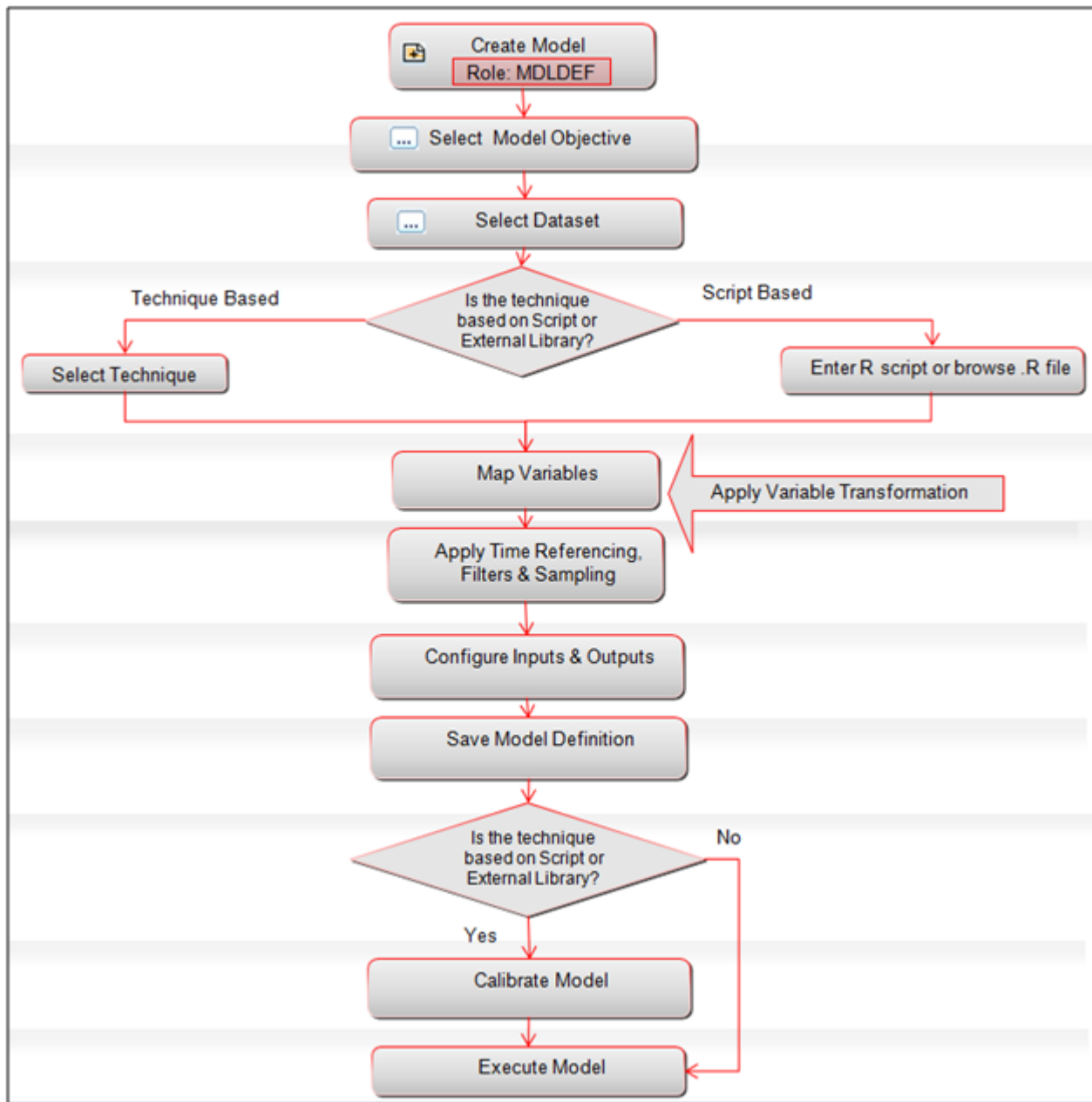
Figure 22. Model Creation Workflow

User Roles and Functions

Functions required to be mapped to the user for managing models are as follows:

- MDLDEF
- MDLAUTH
- MDLEXEC
- MDLOUTPUT
- MDLDEPLOY
- MDLCALIB
- MDLCHAMP

Managing Modeling

This section explains how to manage modeling feature in Oracle Financial Services Enterprise Modeling application. The following topics are included in this section:

- Accessing Model Management
- Model Versioning
- Creating and Executing a Model
- Model Parameters
- Creating Models using Logical Sandbox
- Viewing Model Definition
- Modifying Model Definition
- Deleting Model Definition
- Searching Model Management

Accessing Model Management

You can access the *Model Management* window from the *Oracle Financial Services Enterprise Modeling Home* page.
To access the *Model Management* window, follow these steps:

1. Go to the **Sandbox** tab and select the required sandbox from the **Select Sandbox** drop-down list.

2. Click **Model Creation**. The *Model Management* window is displayed.

Figure 23. Model Management

Note: The latest version of the model definition is displayed, when you select a model. You can click ▣ to view the Model Definitions and click ▣ to edit the Model Definition.

Model Versioning

The Model Definitons created in *Oracle Financial Services Enterprise Modeling* are versioned. The version of the Model Definiton is displayed in the *Model Management* window. Select a model and click **V1** to view different versions of the selected Model Definition.

When a Model Definiton is created, it is saved as version 0. During subsequent modifications, the Model Definition is saved as different versions. For example, the version of a Model Definition is 0, after it is created. The version is updated to 1, after the Model Definition is edited. After editing a Model Definiton, you can choose to save a Model Definition as a newer version or overwrite the existing version.

Modeling using Open R with HDFS Option

Oracle R Advanced Analytics for Hadoop (ORAAH)/Oracle R Connector for Hadoop (ORCH) is the default approach for running Open-R on HDFS. For the configurations required for creating and executing models in Open R framework with HDFS option, refer *Configurations for Open-R with HDFS* section in OFSAAI Administration Guide available at *OHC Documentation Library*.

Basic Functions

Use the following basic functions to get basic OFSAA Metadata details, basic Model details and basic Run details:

 ofs_get_log_handle()

 ofs_get_model_id()

 ofs_get_model_version()

 ofs_get_model_name()

 ofs_get_batch_run_id()

ofs_get_task_id()

ofs_get_infodom()

ofs_get_dataset_codes()

ofs_get_dataset_names()

ofs_get_dataset_queries()

ofs_get_output_names()

ofs_get_meta_data_info()

ofs_get_hive_schema_name()

Examples:

model_id   = OFSAAIRunnerHDFS::ofs_get_model_id();

batch_run_id = OFSAAIRunnerHDFS::ofs_get_batch_run_id();

meta_data_list = OFSAAIRunnerHDFS::ofs_get_meta_data_info();

ofs_get_meta_data_info() is a special function for getting dataset and variable and its mapping info. This function returns a list for each of the dataset.

Sample list for a single dataset looks like as given:

variable.names - contains all the script variables mapped for the dataset.

variable.index - contains the index of each selected variable in the dataset query.

variable.entity.attributes - contains actual base entity and attributes for the selected mata-data variable.

dataset.base.entities - contains all the base entities part of the dataset.

dataset.query - contains dataset query for fetching data.

Note: All these attributes are available as vectors within the list.

print(meta_data_list);

$`Dataset_Name`

$`Dataset_Name`$variable.names

[1] "x" "y" "z"

$`Dataset_Name`$variable.index

[1] "1"   "2:3" "4"

$`Dataset_Name`$variable.entity.attributes

[1] "DATASET_TABLE_1.DATASET_COLUMN1" "DATASET_TABLE_2.DATASET_COLUMN2"
"DATASET_TABLE_2.DATASET_COLUMN3" "DATASET_TABLE_3.DATASET_COLUMN4"

$`Dataset_Name`$dataset.base.entities

[1] "DATASET_TABLE_1" "DATASET_TABLE_2" "DATASET_TABLE_3"

$`Dataset_Name`$dataset.query

[1] "Dataset Query"

Note: For multiple datasets, preceeding lists get appended.

---

ofs_get_log_handle()   : returns, handle to an existing log handle.

ofs_get_model_id()   : returns, ID of the Model, as character/string.

ofs_get_model_version()   : returns, Version of the Model, as numeric.

ofs_get_model_name()   : returns, Name of the Model, as character/string.

ofs_get_batch_run_id()   : returns, Batch Run Id of the Current Batch, in which model is added for the execution, as character/string.

ofs_get_task_id()   : returns, Task Id of the Model in current Batch, character/string

ofs_get_infodom()   : returns, OFSAA information Domain (Infodom) Name, as character/string.

ofs_get_dataset_codes()   : returns, Dataset-Codes for all the selected datasets, as character vector.

ofs_get_dataset_names()   : returns, Dataset-Names for all the selected datasets, as character vector.

ofs_get_dataset_queries() : returns, Dataset-Queries for all the selected datasets, as character vector.

ofs_get_output_names()   : returns, selected Output names , as character vector.

ofs_get_hive_schema_name() : returns, Hive schema name, as character/string.

ORAAH Based Functions for Spark/ORE

Following framework functions will help in connecting/disconnecting Spark/ORE(Hive). Internally these functions will use ORAAH for Spark/ORE connections. These functions will return TRUE on success and FALSE in case of any failures with the proper error message in the logger.

> ofs_ORAAH_spark_connect()

> ofs_ORAAH_spark_disconnect()

> ofs_ORAAH_hive_connect()

> ofs_ORAAH_hive_disconnect()

All the 4 functions returns -

> TRUE : on Success

> FALSE : on Failure

Note: ofs_ORAAH_spark_connect/ofs_ORAAH_spark_disconnect should be called first/last , before using any ORCH-Spark related function, like orch.glm2().
ofs_ORAAH_hive_connect/ofs_ORAAH_hive_disconnect should called first/last , before using any ORCH-ORE related functions.

RDBMS Connect Functions

ofs_rdbms_connect(arg.ofsaa.schema.name = c("CONFIG", "ATOMIC"));

ofs_rdbms_disconnect(arg.ofsaa.schema.name = c("CONFIG", "ATOMIC", "BOTH"))

These functions should be used to get RDBMS connections/disconnections. OFSAA schema type should be passed as an argument. By default it connects to Configuration Schema.

ofs_rdbms_connect(arg.ofsaa.schema.name = c("CONFIG", "ATOMIC"));

returns -

> valid connection handle object in case of success.

> NULL in case of failure with proper error message in logger.

ofs_rdbms_disconnect(arg.ofsaa.schema.name = c("CONFIG", "ATOMIC", "BOTH"))

returns -

TRUE : on Success

FALSE : on Failure

Example:

atomic_conn_handle = OFSAAIRunnerHDFS::ofs_rdbms_connect(); #by default configuration schema.

atomic_conn_handle = OFSAAIRunnerHDFS::ofs_rdbms_connect(arg.ofsaa.schema.name = "ATOMIC");

disconnect_status = OFSAAIRunnerHDFS::ofs_rdbms_disconnect(arg.ofsaa.schema.name "BOTH");

Usage

All these functions are available as part of OFSAAIRunnerHDFS R package. This package is available under `$FIC_DB_HOME/lib` as part of installation. This package needs to be installed on a machine which is running Rserve or client R Engine. Package reference should be used in order to avoid conflict with similar function name.

Example: OFSAAIRunnerHDFS::ofs_get_model_id();

 OFSAAIRunnerHDFS::ofs_ORAAH_spark_connect();

Creating and Executing a Model

The Modeling module enables you to create and execute data models. This section has the following topics:

- Creating a Model Using NAG Technique

- Creating a Model Using External Library Based Technique

- Creating a Model Using R Scripted Technique

- Creating a Model using Script

Note: You can create models only in Sandbox Information Domain.

Creating a Model Using NAG Technique

This section describes the procedure for creating a model using NAG Technique. For information on inbuilt NAG techniques, refer List of NAG Techniques. Oracle Financial Services Enterprise Modeling supports both time homogeneous and non-homogeneous estimates of transition probabilities. For more information on defining such a statistical technique, refer Transition Matrix.

Note: Models based on NAG techniques are not supported in Hive based Sanboxes.

To create a model using NAG technique, follow these steps:

1. Click ⊞ from the *Model Management* toolbar. The *Model Definition* window is displayed. The **Add** button is disabled if you have selected any Model ID in the grid.
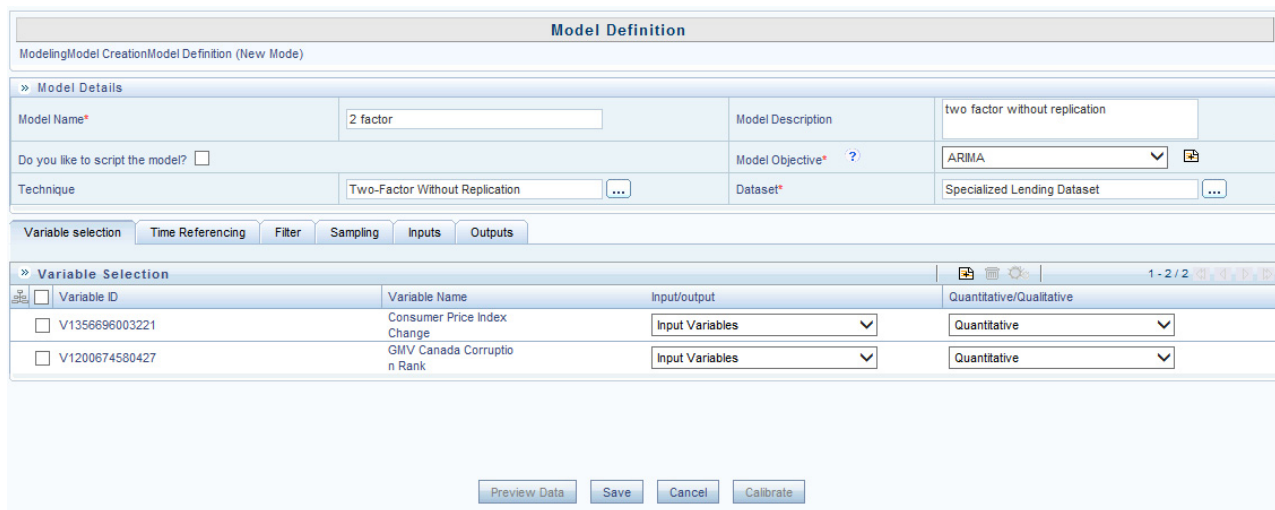
Figure 24. Model Definition

2. Enter the model definition details as described in the following table:

Table 8. Model Definition - Field Descriptions

Field	Description
Fields marked in red asterisk (*) are mandatory.	
Model Name	Specify a model name for the model definition. Model Name is case sensitive and does not allow duplication. For example, model name "Linear Regression" is not allowed if a model with the name "linear regression" exists. Ensure that there are no special characters like `, {,},", ', ~, <,>, /, \, and multiple spaces.
Model Description	Enter a description for the model.
Do you like to script the model?	Select the checkbox to script the model in *Model Script* pane.
Model Objective	Select the Model Objective from the drop-down list. You can also click ⊞ to create a Model Objective.

Table 8. Model Definition - Field Descriptions

Field	Description
Technique	This field is disabled if you have selected to script the model. 1. Click [icon] and open the *Technique Selection* window. The pre-packaged techniques, user defined (registered and authorized) R techniques and External Library techniques are listed in the *Techniques* pane. 2. Click [icon] and expand the technique heading groups. 3. Select the required technique and click [icon]. For more information on inbuilt techniques, see the *List of NAG Techniques* section. 4. Click **OK**. The selected Technique details are displayed in the *Model Definition* window. If you have selected **R** technique, click [icon] to view the script and uploadedSupporting documents.

Dataset	By default, the dataset of the Sandbox is displayed. You can change the dataset if necessary.
	Dataset selection is mandatory:
	• For models based on NAG techniques.
	• For models based on R scripted techniques if variables are declared in the R script.
	
	1. Click [icon] to open the *Dataset Selection* window. The available datasets are listed in the *Datasets* pane. For models created in logical sandbox, the Source Datasets selected during Sandbox creation are displayed.
	
	   ■ Select a dataset and click [icon] to view the details of the selected datasets.
	
	   ■ Click [icon] to create a new dataset. For more details on creating a dataset, refer *Creating Data Set* section in Oracle Financial Services Analytical Applications Infrastructure User Guide.
	You can create dataset using any of the tables which is part of the production information domain. But if you create a dataset with a table which is not part of the Sanbox and create a model using that dataset, then deploy the model to production infodom and execute it there.
	
	2. Select the required Dataset based on which the model is to be created and click [icon]. Ensure the selected dataset is loaded with data, otherwise model execution will fail. You can select multiple datasets for models executed using Standard R Engine. Multiple dataset selection is not supported for models based on NAG and External Library based techniques . If multiple datasets are used, you should use atleast a variable from each dataset.
	
	3. Click **OK**.
	
	Note: The Datasets based on Derived Entities are not supported.

Language	This field is not displayed for techniques based models. Select the scripting language from the drop-down list. The options are: • R • ORE- This option is not displayed in Hive based Infodoms.

Table 8. Model Definition - Field Descriptions

Field	Description
Type	This field is not displayed for techniques based models. Select the type of engine from the drop-down list. The options are: ● Standard R Engine ● ORE Engine- This option is not displayed in Hive based Infodoms.
Input Data Type	This field is displayed only in Hive based infodoms for models based on R scripted techniques or if you select to script the model. Select the input data type. The options are **Data Frame** and **HDFS File**.
Calibrate Model / Host Existing Model	These options to choose Calibrate or Host Existing Model are displayed if NAG technique is selected. The Calibrate Model option is selected by default. ● Select **Calibrate Model** to calibrate the variable output parameters and process for model execution. ● In **Host Existing** model, the sampling option is not available and model has to be processed through batch execution.

The grid below the *Model Details* section displays the various parameters available for the selected technique.

Some of the common parameter types for NAG techniques are explained below. To update the required information, click the following links.

- Variable Selection

- Time Referencing (Not applicable for models defined in Logical Sandbox)

- Filter

- Sampling

- Inputs

- Outputs

5. Once you have updated all the necessary details in the available tabs, click **Save** to save the model definition details.

6. Click **Preview Data** to view the data of the selected dataset. It displays the primary keys and the attributes/ columns of the tables in the selected dataset.

7. Click **Calibrate** and select the Calibration Date from the *Calibration Parameters* window.

8. Click **Execute** to execute the model. The *Execution Parameters* window is displayed.

Figure 25. Execution Parameters window

9. Select the Execution Date from the calendar. The data of the selected date will be used for model execution.

10. Select the Execution Type as **Baseline** or **Stress**.

    If **Stress** is selected, click **Stress Scenario** [...] to open the *Scenario Browser* window. Select the scenario and

    click [→] . The variables and their shocks of the selected scenario are displayed in the *Model Variable Shock Mapping* grid. For more information on stress testing, see "Managing Stress Testing".

    The *Model Execution Status* window provides the execution details.

Creating a Model Using External Library Based Technique

You can create models using Third Party algorithm based techniques which you have defined from the Technique Registration window. The algorithms can be a library or executables. Ensure techniques based on non-self executable libraries are compiled using the Technique Builder utility, before executing a model based on such techniques.

Note: Models based on third party technique is not supported in Hive.

To create a model using external library based technique, follow these steps:

1. Select [icon] from the *Model Management* tool bar. The *Model Definition* window is displayed. The **Add** button is disabled if you have selected any Model ID in the grid.

Figure 26. Model Definition Page

2. Enter the Model Definition Details. The common fields are described in Table 8.

3. The grid below the Model Details section displays the various tabs available for the selected technique. To update the required information, refer to the following sections:

   ● Inputs

   ● Time Referencing (Not applicable for models defined in Logical Sandbox)

   ● Filter

4. Click **Save** to save the model definition details, after all the necessary details are updated.

5. Click **Preview Data** to view the data of the selected dataset. It displays the primary keys and the attributes/ columns of the tables in the selected dataset. Only those columns which are mapped to the variables in the script are displayed.

6. Click **Execute**.

●   Select **Baseline** to execute the model normally.

●   Select **Stress** to execute the model based on a stress scenario. The *Execution Parameters* window is displayed.

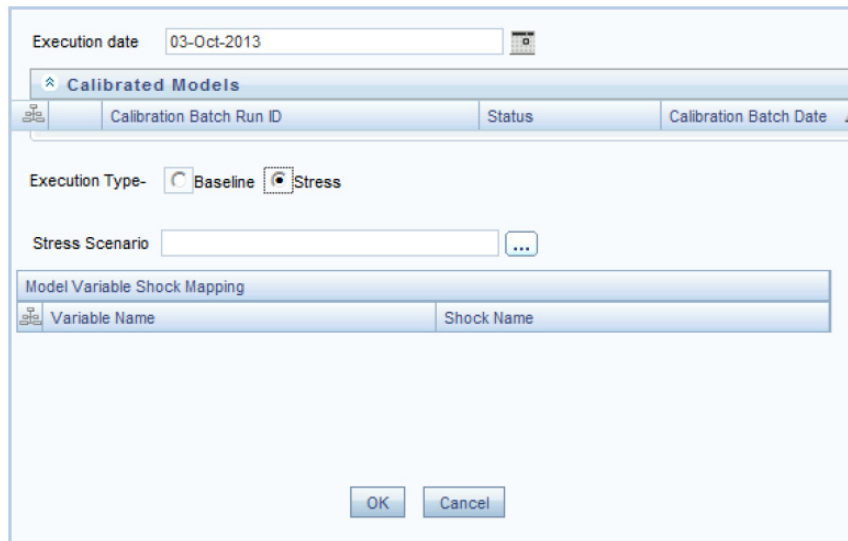**Figure 27. Execution Parameters**

●   Select the Execution Date from the calendar. The data of the selected date will be used for model execution.

●   Click **Stress Scenario** to open the *Scenario Browser* window. Select the scenario and click [icon]. The variables and their shocks of the selected scenario are displayed in the *Model Variable Shock Mapping* grid. For more information on stress testing, see "Managing Stress Testing".

7. The Execution Status grid displays the model execution log dynamically.

Creating a Model Using R Scripted Technique

You can create models using a prepackaged technique or a technique which you have defined from the Technique Registration window. To know about available prepackaged ORE techniques, see List of Prepackaged ORE Techniques section.

Note: Execution Status Log is not displayed in *Model Definition* window for models created using Standard R Engine.

To create a model using R scripted technique, follow these steps:

1. Select [icon] from the *Model Management* tool bar. The *Model Definition* window is displayed. The **Add** button is disabled if you have selected any Model ID in the grid.
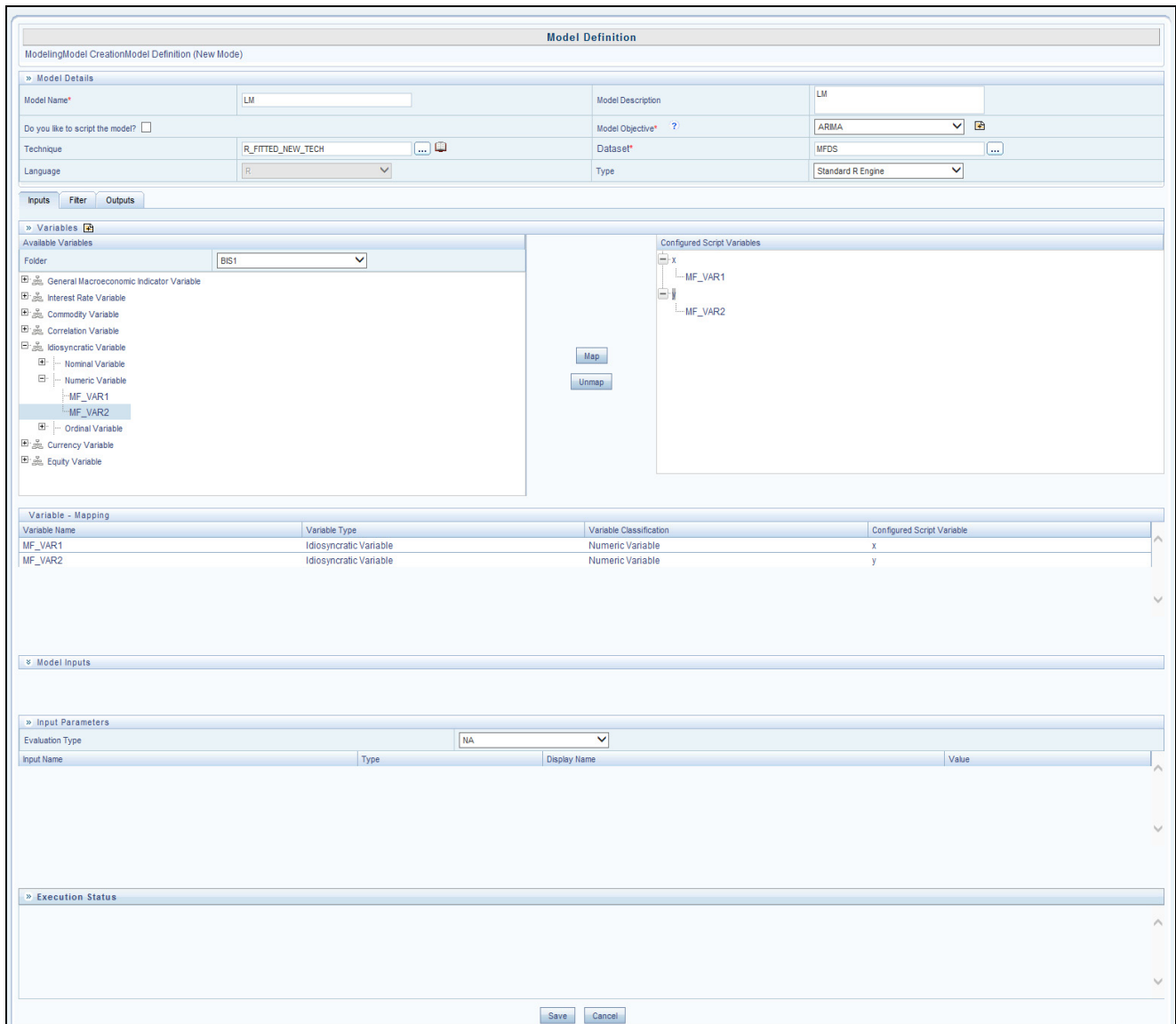
Figure 28. Model Definition page

2. Enter the Model Definition Details. The common fields are described in Table 8.

    The grid below the Model Details section displays the various tabs available for the selected technique. To update the required information, refer to the following sections:

    ● Inputs

- Time Referencing (Not applicable for models defined in Logical Sandbox)

- Filter

- Outputs

3. Click **Save** to save the model definition details, after all the necessary details are updated.

4. Click **Preview Data** to view the data of the selected dataset. It displays the primary keys and the attributes/ columns of the tables in the selected dataset. Only those columns which are mapped to the variables in the script are displayed.

Note: In case of Hive based Sandbox information domain, previewing data takes long time and only 100 records are displayed.

5. Click **Execute**.

- Select **Baseline** to execute the model normally.

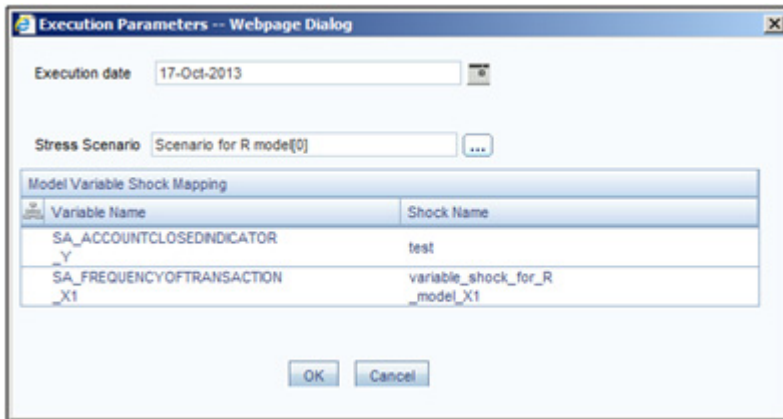- Select **Stress** to execute the model based on a stress scenario. The Execution Parameters window is displayed.
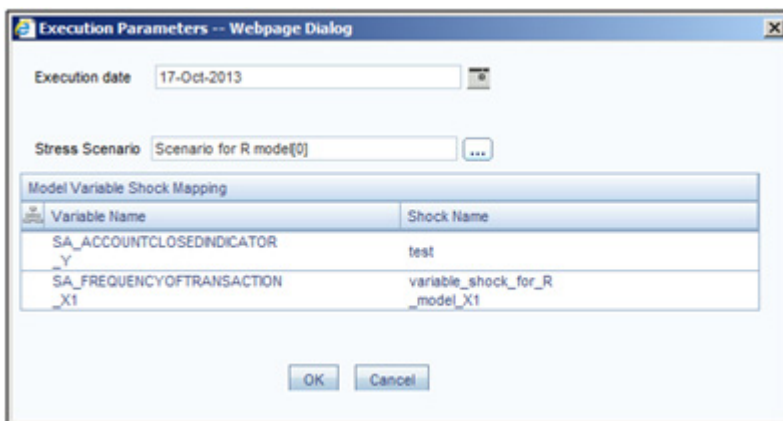
Figure 29. Execution Parameters

- Select the **Execution Date** from the calendar. The data of the selected date will be used for model execution.

- Click **Stress Scenario** to open the Scenario Browser window. Select the scenario and click [icon] . The variables and their shocks of the selected scenario are displayed in the Model Variable Shock Mapping grid. For more information on stress testing, see "Managing Stress Testing".

  The Execution Status grid displays the model execution log dynamically.

  Note: For R based models, the execution may fail if the dataset contains internal joins. Executing a model using standard R engine with the new cloudera jars is failing with model queries exceeding a certain limit. Workaround is to append UseNativeQuery=1 in the JDBC URL of the Hive schemas in which model definitions and executions happen. For example, jdbc:hive2:10.123.456.78:1000/default;useNativeQuery=1

Creating a Model using Script

This feature allows you to create models based on user written scripts. The supported scripting languages are Standard R and ORE. The script should be a valid script.

In case of R script, all the object names used in the R-script should be syntactically valid names. You should select Language as ORE if you are using ORE functions in the script. ORE enables transparent access to data stored in the Database for scalability and high performance. For more information, refer to *Enterprise Modeling support for R Scripts and Oracle R Enterprise (ORE) Statistical Functions.*

Note: The models defined based on R scripting can be directly deployed to the production infodom without execution in sandbox.

To create a model using script, follow these steps:

1. Select ![icon] from the *Model Management* tool bar. The *Model Definition* window is displayed.
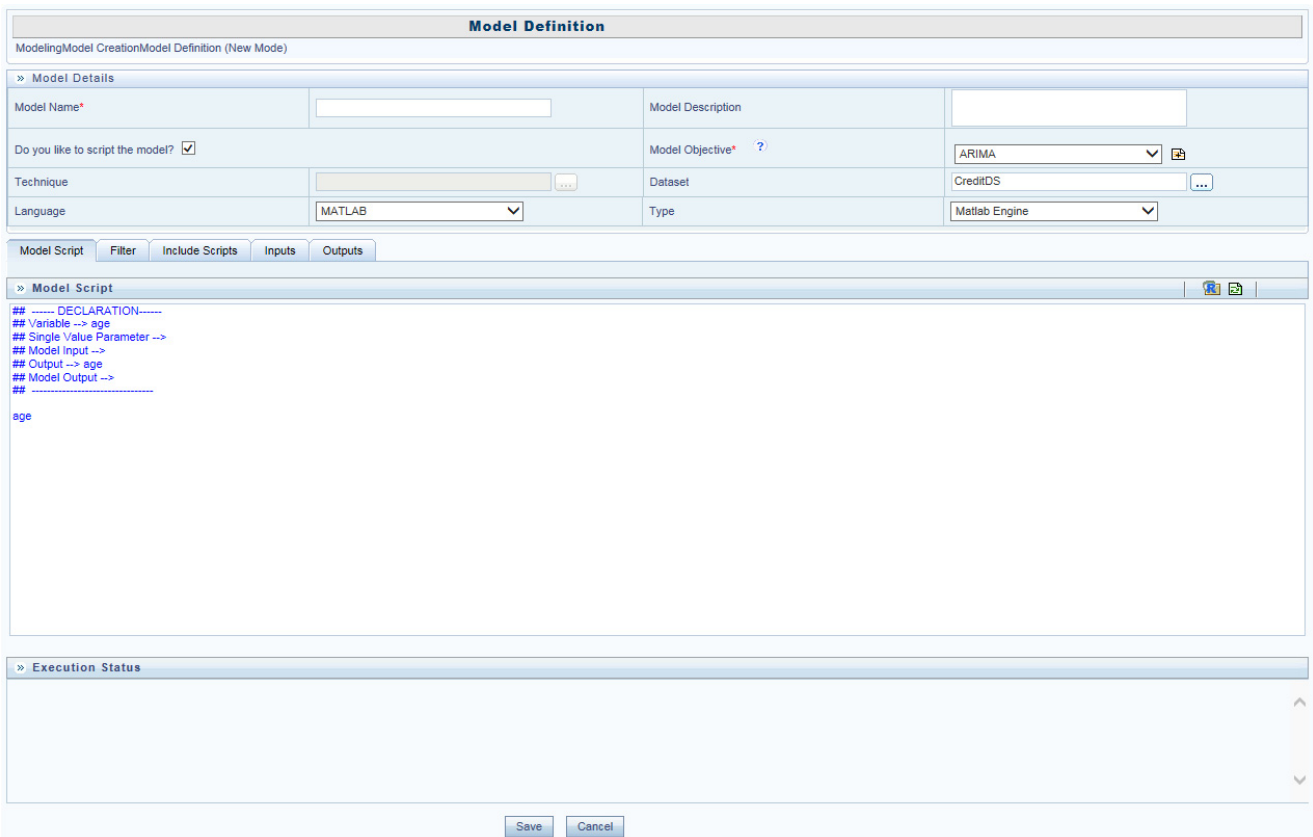
Figure 30. Model Definition

2. Enter the model definition details. The common fields are described in Table 8.

3. For R scripted model, click ![icon] to browse and upload **.R** file. You can use this option if you have already defined a technique and saved it in an **.R** file. Once uploaded successfully, the script is displayed in the *Model Script* pane.
Or
In the Model Script pane, enter the script for the model. For information on how to use fitting and prediction, see *Fitting and Prediction Using R Script.*
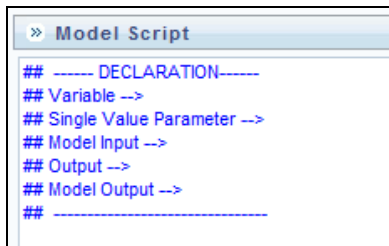
Figure 31. Scripting Console

> **Note:** The format of declaration and the content should not be altered. The scripting should start only from the line after the declaration block.

By default, the Model Script is displayed as shown above.

- ## **Variable -->** Enter the variables you want to use in the script separated by commas.

- ## **Single Value Parameter -->** Enter the input parameters you want to use in the script.

- ## **Model Input -->** Enter the script variable names to which you want to load the output of another model in case of model chaining.

- ## **Output -->** Enter the output parameters you want to use in the script.

- ## **Model Output-->** Enter the object names you want to persist.

> **Note:** The variables and the input parameters are case sensitive. Same name cannot be used for both variables and input parameters.
> You should explicitly define the outputs in the script that need to be updated back to tables. If the output is not defined, then the tables are not updated.
> For example :
> x = rbeta(100,1,2)
> y = rbeta(100,1,2)
> op = lm(y~x)
>
> If op$residuals needs to be updated then declare the output with a name.
> For Example:
> Residuals = op$residuals

The grid below the *Model Details* section displays the various tabs available. To update the required information, refer to the following sections:

- Inputs

- Filter

- Include Scripts

- Outputs

4. Enter valid script of the model in the selected scripting language. For more information on data usage and data handling when R script and ORE functions are used, see *R Scripts and Oracle R Enterprise (ORE) Statistical Functions*.

5. Click **Save** to save the model definition details, after all the necessary details are updated.

6. Click **Preview Data** to view the data of the selected dataset. It displays the primary keys and the attributes/ columns of the tables in the selected dataset. Only those columns which are mapped to the variables in the script are displayed.

Note: In case of Hive based Sandbox information domain, previewing data takes long time and only 100 records are displayed.

7. Click [icon] to execute the model.

 - Select **Baseline** to execute the model normally.

 - Select **Stress** to execute the model based on a stress scenario. The Execution Parameters window is displayed.
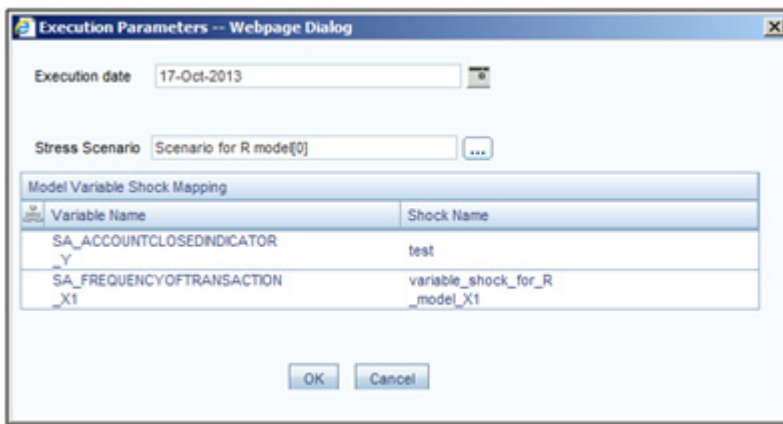
Figure 32. Execution Parameters

 - Select the Execution Date from the calendar. The data of the selected date will be used for model execution.

 - Click **Stress Scenario** to open the Scenario Browser window. Select the scenario and click [icon]. The variables and their shocks of the selected scenario are displayed in the Model Variable Shock Mapping grid. For more information on stress testing, see "Managing Stress Testing".

You can view the status of the model execution dynamically in the Execution Status grid.

Note the following points about Model execution:

 ▪ For R based models, the execution may fail if the dataset contains internal joins.

 ▪ Executing a model using standard R engine with the new cloudera jars is failing with model queries exceeding a certain limit. Workaround is to append UseNativeQuery=1 in the JDBC URL of the Hive schemas in which model definitions and executions happen. For example:

```
jdbc:hive2:10.123.456.78:1000/default;useNativeQuery=1
```

 ▪ Models executed using Standard R engine will fail if multiple primary nodes are set in the ModelingFramework.XML

- ■ Users who are using ORE1.4.1 and R 3.1.1 may have to explicitly set session timezone in scripts registered within OFS EM by using the 'Sys.env(TZ=<time zone>)' R function. Alternatively you may set the same call in 'R_HOME/etc/Rprofile.site' file on the database server, where R_HOME is the home directory of the R instance on which ORE server packages are installed.

8. Click [image] to view the output. For more information, see the View Model Outputs section.

Model Parameters

The grid in the Model Details section displays the various parameters applicable when a technique is selected. It is mandatory to update the required information in the tabs displayed and the parameters or fields in the available tabs vary depending on the technique selected. Few of the common input parameter types are explained below.

Variable Selection

This tab is displayed for NAG techniques only.

In the *Variable Selection* tab, you can add variables you want to use in the model definition.

1. Click ![icon] from the *Variable Selection* toolbar. The *Variable Browser* window is displayed. It displays all the variables defined in the *Variable Management* window. Select the required variable from the hierarchical members list and click ![icon] .

2. Click **OK**. The selected Variable details are displayed in the grid. Multiple instances of a single variable can be selected and the variable summary grid displays all the variables with unique IDs.

3. Click ![icon] in the variable grid to view the Variable Transformation details. You can add a technique for transformation.

4. Select a variable you want to delete and click ![icon] to remove the variable.

Time Referencing

In the *Time Referencing* tab, you can apply a time filter to further slice the data based on time for specific models. Time referencing can be in terms of days, months, or years. You can specify a particular variable as the Anchor Variable and all the other selected variables are referenced relatively to the anchor variable.

1. In the *Model Definition* window, click ![icon] adjacent to **Make Anchor Variable** in the *Relative Referencing* grid. The *Anchor Variable Browser* window displays the list of variables you have mapped in the *Variable Selectioin* tab.

   Note: You need to map at least one variable from the *Variable Selection* tab before adding Anchor variable.

2. Select the required variable from the hierarchical members list and click ![icon] . The selected variable is added to the *Selected Members* pane.

3. Select the **Time Reference Period** as either **Days** or **Months** or **Years**.

4. Click **OK**. The Variables collapsible grid displays the list of variables in the model definition. The selected Time Referencing variable is displayed in the *Model Definition* window and is denoted with an anchor sign.

   Once you have defined a set of Time Referencing variables, you can click ![icon] to view the details and ![icon] to edit the details specifying the anchor position and Time Reference Values.

Filter

In the *Filter* tab, you can add multiple non-time hierarchy members as filters.

1. In the *Model Definition* window, click [image] from the *Filters* toolbar. The *Filter Browser* window is displayed.

2. Select Data Filter or Hierarchy to display the corresponding filters.

3. Select the required filter or hierarchy from the list and click [image] . The selected filter is added to the *Selected Members* pane.

   Note: If a Hierarchy is created on a table with the same column holding hierarchy Code and Description, then the hierarchy nodes will not be displayed in the *Hierarchy Browser* window on Hive connections. In such scenario, use the concat functionality in the **Description** field like concat(<TableName.ColumnName>). For example, concat(credit.age,'').

4. Click **OK**. The selected Filters are displayed in the grid.

5. Filters can be applied to both Production and Sandbox Information Domains. Select the required option **Apply in Production** or **Apply in Sandbox** to apply the filter in the required information domain.

Note: Data Element Filters created in the Filters screen is displayed when you select **Data Filter**.

Sampling

Note: This is applicable for models based on NAG techniques only.

In the *Sampling* tab, you can specify the type of sample for the model definition. The available options are Stratified, Training, Test, and Control sample.

1. In the *Sampling* tab of the *Model Definition* window, select the **Basis of Sampling** as either in **Percentage (%)** or **Absolute** option.

2. Select **Replacements** option as either **Yes** to repeat the records with other samples, or **No** to restrict one record to one sample.

3. Select the **Stratification** (grouping) Basis based on distinct values. Click [image] , the Stratification Basis browser is displayed.

4. Select the hierarchy in which you want to group the records and click [image] . The selected filter is added to the *Selected Hierarchies* pane.

5. Click **OK**. The selected hierarchy is displayed in the grid. Usually there is a single level hierarchy available for Stratified sample selection.

6. Specify the **Training Sample** value, which is the default sample on which model fitting or predictions are carried out. It is mandatory to select a training sample, or the default 100% record set is assumed as Training Sample.

7. Add **Test Sample** by clicking [image] , and specifying the **Sample Name** and **Sample Size** in the *New Test Sample* window. Click **OK**. You can also view, modify, and delete the test sample created.
   Ensure that the sum of **Training Sample** value and **Test Sample** values constitutes to 100%.

8. Specify the **Control Sample** by clicking [image] and selecting the Control Hierarchy and Control Hierarchy Node in the Control Hierarchy browser separately.

Inputs

The following sections describe the various inputs for:

- For Script based Models and For R scripted Technique
- For External Library Based Technique;
- For NAG Technique

For External Library Based Technique

You can view the Parameters you have added during Technique Definition, for which you have selected the **Configured During Model Definition?** checkbox, under the *Configured Script Variables* pane.

1. Select a variable from the *Available Variables* pane (by expanding the required variable type) and a variable from the *Configured Script Variables* pane, and click **Map**. The mapping details are displayed in the *Variable-Mapping* grid.
   To unmap, select the variable from the *Configured Script Variables* pane and click **Unmap**.

2. Under the *Input Parameters* pane, the Single Value Parameters and Multi Value Parameters (for which the Configured During Model Definition? checkbox is selected) will be displayed. Enter the values for the displayed parameters.

For Script based Models and For R scripted Technique

The variablesand model inputs you have declared in the *Model Script* pane are displayed in the *Inputs* tab.

1. From the *Variables* grid, map the configured script variables to the available variables in the system.

   - Select a variable from the *Available Variables* pane by expanding the required variable type and a variable in the *Configured Script Variables* pane, and click **Map**.

   - You can add a new variable and then use that variable for mapping.

     - Click ![icon] to add new variables. The *Variable Defintion* page is displayed. You can create a new variable from the *Model Definition* page, as per the requirement. For more information, refer Adding Variable Definition section.

   The mapping details are displayed in the *Variable-Mapping* grid. To unmap, select the variable from the *Configured Script Variables* pane and click **Unmap**.

   Note:

   - You cannot select a variable in the *Available Variables* pane which is already mapped to another variable in the script. That is, an OFSAA variable can be mapped to only one input variable in the model script. If you want to use the same OFSAA variable for mapping to multiple model input variables, create a copy of the variable and assign it to required model input variables.

   - Mapping of single variable declared in the R script to multiple variables is not supported if ORE implementation is used. However, for prepackaged ORE models, multiple variable mapping to single variable in the R script is supported.

2. From the *Model Inputs* grid, map the output of the model which you want to map to the declared Model Input.

- Select a Model Output from the *Available Model Outputs* pane by expanding the required model and a Model Input from the *Model Inputs* pane, and click **Map**.

The mapping details are displayed in the *Configured Model Inputs* grid. To unmap, select the Model Input from the *Model Inputs* pane and click **Unmap**.

3. From the *Input Parameters* grid, select the **Evaluation Type** from the drop-down list. You can execute model on complete set of records in the dataset, on a group of records or on a set of rows.

- **Group**- Select this option if the model needs to be executed on a group, which is defined using a grouping variable. Select the Grouping Variable from the drop-down list.

- **Row**- Select this option if the model needs to be executed on a set of rows. Specify the Number of rows.

    Note: For Evaluation Type as Row, graphical output (plot) is not supported and the number of records processed is five times the value given in the Number of Rows field. These are limitations.

- **NA**- Select this option if the model needs to be executed on complete set of records in the dataset.

4. All single value parameters declared in the technique are displayed. Displays the Value if it was given while defining the technique. Else enter the appropriate value.

For NAG Technique

Based on the selected NAG Technique, the Input tab varies. For some techniques, this tab will not appear.

In the Inputs tab, you can specify the link function associated to the selected technique and confirm if a Mean value is included during prediction for Transition Matrix techniques

1. Specify the **Link Function** by selecting from the drop-down list.

2. Specify if **Mean value** is included by selecting **Yes** or **No**.

In the *Model Inputs* tab, you can define the transition parameters for the historic data.

1. In the *State Space* grid, enter the details as described in the following table:

Table 9. NAG Technique - Field Descriptions

Field	Description
Fields marked in red asterisk (*) are mandatory.	
Historical Transition Percentage	1. Click ⬚ . The *Variable Browser* window is displayed. 2. Search for a particular Member by entering the keyword and clicking 🔍 in the Search grid. In the Members list, you can click + to expand each hierarchy member and view the subsequent members. 3. Select the required member and click ▶ or double click to move the member to the *Selected Members* pane. You can also remove a member by selecting from the Selected Members list and clicking ◀ 4. Click **OK.** The selected member is displayed in the **Historical Transition Percentage** field.

Table 9. NAG Technique - Field Descriptions

Field	Description
Current State	Click [...]. The *Hierarchy Browser* window is displayed. Follow the above procedure (as explained to define Historical Transition Percentage) to define the Current State parameter.
Future State	Click [...]. The *Hierarchy Browser* window is displayed. Follow the above procedure (as explained to define Historical Transition Percentage) to define the Future State parameter.
State Space Sequence	Click [...]. The *Hierarchy Browser* window is displayed. Follow the above procedure (as explained to define Historical Transition Percentage) to define the State Space Sequence parameter. **Note:** You can select multiple states by holding Ctrl button while selecting. You can also sort the selected list by clicking [▲] and [▼] buttons.
Unity Adjustment State	Click [...]. The *HierarchyMember Browser* window is displayed. Follow the above procedure (as explained to define Historical Transition Percentage) to define the Unity Adjustment State parameter. **Note:** Ensure that you select a state which is present in the selected State Space Sequence list.
Absorbing State	Click [...]. The *HierarchyMember Browser* window is displayed. Follow the above procedure (as explained to define Historical Transition Percentage) to define the Current State parameter. **Note:** Ensure that you select a state which is present in the selected State Space Sequence list.

4. Select the Time Interval as Day, Week, Month, Quarter, Half-Year, or Year from the drop-down list.

5. Enter a numeric value in the **Number of Historic Intervals** field.

Note: The **Number of Historic Intervals** field is present only if you have selected the Calibrate Model option.

6. The options to define the transition parameters vary depending on the technique selected.

- If you have selected **Transition Matrix - EWMA**, enter the **Decay Factor** value (lesser than 1) in the *EWMA Parameter* grid.

- If you have selected **Transition Matrix - Linear Regression**, enter the **Confidence Level** value (lesser than 1) in the *Regression Parameters* grid.

- If you have selected **Transition Matrix - Multi Factor**, select the **Time Homogeneous Estimation** option as either **YES** or **NO**. In case you have selected **No**, enter numeric value in **Number of Intervals Predicted** field.

- You also need to select **Standard Normal Assumption** as either YES or NO in the *Asset Value Parameter* grid.

- If you have selected **Transition Matrix - Time Series**, enter the numeric values in following fields:

- ■ Number of Autoregressive Terms

- ■ Number of Non-seasonal Difference

- ■ Number of Lagged Forecast Error in the Prediction Equation

- ■ Seasonal Period

- ■ Order of Seasonal Differencing

- ■ Seasonal Autoregressive

- ■ Seasonal Moving Average Arguments

- ■ Number of Future Values

Include Scripts

This tab is used to source already defined algorithms to your script.

1. Select the required algorithms/ scripts from the *Scripts List* tree and click .

2. You can view the scripts by selecting the script and clicking .

3. After adding scripts, you can position the scripts as required by selecting it and clicking and .

Outputs

The following sections describe the various Output options for :

- For R Scripted Technique and For Script Based Models
- For NAG Techniques

For R Scripted Technique and For Script Based Models

The *Outputs* tab allows you to store the output values computed during the model execution to a table in your atomic schema by mapping the output value to a variable, which you have defined through the Variables Definition window. This is supported only for record level outputs. Additionally, you can create a new table to store the output if it is a dataframe, vector or matrix.

Note: You can view the *Outputs* tab only after declaring Output variables (## Output -->)in the model script.
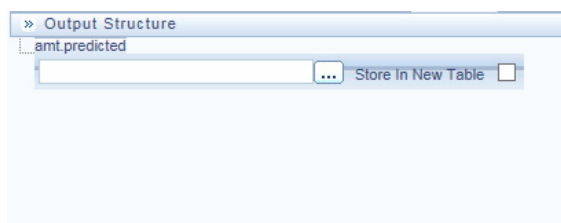
Figure 33. Outputs window

1. From the *Outputs* tab, click corresponding to the declared output variable whose value you want to map to a variable. The *Variable Browser* window is displayed.

2. Select the appropriate variable and click **Ok**.

3. Select the checkbox corresponding to **Store in New Table** if you want to create a new table to store the output.

   New table name is <<Outputname>>_<<ModelID>>_<<Version Number>>. The combined length should not be more than 30. So ensure the Output name does not have any special characters.

Note the following limitations:

- Creating new tables for storing the model outputs is supported only for scripted models, executed using ORE engine. New table creation may not work for Evaluation type selected as Group and Row.

Note: For models executed using ORE engine, you can map only row level outputs to variables.

Scenarios

Consider the following script where outputs are not configured. Then the framework output will be just the graphical output. That is, when the outputs are not chosen by the user, then the framework reports the last line's output as the only default output.

Note that the plots are always produced.

```
##  ---------DECLARATION------------
## Variable --> DepVar,IndepVar1,IndepVar2
## Single Value Parameter -->
## Output -->
##  -------------------------------
art.mod<-lm(DepVar ~ IndepVar1 + IndepVar2)


art.summ<-summary(art.mod)
coef( art.summ )
art.summ[[ "r.squared" ]]


#do some line plots
#plot()


#form new data.frame object
new.x.datafrme = data.frame(x=seq(from=range(IndependentVariable1)[ 1 ],to=range(
IndependentVariable1)[2],length=length(DependentVariable)))


#form new regression model
RegModel<-lm(DepVar ~ new.x.datafrme$x + IndepVar2)


#perform some operations on the new data
Plot(RegModel)

```

In this case, the output window will have a tree containing the components of 'RegModel' object with the same name as the root node.

Alternatively, you can also put the intended objects name at the last line of the script as:

```
##  ---------DECLARATION------------
## Variable -->
## Single Value Parameter -->
## Output --> RegModel
```

```
##   -------------------------------
art.mod<-lm(DepVar ~ IndepVar1 + IndepVar2)

art.summ<-summary(art.mod)
coef( art.summ )
art.summ[[ "r.squared" ]]

#do some line plots
#plot()

#form new data.frame object
new.x.datafrme = data.frame(x=seq(from=range(IndependentVariable1)[ 1 ],to=range(
IndependentVariable1)[2],length=length(DependentVariable)))

#form new regression model
RegModel<-lm(DepVar ~ new.x.datafrme$x +
IndepVar2)

#perform some operations on the new data
Plot(RegModel)
RegModel
```

Here the output window will show a tree containing the components of 'RegModel' object, but since the output name was not configured or specified, it will be held under a generic framework name 'OFSAAOutput'

One of the added advantages of configuring the outputs is that one can get more than one object as output as shown in the following script:

```
##   ---------DECLARATION------------
## Variable -->
## Single Value Parameter -->
## Output --> RegModel, art.mod
##   -------------------------------
art.mod<-lm(DepVar ~ IndepVar1 + IndepVar2)

art.summ<-summary(art.mod)
coef( art.summ )
art.summ[[ "r.squared" ]]

#do some line plots
#plot()

#form new data.frame object
new.x.datafrme = data.frame(x=seq(from=range(IndependentVariable1)[ 1 ],to=range(
IndependentVariable1)[2],length=length(DependentVariable)))

#form new regression model
RegModel<-lm(DepVar ~ new.x.datafrme$x +
IndepVar2)
```

```
#perform some operations on the new data
Plot(RegModel)
```

For the above script, the output window will contain trees for both 'RegModel' and 'art.mod'.

Here are the possible scenarios and the respective framework behavior:

- **Case A**: When no outputs are specified in the declaration block and outputs are not configured in the Outputs window:
  The value of the last evaluated expression is returned with the name 'OFSAAOutput' for the model execution.

- **Case B:** When no outputs are specified in the declaration block and the Configure Outputs button is clicked:
  All the objects from the script execution environment get listed as a tree with each object as separate nodes. Now you can choose the outputs to be reported. The selected ones will be placed in the declaration block. If you do not select any object as output, then the behavior will be the same as case A, for the model execution.

- **Case C:** Some objects are declared as outputs in the declaration block either by explicitly writing the correct names in the declaration block against the label Outputs, or by right-clicking a valid object name and selecting it as output:
  Now, only those which are listed in the declaration block will come in the Configure Outputs window (as checked ones, since you have already selected them as the outputs explicitly).

For NAG Techniques

In the *Outputs* tab, there are two grids namely, *Process Output Selection* and *Data Output variables Selection*. In the *Process Output Selection* grid, you can specify the type of output which can be derived when predictions are carried out.

1. In the *Model Definition* window, click ⊞ from the *Process Output Selection* toolbar. The *Process Output* browser is displayed.

2. Select the required output type from the *Members* list and click ▶. The selected process output is added to the *Selected Members* pane.

3. Click **OK**. The selected *Process Outputs* are displayed in the grid.

4. Select the **Process Output Required in Tables** checkbox to store process output in your Database with Name and Comments.

In the *Data Output Variables Selection* grid, you can populate the variable data into the tables as another filtering parameter.

5. Click ⊞ from the *Data Output Variable Selection* toolbar. The *Data Output Browser* is displayed.

6. Select the required Data Output variable from the *Members* list and click ▶. The selected Data output filter is added to the *Selected Members* pane.

7. Click **OK**. The selected Data Outputs are displayed in the grid.

In the *Data Output Variable Selection* toolbar, you can click [icon] , to view the properties of Data output variable transformation and click [icon] to delete the Data output.

Creating Models using Logical Sandbox

This feature allows you to create models in logical sandbox. In this case, the production and the sandbox information domains are the same. You can define the model from the production infodom by selecting the required logical sandbox from the Sandbox drop-down list provided in the Modeling window.

Note:

- The model management window displays only the models which are defined in the selected Logical sandbox.

- While creating model definition in the sandbox, you can select only those datasets which are selected in the sandbox definition.

- There will be no deployment process for the models defined in the logical sandboxes.

To create a model using logical sandbox, follow these steps:

Note: If a logical sandbox is defined in a production information domain, then only you will have the Model Management LHS menu in the Modeling window.

1. Click **Model Management**. The models defined in the selected logical sandbox are displayed in the Model Management window.

2. Click [icon] from the Model Management toolbar. The Model Definition window is displayed. For more information, see section *Creating and Executing a Model.*

Viewing Model Definition

You can view individual Model Definition details at any given point. To view the existing Model Definition details in the Model Definition window, follow these steps:

1. Select the checkbox adjacent to the Model ID.

2. Click [icon] in the Model Management toolbar.
   An information dialog is displayed indicating that view mode is selected and any accidental changes will not be updated. Click **OK** to confirm and view the details.

3. In the Model Definition View window you can:

   Note: Select **Preview Data** to view the variable parameters corresponding to the technique selected.In case of Hive based Sandbox information domain, previewing data takes long time and only 100 records are displayed.

   - Select **Execute** to process the model execution. The status of which can be verified in Model Execution Status option, accessing *Oracle Financial Services Enterprise Modeling > Modeling > Model > Model Execution Status.*

Modifying Model Definition

You can update the model definition details of an existing Model in the Model Definition window:

Note: Modifying ORE models is not supported. Additionally, applying hierarchy filters for R scripted models in edit mode is not supported.

To modify model definition

1. Select the checkbox adjacent to the Model ID whose details are to be updated.

2. Click ![edit icon] in the Model Management tool bar. The Edit button is disabled if you have selected multiple Model IDs.

3. Edit the Model Definition details as required. Model Name, Technique, and Model Objective are not editable. You can update the Model Description, Dataset, and the variable parameters based on the technique selected. For more information, refer to *Creating and Executing a Model*.

4. Once you have updated all the necessary details in the Model Definition Edit window, you can:

● Click **Preview Data** to view the new Model Definition details before upload.

   Note: In case of Hive based Sandbox information domain, previewing data takes long time and only 100 records are displayed.

● Click **Save** to update the model definition details. You can choose save a Model Definition as a new version or overwrite the existing version. For more details, refer to *Model Versioning* section.

● Click **Save** and select **Execute** to process the model execution. The status of which can be verified in Model Execution Status option, accessing *Oracle Financial Services Enterprise Modeling > Modeling > Model > Model Execution Status*.

Deleting Model Definition

You can remove the model definitions which are no longer required by deleting from the Model Management window.

1. Select the checkbox adjacent to the Model ID(s) whose details are to be removed.

2. Click ![delete icon] in the Model Management tool bar.

3. Click **OK** in the information dialog to confirm deletion.

Searching Model Management

The Model Management page allows you to search the models that you want to view.

To search for models, follow these steps:

1. Navigate to the Model Management page.

2. Enter the Model Name and Model Objective.

3. Click ![icon] . The filtered list is displayed.

Model Chaining

Model Chaining is used to input an object/objects from one model to another model. It can also be used for separation of calibration and prediction. The objects persisted from any model can be chained to any other model. In case of ORE intermediate objects are saved in ORE data-store whereas in Standard-R / Open-R , objects are saved or persisted as a file.

The following tags are available in the Model Script Console:

- **##Model Input-->** Enter the object names to which you want to map object from some other model.
- **##Model Output-->** Enter the object names you want to persist.

Note: Object persisted out of an ORE based model cannot be chained /inputted to Open-R / Standard-R based model and vice-versa.

Figure 34. Model Script Console

Model Execution Status

Model Execution Status in the Sandbox Information Domain enables you to verify the status of the executed model at any given point. The status can be Complete, Ongoing, or Failed based on the current processed stage of the system.

This section includes the following topics:

- Accessing Model Execution Status
- Searching Model Execution Status

Accessing Model Execution Status

To access the Model Execution Status page, follow these steps:

1. Click **Sandbox** tab.
2. Click **Model Execution Status**. The Model Execution Status page is displayed.

Note: This menu is displayed only if you are in sandbox infodom.

Figure 35. Model Execution Status

Searching Model Execution Status

The Model Execution Status page allows you to search the models that you want to view.

To search for Model Execution, follow these steps:

1. Navigate to the Model Execution Status page.

2. Enter the Model Name.

3. Click . The filtered list is displayed

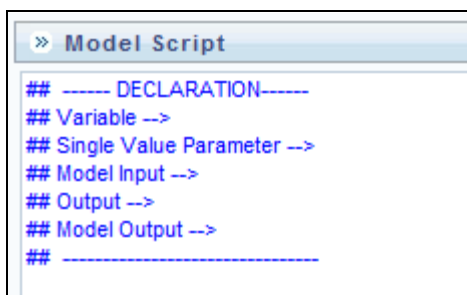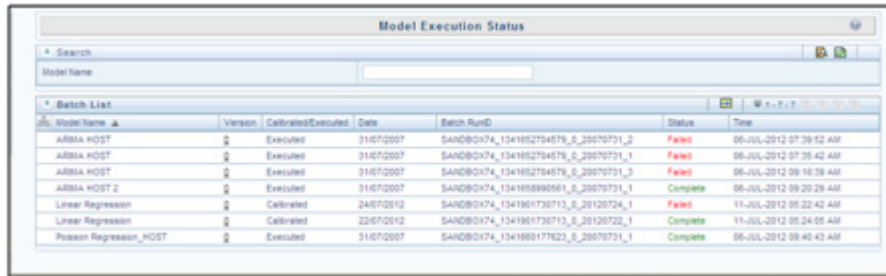# Model Outputs

The Model Outputs page in Sandbox Information Domain displays the outputs of all models executed in the selected Sandbox Information Domain. The Model Outputs page in Production Information Domain displays the outputs for the models deployed in the production Information Domain and also those requested for execution. You can also view or download the derived output values as a .csv file and plots as .png files for reference.

This section includes the following topics:

- Accessing Model Outputs
- Searching Model Outputs
- View and Compare Model Outputs

Accessing Model Outputs

You can access the Model Outputs page from the Application tab and the Sandbox tab.
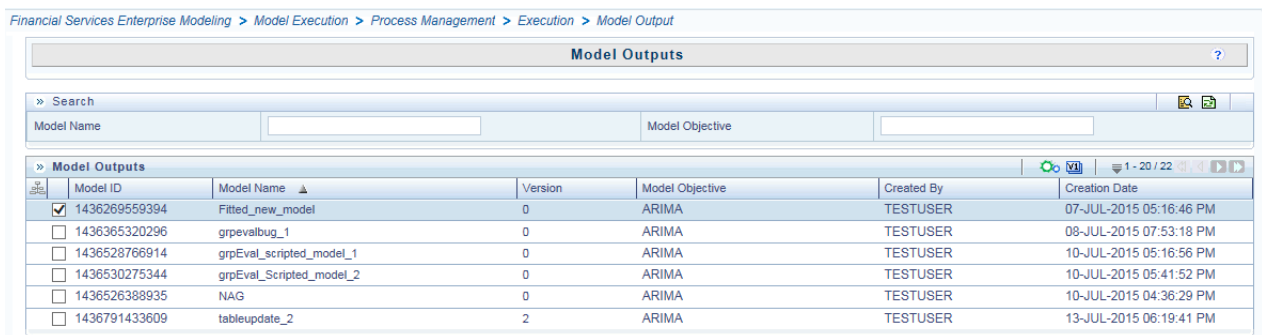
To access the Model Outputs page from Application tab, follow these steps:

1. Select **Oracle Financial Services Enterprise Modeling** from the *Application* tab.

2. Click   to expand the Model Execution.

3. Click [ ] to expand the Process Management.

4. Click [ ] to expand the Execution.

5. Click **Model Outputs**. The *Model Outputs* page is displayed.

To access the Model Outputs page from the *Sandbox* tab, follow these steps:

1. Click **Sandbox** tab.

2. From the LHS menu, click **Model Outputs**. The *Model Outputs* page is displayed.

Figure 36. Model Outputs

Searching Model Outputs

The Model Outputs page allows you to search the models that you want to view.

To search for Model Outputs, follow these steps:

1. Navigate to the Model Outputs page.

2. Enter the Model Name and Model Objective.

3. Click [ ] . The filtered list is displayed.

View and Compare Model Outputs

To view and compare the model outputs, follow these steps:

1. Select the checkbox adjacent to the Model ID.

2. Click [ ] from the *Model Outputs* toolbar. The *Output Summary* window is displayed.
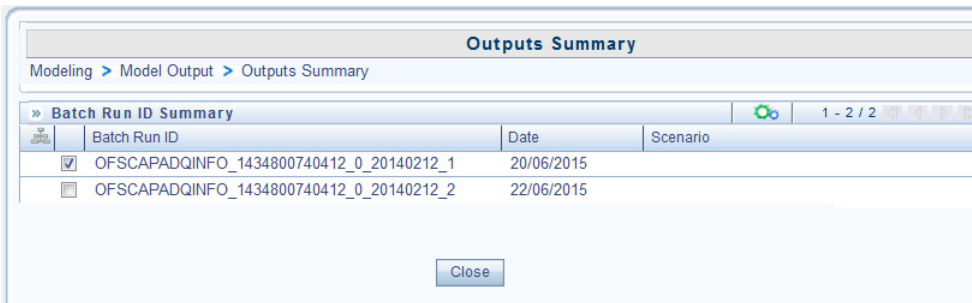
Figure 37. Outputs Summary

3. Select the checkbox adjacent to a Batch Run ID to view the details or select multiple checkboxes to compare Batch Run IDs.

4. Click to view details or compare Batch Run ID(s). The *View/Compare Sample* window is displayed with the comparison details of the selected models.
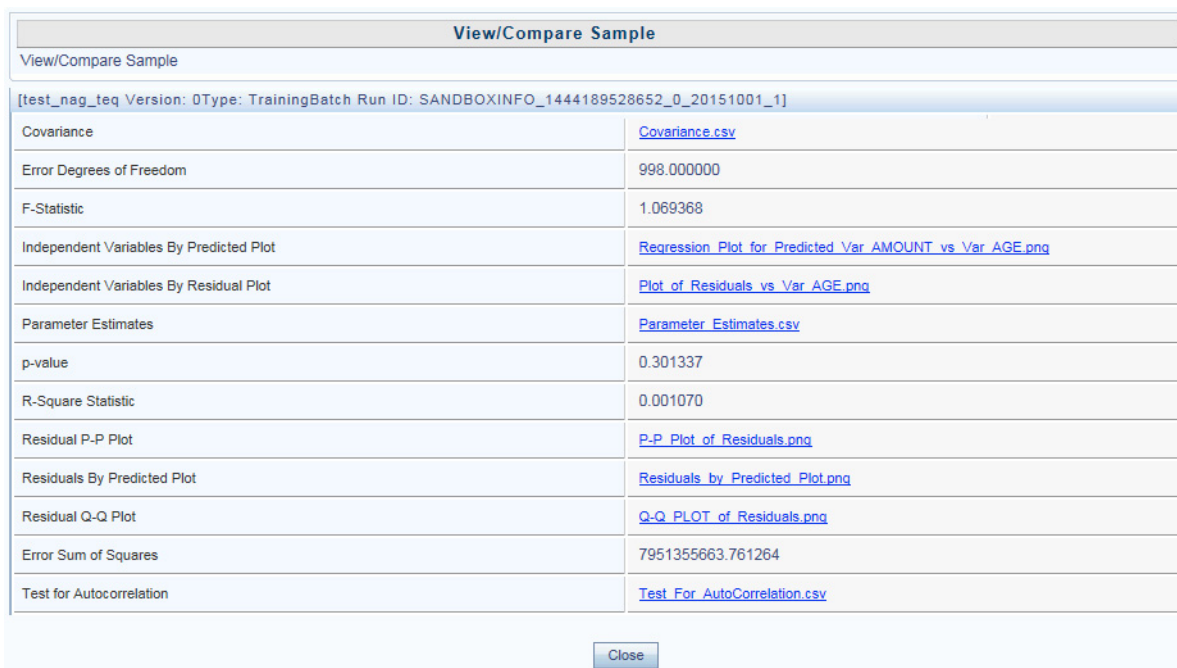
Figure 38. Output Window for NAG Technique Based Models

5. Click the links to view/download the derived values stored as .csv files or plots saved as image files.
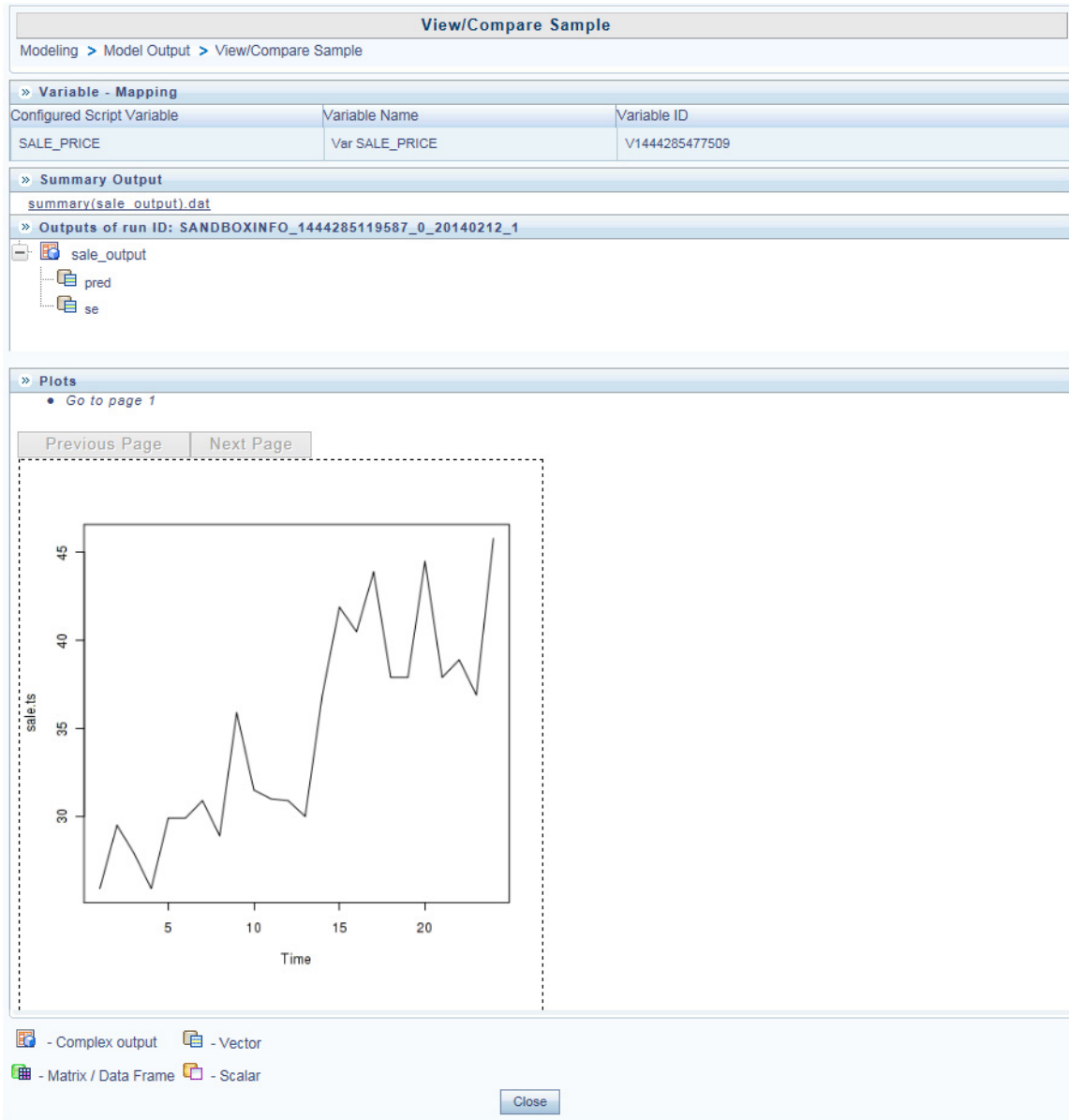
Figure 39. Output window for R scripted models

6. Click the file name (.dat file) under the *Summary Output* pane to view the summary of outputs.This is displayed only for models based on Standard R Engine.

7. Click the links in the Outputs pane to download or view the derived values in .csv files.

Model Deployment

Model Deployment in the Sandbox Information Domain enables you to request for deployment of a model to the production information domain. Once you define a model and test it in the Sandbox, and if the testing (checking the results of model execution) results in concluding that the definition is sound and satisfactory, promote the model to the production infodom to execute the model on the production data.

Since models based on R scripting can be directly deployed without execution, those models will be displayed in the Model Deployment window. In case of models based on NAG techniques, the successfully executed models only will be displayed.

Note: Model deployment is not required for models created in logical sandboxes.

This section includes the following topics:
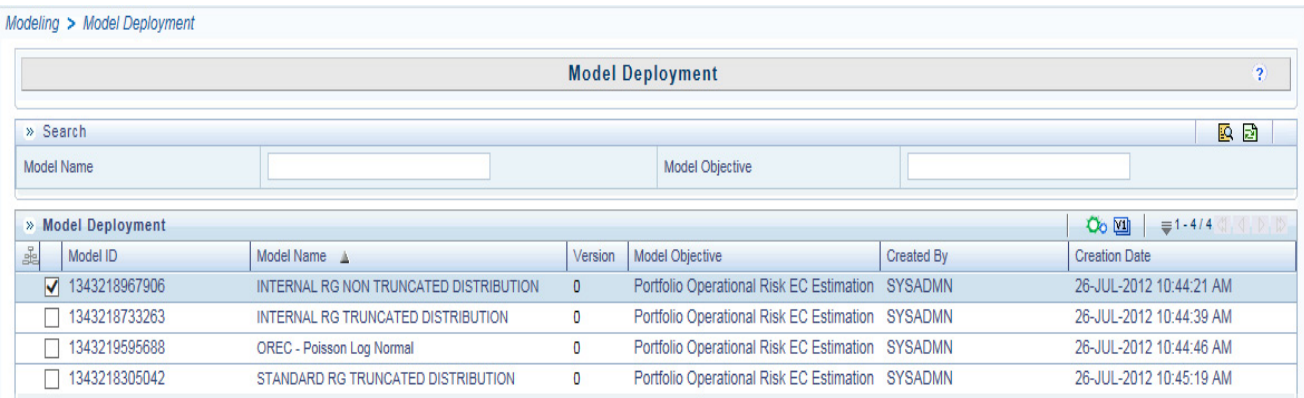
- Accessing Model Deployment
- Searching Model Deployment
- Requesting and Authorizing Model Deployment

Accessing Model Deployment

To access the Model Deployment page, follow these steps:

1. Click **Sandbox** tab.
2. Click **Model Deployment**. The Model Deployment page is displayed.

Note: This menu is displayed only if you are in sandbox infodom.

Figure 40. Model Deployment Page

Searching Model Deployment

The Model Deployment page allows you to search the models that you want to view.

To search for Model Deployment, follow these steps:

1. Navigate to the Model Deployment page.
2. Enter the Model Name and Model Objective.

3. Click . The filtered list is displayed.

Requesting and Authorizing Model Deployment

You can request a model for deployment and view its status in the Processing Modeling Framework (PMF). You can view the current status of the model deployment life-cycle and click on the various symbols in the PMF diagram to view details for the specific state in the workflow.

Note: For more information on PMF, see the *OFSAAI User Guide Release 8.0.4.0.0* on OHC.

To request and authorize a model for deployment, perform the following steps:

1. Select the checkbox adjacent to Model ID and click to display the *Model Deployment Authorization* window.

2. Select the **Request for Deployment** checkbox in the Model Deployment grid.

   Note: Once you have requested for deployment, you can view the status for the model deployment in the PMF. Click on the **System Configuration and Identity Management** tab. Click **Process Monitor** on the LHS menu and search for the Model that was requested for deployment. Click on the link to display the **PMF** window. The window displays the state of the Model deployment.

3. Select **Authorize and Deploy** checkbox to authorize the deployment request. This checkbox is enabled if you are mapped to the MDLAUTH function role. And if you are not, an authorizer has to approve the deployment.

   Note: Click on the **My Inbox** tab and click **My Task** from the LHS menu. You can view notifications for the approval or rejection of the Model deployment here. For rejected requests, you can click on the **Sandbox** tab and edit the model from the **Model Creation** window. For more information, see Creating and Executing a Model. Once you have edited the Model, you can request again for approval to deploy and the process is a repeat of steps 1 to 3.
   Authorizers approving or rejecting model deployment requests can access them from the **My Inbox > My Task** as described in the above paragraph. Click on the **Task ID** in the notification to display the *Model Deployment Authorization* window and approve or reject the model deployment.

4. Click **Save** to process the model deployment.

On successful deployment, the model is available in the Run Rule Framework as a component. Run filter and process filter is supported for models stitched in a Run for execution.

Note: To execute Open R models, pass the value for `$HOST` as a Run-Time parameter.

Note: Once deployed, you can view the success or failure of the Model deployment in the **PMF** window. Click on the **System Configuration and Identity Management** tab. Click **Process Monitor** on the LHS menu and search for the Model that was deployed. Click on the link to display the **PMF** window. The window displays the state of the Model deployment as either Successful or Failed. You can click on the symbols to view more details. The following screenshot of the Model deployment on the PMF window is an example that has been through a cycle of model rejection and approval, and deployment failure and success.
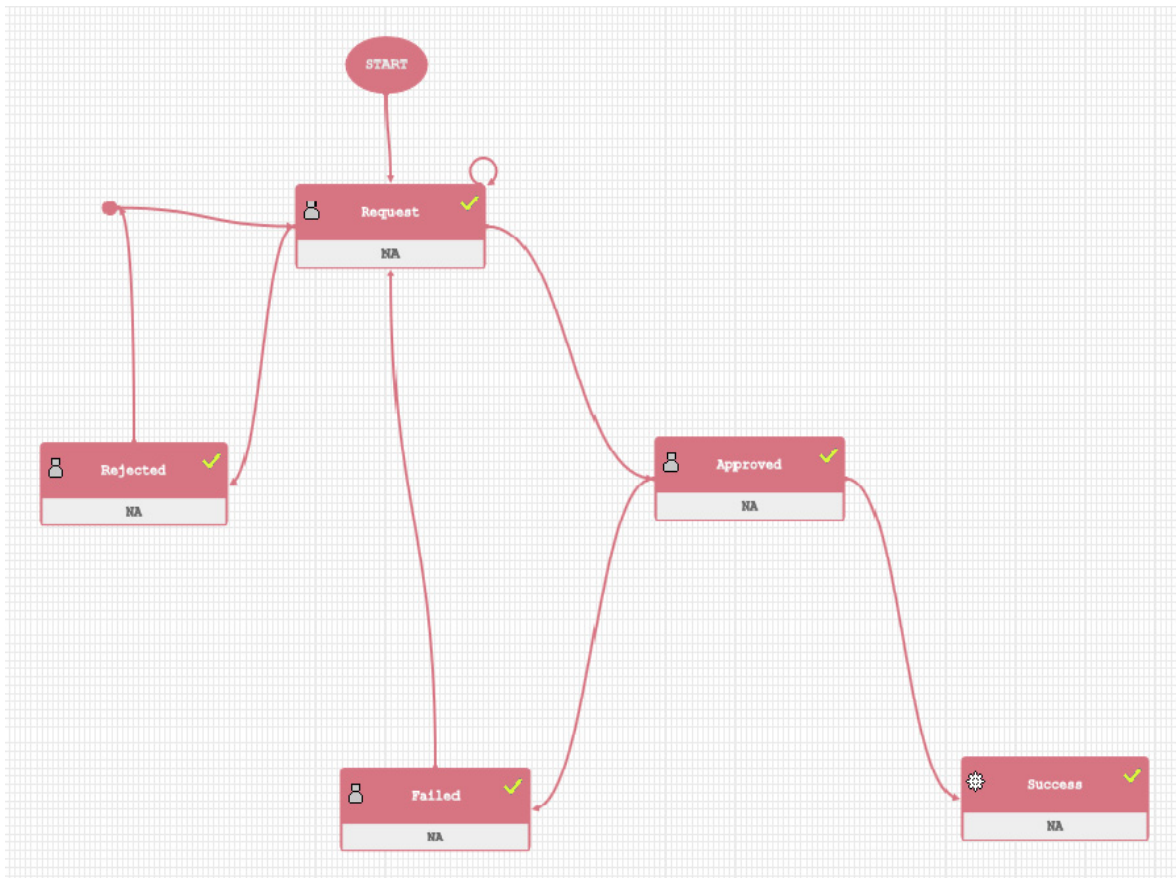
Model Deployment States on PMF Window

Model Execution

The Model Execution module allows to you request for model execution and work with champion challenger.

This section includes the following topics:

- Request for Model Execution
- Champion Challenger

Request for Model Execution

Request for Model Execution in the Production Information Domain enables you to request for a batch execution for the selected model. A batch is scheduled in the Batch Processing and the model is executed in the production environment.

This section includes the following topics:

- Accessing Request for Model Execution
- Requesting for Model Execution
- Searching for Request for Model Execution

Accessing Request for Model Execution

To access the Request for Model Execution page, follow these steps:

1. Select **Oracle Financial Services Enterprise Modeling** from the Application tab.

2. Click ▶ to expand Model Execution.

3. Click ▶ to expand Process Management.

4. Click ▶ to expand Model Management and click **Request for Model Execution**. The *Request for Model Execution* window is displayed.
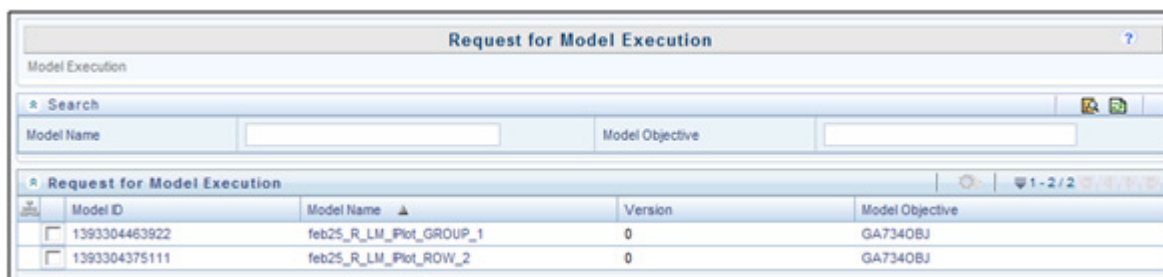
Figure 41. Request for Model Execution

Requesting for Model Execution

To request for model execution, follow these steps:

1. From the *Request for Model Execution* window, select the required model and click [icon] . The Request for Model Execution window is displayed.

2. Select the **Register Batch** checkbox.

3. Click **Save** to process for model execution.

When there is a request for model execution, a batch is registered in the Operations framework which has to be executed from the Batch Scheduling window in the application. For more information, refer *Operations* section in the *Oracle Financial Services Analytical Applications Infrastructure User Guide.*

Note: The Request for Model Execution page displays all deployed models in case of schema based sandboxes.

Note: Market Risk (MR) Models will not be displayed on the Request for Model Execution window. To create and execute a MR Model, go to the Run Definition window.

Searching for Request for Model Execution

The Request for Model Execution page allows you to search specific model execution request.

To search for Request for Model Execution, follow these steps:

1. Navigate to the Request for Model Execution page.

2. Enter the Model Name and Model Objective.

3. Click . The filtered list is displayed.

Champion Challenger

Champion refers to the first model deployed, after calibrating the parameters for a specific model objective. Challenger(s) refers to the subsequent models deployed for the same model objective but with different techniques used for predictions.

When several prediction models (challengers) are deployed and one of the challengers produces optimum output meeting all the prediction requirements, the same can be set as Champion.

This section includes the following topics:

- Accessing Champion Challenger

- Searching for Champion Challenger

- Requesting New Champion

Accessing Champion Challenger

To access the Champion Challenger page, follow these steps:

1. Select **Oracle Financial Services Enterprise Modeling** from the Application tab.

2. Click to expand Model Execution.

3. Click to expand Process Management.

4. Click to expand Model Management.

5. Click **Champion Challenger**. The Champion Challenger page is displayed.
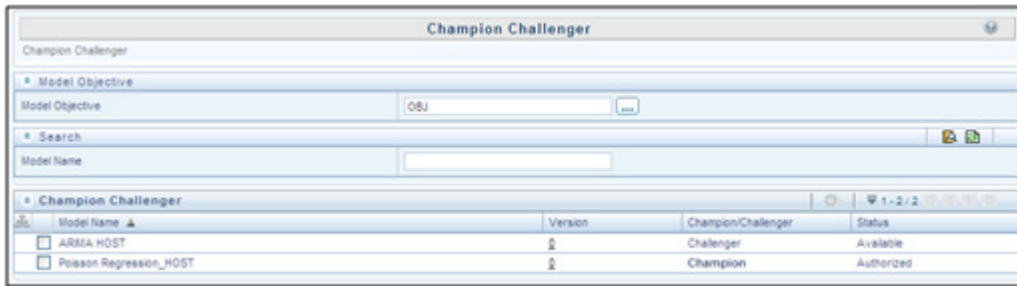
Figure 42. Champion Challenger

Requesting New Champion

To request a new champion, follow these steps:

1. Select the Model Objective, click [icon] and open the Model Objective browser.

2. Select the required Model Objective in the Hierarchy list and click [icon] .

3. Click **OK**. The window is refreshed to display the available models.

4. Select the checkbox adjacent to the model whose status has to be set to champion.

5. Click [icon] in the Champion Challenger toolbar. The Request New Champion window is displayed.

6. Select the **Request New Champion** checkbox.
   If you have been mapped to MDLCHAMP function role, you can select **Authorize** checkbox to authorize new champion.

7. Click **Save** to update the changes and return to Champion Challenger window.
   In the Champion Challenger window, the status of the selected model is updated as Champion and Authorized.

Searching for Champion Challenger

The Champion Challenger page allows you to search for a specific champion challenger.

To search for Champion Challenger, follow these steps:

1. Navigate to the Champion Challenger page.

2. Enter the Model Name.

3. Click [icon] . The filtered list is displayed.

CHAPTER 8   *Managing Stress Testing*

This chapter provides information about Modeling in the Oracle Financial Services Enterprise Stress Testing application and step-by-step instructions to use this section.

This chapter includes the following options:

- About Stress Testing
- Variable Definition
- Upload Scenario
- Variable Shock Library
- Scenario Management
- Stress Definition

About Stress Testing

Stress testing is an integral part of a bank's risk measurement system and plays an important role in estimating the effects of potential financial crises on a bank's operations. Stress Testing or risk estimation technique, refers to the process of examining the stability of a system or entity in adverse conditions. It involves testing beyond normal operational capacity, often to a breaking point, in order to observe the results. It also helps banks conduct analysis to estimate the impact of movements in the variables on specific measures such as profitability and capital adequacy.

The Stress Testing utility supports the stress testing requirements across the entire suite of OFSAA products. It allows banks to define shocks and assess the impact of such shocks across multiple business areas.

The two commonly accepted forms of Stress Testing are:

- **Sensitivity Analysis**: Shocks are applied on a single variable.
- **Scenario Analysis**: A scenario is defined as a shock to a single variable or a collection of shocks on multiple variables. Scenario analysis involves applying simultaneous shocks on multiple variables to assess the impact of scenario on a measure or a set of measures. Scenarios are further classified into the following categories:

    - **Historical Scenarios:** These scenarios replicate the past events docket. They are defined by specifying shocks to variables such that they replicate the movement seen during historical events.
      For example, the user may define a scenario that replicates the movement in stock market indices as observed during the catastrophic event. This scenario can then be applied to the current trading book portfolio of the bank to estimate the loss that might be incurred if a catastrophic event occurs. However, the historical scenarios may not cover the entire range of potential adverse conditions

    - **Hypothetical Scenarios**: These scenarios are based on user judgment and addresses the other possible adverse movements in the variables.

Stress Testing Workflow
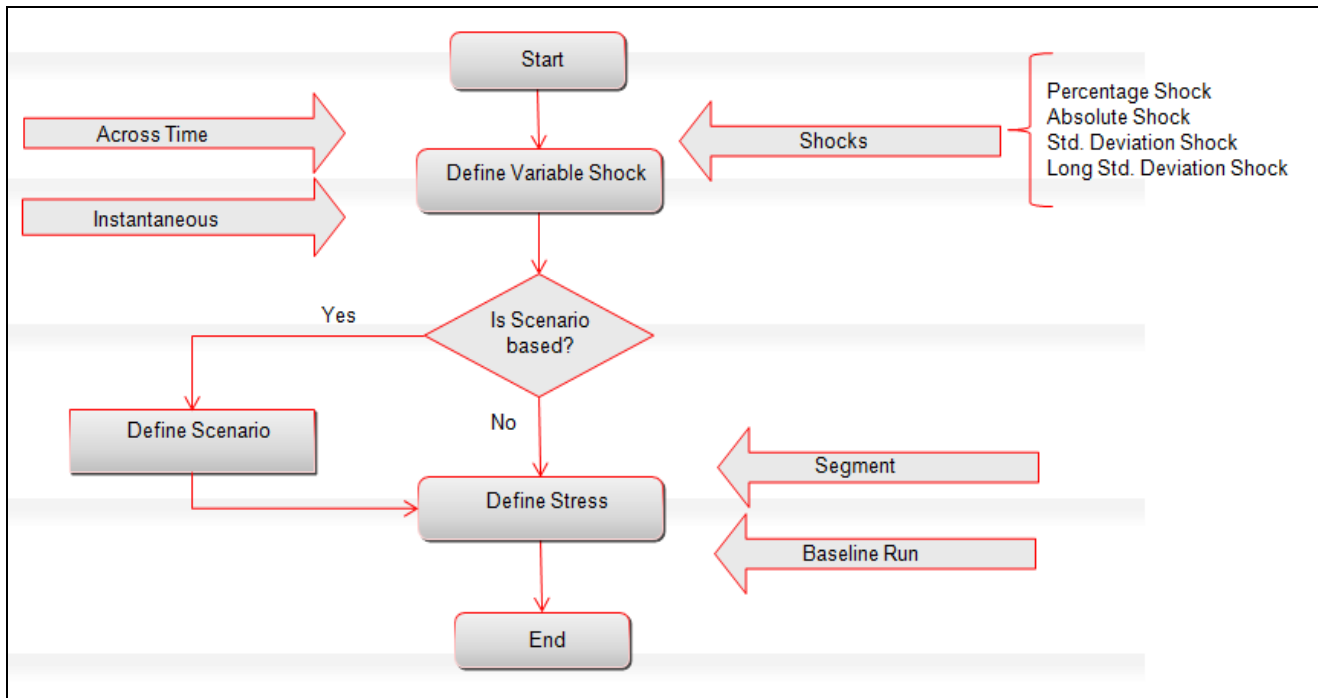
Figure 43. Stress Testing Workflow

Variable Definition
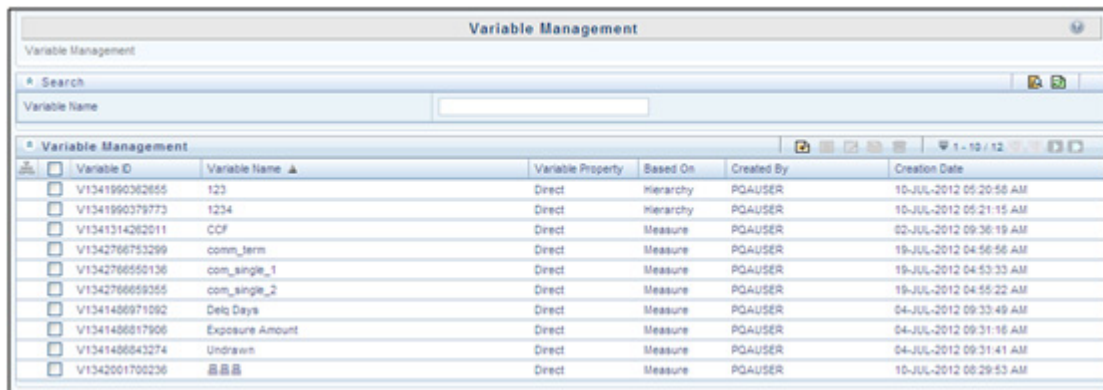
Variable refers to a logical set of attributes that are likely to change based on the selected parameters. In a modeling environment, variables play a vital role in filtering the model parameters and deriving an estimate based on historical data. Variables are defined in the production information domain.

This section includes the following topics;

- Accessing Variable Definition
- Adding Variable Definition

Accessing Variable Definition

1. Login to Oracle Financial Services Enterprise Modeling as a Business User. The Oracle Financial Services Enterprise Modeling Home page is displayed.

2. Select **Oracle Financial Services Enterprise Modeling** from the Application tab.

3. Click ▶ to expand the Stress Testing section.

4. Click **Variable Definition**. The Variable Management page is displayed.

Figure 44. Variable Management

Adding Variable Definition

The Add Variable Definition page enables you to add a variable by filtering through the required parameters. The options available to filter the data vary depending on the variable type selected.

To add variable definition, follow these steps:

1. Select ⬚ from the Variable Management tool bar. The Add button is disabled if you have selected any checkbox in the grid. The Variable Definition Add window is displayed.

Figure 45. Variable Definition

2. Enter the Variable details as described in the following table:

Table 10. Variable Definition - Field Descriptions

Field	Description
Fields marked in red asterisk (*) are mandatory.	
Folder	Select the folder in which you want to create the variable.
Variable Name	Enter a name for the variable. Ensure that there are no special characters like `, {,},'', ', ~, <,>, /, \, and multiple spaces.
Variable Description	Enter the required description for the variable.
Variable Type	Select the variable type from the drop down list. The available options are: ● Commodity Variable ● Correlation Variable ● Currency Variable ● Equity Variable ● General Macroeconomic Indicator Variable ● Idiosyncratic Variable ● Interest Rate Variable You can add a custom variable type by clicking ⊞ and entering a **Variable Type** name in the Variable Type window.
Variable Structure	Select the Variable Structure as either **Single Value** or **Term Structure** from the drop down list. The **Term Structure** option is available only if the **Variable Type** is selected as **Commodity Variable** or **Interest Rate Variable**. Click ✎ from the Term Structure toolbar. Select the required variables from the Variable Browser window.
Single Maturity	This field is displayed only if **Variable Type** is selected as **Commodity Variable** or **Interest Rate Variable**: ● Select the **Maturity Unit** as Days, Months, Quarters, or Years from the drop-down list. ● Select the **Maturity Type** as either **Value** or **Node**.

Table 10. Variable Definition - Field Descriptions

Field	Description
Maturity Value	This field is displayed only if **Commodity Variable** or **Interest Rate Variable** is selected as **Variable Type** and **Maturity Type** is selected as **Value**. Specify a numeric value.
Node Selection	This field is displayed only if Commodity Variable or Interest Rate Variable is selected as Variable Type and Maturity Type is selected as Node. 1. Click [...] and select the required hierarchy from the Hierarchy browser window. 2. Click [...] and select the required node of the selected hierarchy from the Hierarchy browser window.
Based On	Select any of the following options from the drop-down list, based on which the variable definitions are to be created. - Hierarchy - Measure - Business Processor - Entity
Variable Classification	Select the required variable classification from the drop-down list. The options are **Numeric Variable**, **Nominal Variable**, and **Ordinal Variable**. The **Nominal Variable** and **Ordinal Variable** options are available only if you select Variable Type as **General Macroeconomic Indicator** or **Idiosyncratic Variable** and **Based on** as **Hierarchy**.
Variable Transformation	This feature is available for variables based on Measures, Business Processor, and Entity. 1. Click to define a transformation for the Variable. The *Technique Browser for Transformation* window is displayed. 2. Select the transformation you want to apply to the variable and click . The options are **Arithmetic**, **Exponential**, **Logarithm**, **Power**, and **Trigonometric**. 3. Click or to change the order in which the transformation has to be applied. Click **OK**. - If **Arithmetic** is selected, select the **Operator** (Addition, Subtraction, Multiplication, and Division) from the drop-down list and enter the **Operator Value**. - If **Logarithm** is selected, select the **Base** from the drop-down list. The options are 10, 2, and e. - If **Power** is selected, enter the value of **Power**. - If **Trigonometric** is selected, select the **Function** from the drop-down list. The options are Sine, Cosine, and Tangent. - If **Exponential** is selected, the exponential value of the variable willbe considered for transformation of the variable.

4. If the variable is based on **Hierarchy,** follow these steps:

  - Select **Variable Property** as **Direct** or **Dummy** (variable in Binary form and used mainly in regression analysis). The **Dummy** option is available only if **Variable Type** is selected as **General Macroeconomic Indicator** or **Idiosyncratic Variable** .

- Select the required Hierarchy from the **Selected Hierarchy** drop-down list.

   Note: Hierarchy-based variables cannot be created on multi-level Business Intelligence hierarchies.

5. If the variable is based on **Measures**, follow these steps:

   - Select **Yes** or **No** adjacent to **Apply Filters**.

   - If **Yes** is selected, perform the following steps:

     - Select the **Dataset** from the drop-down list.You can click to view the details of the selected dataset.

     - Select the Measure from the **Selected Measures** drop-down list. You can click to add a new Business Measure. For more details on creating a Business Measure, see *Creating Business Measure* section in *Oracle Financial Services Analytical Applications Infrastructure User Guide.*

     - Click in the *Filters* grid to open **Hierarchy browser**.

     - Select the hierarchy member(s) and click **OK**. The selected members are displayed in the *Filters* grid.

     - Click a hierarchy member to invoke a grid with the member name.

     - Click in the hierarchy member grid and the *Hierarchy Browser* window is displayed.

     - Select the node(s) and click **OK**. The selected nodes are displayed in the Hierarchy member grid under Nodes.

   - If **No** is selected, select the Measure from the **Selected Measures** drop-down list. You can click to add a new Business Measure. For more details on creating a Business Measure, see *Creating Business Measure* section in *Oracle Financial Services Analytical Applications Infrastructure User Guide.*

6. If the variable is based on **Business Processor**, follow these steps:

   - Select the Business Processor from the **Selected BP** drop-down list.

     You can click to add a new Business Processor. For more details on creating a Business Processor, see *Adding a Business Processor* section in *Oracle Financial Services Analytical Applications Infrastructure User Guide.*

7. If the variable is based on **Entity**, follow these steps:

   - Click Entity to open the *Entity and Attribute* window. The available tables are displayed under the *Available Entities* section.

   - Select the checkbox corresponding to the table you want to select. The available columns in the selected table are displayed under the *Available Attributes* section.

   - Select the Attribute for which you want to create the variables and click **Save**. The selected attributes are displayed in the *Selected Attributes* section.

8. Click **Save** to save the new Variable definition details. The Audit Trails grid at the bottom of *Variable Definition* window displays metadata information about the Variable definition created.

Upload Scenario

The financial institutions may be required to conduct stress tests based on the supervisory stress scenarios provided by the Regulators. In such case, the regulators will provide the data to be used for running the stress tests for different scenarios such as Baseline, Adverse or Severly Adverse. You can upload the data which is available in an Excel spreadsheet to OFS Enterprise Modeling framework and conduct the tests.

This section includes the following topics:

- Accessing Upload Scenario
- Uploading New Scenario
- Deleting Upload Scenarios
- Searching Upload Scenarios

Accessing Upload Scenario

To access the *Upload Scenario* window, follow these steps:

1. Select **Oracle Financial Services Enterprise Modeling** from the *Application* tab.

2. Click ▶ to expand **Stress Testing**.

3. Click **Upload Scenario**. The *Upload Scenario* window is displayed.

Uploading New Scenario

This option allows you to upload scenario data which you have got from regulators in an Excel file.

Note: Rollback is not handled if wrong Scenario data is uploaded.

To upload scenario, follow these steps:

1. From the *Upload Scenario* window, click from the Upload Scenarios toolbar. The *Upload Scenario* window is displayed.

2. Enter the details as tabulated:

Table 11. Variable Definition - Field Descriptions

Field	Description
Fields marked in red asterisk (*) are mandatory.	
Source	Enter the source name from whom you got the scenario data.
Scenario Name	Enter the scenario name.
Scenario File	Click Browse and select the appropriate scenario file. Click ⇨ to upload the file to the setup.
Effective Date	Specify the duration for which the scenario data is effective. This is optional. Click 🗓 and select the Start Date and End Date.

3. Click **Save**.

Deleting Upload Scenarios

You can remove the upload scenarios which are no longer required in the system, by deleting from the *Upload Scenario* window.

To delete upload scenarios, follow these steps:

1. Select the checkbox adjacent to the Source which you want to delete.

2. Click in the *Upload Scenarios* tool bar.

3. Click **OK** in the information dialog to confirm deletion.

Searching Upload Scenarios

The *Upload Scenario* window allows you to search for specific uploaded scenarios.

To search for uploaded scenarios, follow these steps:

1. Navigate to the *Upload Scenarios* window.

2. Enter the name of the **Source**.

3. Click . The filtered list is displayed.

Variable Shock Library

Variable Shock refers to modulating the data causing an adverse shift in the value of a variable. The Variable Shock Library within the Stress Testing framework facilitates you to define multiple shocks to variables and maintaining a library of such shocks in the Production Information Domain. You can also view, modify, copy, and delete variable shock definitions.
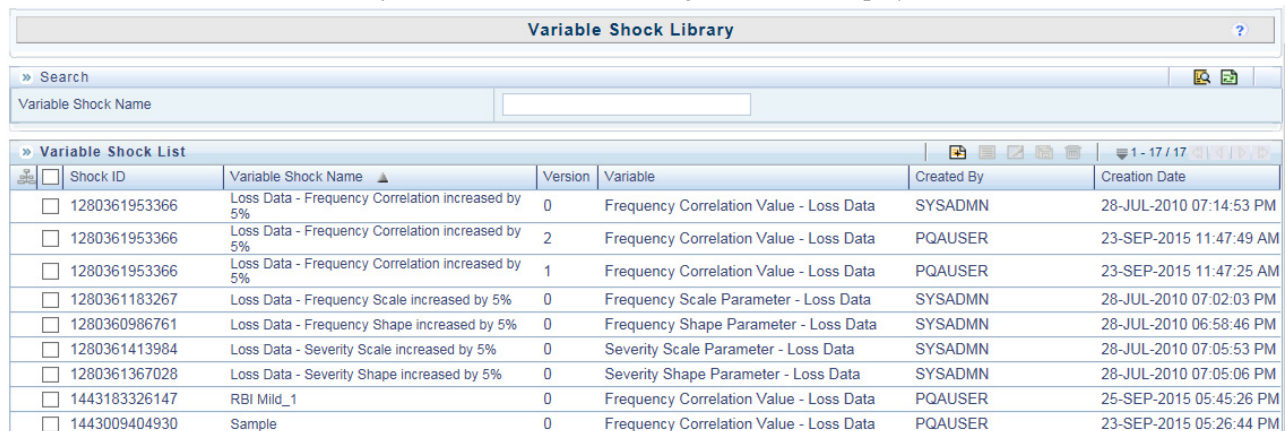
This section includes the following topics:

- Accessing Variable Shock Library
- Adding Variable Shock Definition
- Viewing Variable Shock Definition
- Modifying Variable Shock Definition
- Copying Variable Shock Definition
- Deleting Variable Shock Definition
- Searching Variable Shock Library

Accessing Variable Shock Library

To access the Variable Shock Library page, follow these steps:

1. Select **Oracle Financial Services Enterprise Modeling** from the Application tab.

2. Click ▶ to expand Stress Testing.

3. Click **Variable Shock Library**. The *Variable Shock Library* window is displayed.

	Shock ID	Variable Shock Name ▲	Version	Variable	Created By	Creation Date
☐	1280361953366	Loss Data - Frequency Correlation increased by 5%	0	Frequency Correlation Value - Loss Data	SYSADMN	28-JUL-2010 07:14:53 PM
☐	1280361953366	Loss Data - Frequency Correlation increased by 5%	2	Frequency Correlation Value - Loss Data	PQAUSER	23-SEP-2015 11:47:49 AM
☐	1280361953366	Loss Data - Frequency Correlation increased by 5%	1	Frequency Correlation Value - Loss Data	PQAUSER	23-SEP-2015 11:47:25 AM
☐	1280361183267	Loss Data - Frequency Scale increased by 5%	0	Frequency Scale Parameter - Loss Data	SYSADMN	28-JUL-2010 07:02:03 PM
☐	1280360986761	Loss Data - Frequency Shape increased by 5%	0	Frequency Shape Parameter - Loss Data	SYSADMN	28-JUL-2010 06:58:46 PM
☐	1280361413984	Loss Data - Severity Scale increased by 5%	0	Severity Scale Parameter - Loss Data	SYSADMN	28-JUL-2010 07:05:53 PM
☐	1280361367028	Loss Data - Severity Shape increased by 5%	0	Severity Shape Parameter - Loss Data	SYSADMN	28-JUL-2010 07:05:06 PM
☐	1443183326147	RBI Mild_1	0	Frequency Correlation Value - Loss Data	PQAUSER	25-SEP-2015 05:45:26 PM
☐	1443009404930	Sample	0	Frequency Correlation Value - Loss Data	PQAUSER	23-SEP-2015 05:26:44 PM

Figure 46. Variable Shock Library

Adding Variable Shock Definition

This feature facilitates you to define a variable shock by filtering through the specific required parameters. The options available to filter the data vary depending on the variable type selected.

To add variable shock definition, follow these steps:

1. Select ![icon] from the *Variable Shock List* tool bar. The **Add** button is disabled if you have selected any checkbox in the grid. The *Variable Shock Definition (New Mode)* window is displayed.

Figure 47. Variable Shock Definition

2. Enter the Variable shock details as described in the following table:

Table 12. Variable Shock Definition - Field Descriptions

Field	Description
Fields marked in red asterisk (*) are mandatory.	
Shock Name	Enter a name for the variable shock. Ensure that there are no special characters like `, {,},",', ~, <,>, /, \, and multiple spaces.
Shock Description	Enter the required description for the variable shock.
Dataset	1. Click ![icon] and open the Dataset browser. The available datasets are listed in the Members pane.
	2. Select the required Dataset based on which the variable shock is to be created and click ![icon] .
	3. Click **OK**.
	Note: The Datasets based on Derived Entities are not supported.

Table 12. Variable Shock Definition - Field Descriptions

Field	Description
Variable Name	1. Click [...] and open the Variable browser. The defined variables are listed in the Members pane. 2. Select the required variable based on which the variable shock is to be created and click ▶. If you want to create Categorical Shock, select Nominal or Ordinal Variable. 3. Click **Ok.**
Is Formula based	Select **Yes** if variable shock is based on formula.
Time Specification: Specify the shifts in the value across multiple time points.	
Time Hierarchy	1. Click [...] and open the Hierarchy browser. The available Time Hierarchies are listed in the Members pane. 2. Select the required Time Hierarchy based on which the variable shock is to be created and click ▶. 3. Click **Ok.**
Shock Type	Select the shock type from the drop-down list, as either: ● **Across Time** - to specify shocks at multiple time points and the occurrence of which can be in the past or in the future. ● **Instantaneous** - if you do not have specific time points and want to shock the data based on the current values. Selecting Instantaneous will disable the other options in the Time Specification of Shock grid.
If **Across Time** option is selected in the Shock Type	The **Shock in Reference** is selected as **Current Value**. Select **Time Point** as either **Standard** or **Custom**. ● **Standard**- Select this option if you want to use system generated standard **Time Point values**. ■ Specify **Number of Time Points** and click 🔁. The **Time Point values** are auto populated. ● **Custom**- Select this option if you want to specify custom **Time Point Values**. ■ Specify **Number of Time Points** and click 🔁. Enter required **Time Point Values** Specify the frequency from the drop-down list as **Days**, **Weeks**, **Months**, or **Years**. 4.

Table 12. Variable Shock Definition - Field Descriptions

Field	Description
Filter Specification: Define the filtering criteria for the specified shock. The option is available only for **Idiosyncratic Variables**. Multiple shocks can be applied across filters which are specified based on combinations of dimensions. **Note:** While defining a Variable Shock across time, a Dataset with Date Filter should be selected. For more information, see Creating Data Set section in the *Oracle Financial Services Analytical Applications Infrastructure User Guide*. 1. Click ⬛ in the *Filter Specification* toolbar and open the *Filter Browser* window. 2. Click ⬛ to open the *Hierarchy Browser* window. 3. Select the required hierarchy(s) and click ➡. 4. Click **OK** and return to the *Filter Browser*. 5. In the Hierarchical list, click ⊞ to expand a node and select the required checkbox. 6. Click ➡ and move the selection to the *Selected Hierarchies* pane. 7. Click **OK**. The selected hierarchies are displayed in the *Selected Dimensions* pane.	
Shock Parameters: Specify quantum of shifts in variables, based on time specification and shock curve.	
Shock Unit	This field is not displayed for **Idiosyncratic Variables** (categorical variable). Select the shock unit from the drop-down list. The available options are: ● Percentage Shift ● Absolute Shift ● Absolute Value ● Standard Deviation Shift ● Long Standard Deviation Shift A shock value may be positive or negative.
Time Window Size	If you have selected **Standard Deviation Shift** or **Long Standard Deviation Shift** as **Shock Unit**, this field is enabled with a default value "2". You can change the same by entering the required value.
Shock Curve	Shock Curve is enabled for term structure variables. Select any of the following option from the drop-down list. ● Parallel ● Twist ● Inversion
Sampling Percentage	This field is displayed for categorical variables. By default, sampling percentage is selected as 100. Specify the percentage of data for which you want to apply shock.
Seed Value	Seed is the start point of the sequence, which is used to ensure the same set/ sequence of data is selected every time for applying shock, since each seed value corresponds to the same sequence. Select **Enter seed value** from the drop-down list and enter the Seed Value as required. By default, 1234 is selected. Select **Random seed value** if you want to use system generated random value as Seed Value.

Table 12. Variable Shock Definition - Field Descriptions

Field	Description
Shock Values	Shock Value is the quantum of shift in the variable. You can specify Shock Values across filters and time points. If **Shock Unit** is selected as **Absolute Value**, click [icon] and enter the required shock value for the **Time Points**. You can specify a shock that involves a transition from one category to another or map the selected to a shock category. 1. Click [icon] in the *Shock Value* toolbar. The *Category Browser* window is displayed. 2. Select the required category and click [icon] 3. Click **OK**. 4. Click [icon] to generate the list of shock values that are selected. The selected Time Points are displayed for each selected category. 5. Click [icon] against the listed category and specify the values for each category from the *Category Browser* window. 6. Click **OK**.
If you select **No** for **Is Formula based** option, the following fields are displayed: This option is used if you want to apply shock based on the uploaded Scenario values.	
Source	Select the source from the drop-down list. This will list the sources who have provided the scenario data which is uploaded in the system.
Scenario Name	Select the appropriate Scenario from the drop-down list. It displays the Scenarios uploaded for the selected source.
Column	Select the appropriate column from the drop-down list. It will show all the columns of the scenario file uploaded for the selected source and scenario name. The value in the selected column will be considered as the shocked value. **Note:** The Column list is not refreshed when you change the Source.

3. Click **Save**. The new variable shock details are saved and displayed in the *Variable Shock Library* window.

Viewing Variable Shock Definition

You can view individual Variable Shock Definition details at any given point.

To view the existing Variable Shock Definition details, follow these steps:

1. Select the checkbox adjacent to the Shock ID.

2. Click [icon] from the *Variable Shock List* tool bar. The *Variable Shock Definition View* window is displayed with the variable shock details.

Modifying Variable Shock Definition

You can modify only the Shock Description if the selected shock is mapped to a Variable definition. If not, then all the filtering parameters can be modified except the Shock Name. When you modify any of the Variable Shock

parameters other than the Shock Description, the details are uploaded as an incremented version without overwriting the existing definition details.

To modify an existing Variable Shock Definition follow these steps:

1. Select the checkbox adjacent to the Shock ID whose details are to be updated.

2. Click ![icon] in the *Variable Shock List* tool bar. Edit button is disabled if you have selected multiple Shock IDs. The *Variable Shock Definition Edit* window is displayed.

3. Edit the Variable Shock Definition details as required. For more information, refer to *Add Variable Shock Definition*.

4. Click **Save** to save the changes.

Copying Variable Shock Definition

The Copy Variable Shock Definition facilitates you to quickly create a new Shock Definition based on the existing shock variables or by updating the values of the required variables.

To copy an existing Variable Shock Definition follow these steps:

1. Select the checkbox adjacent to the Shock ID whose details are to be duplicated.

2. Click ![icon] in the *Variable Shock List* tool bar. The **Copy** button is disabled if you have selected multiple Shock ID(s).

3. In the *Variable Shock Definition Copy* window, you can:

● Create new variable shock definition with existing variables. Specify a new Variable Name and click **Save**.

● Create new variable shock definition by updating the required variables. Specify a new Variable Name and update the required details. For more information, refer *Add Variable Shock Definition*. Click **Save**.

The Variable Shock details are displayed in the Variable Shock Library window.

Deleting Variable Shock Definition

You can remove the variable shock definition(s) which are not used in Scenario Definition and which are no longer required in the system, by deleting from the Variable Shock Library window.

To delete for Variable Shock Definition, follow these steps:

1. Select the checkbox adjacent to the Shock ID whose details are to be removed.

2. Click ![icon] in the *Variable Shock List* tool bar.

3. Click **OK** in the information dialog to confirm deletion.

Searching Variable Shock Library

The Variable Shock Library page allows you to search specific model execution request.

To search for Variable Shock Library, follow these steps:

1. Navigate to the *Variable Shock Library* window.

2. Enter the **Variable Shock Name**.

3. Click ![icon]. The filtered list is displayed.

Scenario Management

Scenario in Stress Testing refers to a set of unusual, hypothetical events structured within the variables. A scenario can be defined using variable based shocks and every single Variable Shock constitutes a scenario.

Scenario Management within the Stress Testing enables you to define and maintain multiple Scenarios on the same set of Variables in the Production Information Domain. You can also view, modify, copy, and delete scenario(s).

This section includes the following topics:

- Accessing Scenario Management
- Adding Stress Testing Scenario
- Viewing Stress Testing Scenario
- Modifying Stress Testing Scenario
- Copying Stress Testing Scenario
- Deleting Stress Testing Scenario
- Searching Scenarios

Accessing Scenario Management

To access the Scenario Management page, follow these steps:

1. Select **Oracle Financial Services Enterprise Modeling** from the Application tab.

2. Click ![icon] to expand Stress Testing.

3. Click **Scenario**. The Scenario Management page is displayed.

Figure 48. Scenario Management

Adding Stress Testing Scenario

You can create stress testing scenario by associating the appropriate Variable Shock Definitions. To add stress testing scenario definition, follow these steps:

1. Select ![icon] from the *Scenario List* tool bar. The **Add** button is disabled if you have selected any checkbox in the grid. The *Scenario Definition* window is displayed.

Figure 49. Scenario Definition Page

2. Enter the Scenario details as described in the following table:

Table 13. Scenario Definition - Field Descriptions

Field	Description
Fields marked in red asterisk (*) are mandatory.	
Scenario Name	Enter a name for the scenario. Ensure that there are no special characters like `` ` ``, {,},",',~, <,>, /, \, and multiple spaces.
Scenario Description	Enter the required description for the scenario.

To add Variable Shock to the scenario, follow these steps:

1. Select from the *Variable Shocks* tool bar. The **Add** button is disabled if you have selected any checkbox in the grid. The *Add Variable Shocks to Scenario* window is displayed.

Figure 50. Add Variable Shocks to Scenario

2. Select the required variable(s) by clicking on the adjacent checkbox in the *Variable Shock List* grid.
   You can also make use of Search option to search for a variable by specifying Variable Name, Shock Name or even by selecting the Variable Type, Shock type, Source and Scenario from the drop-down list.

3. Click **OK**. The selected variables are listed in the *Variable Shock* grid in the *Scenario Definition* window.

   You can also remove a variable by selecting the adjacent checkbox and clicking .

4. Click **Save**. The scenario details are saved and displayed in the *Scenario Management* window.

Viewing Stress Testing Scenario

You can view individual Scenario Definition details at any given point.

To view the existing Scenario Definition details, follow these steps:

1. Select the checkbox adjacent to the Scenario ID.

2. Click in the Scenario List tool bar.
   The Scenario Definition View window is displayed with the scenario details and the mapped variable shock.

Modifying Stress Testing Scenario

You can modify only the Scenario Description if the selected scenario is mapped to a Stress definition. If not, then all the filtering parameters can be modified except the Scenario Name. When you modify any of the Scenario parameters other than the Scenario Description, the details are uploaded as an incremented version without overwriting the existing scenario details.

To modify an existing Scenario Definition, follow these steps:

1. Select the checkbox adjacent to the Scenario ID whose details are to be updated.

2. Click in the Scenario List tool bar. Edit button is disabled if you have selected multiple Scenario IDs. The Scenario Definition Edit window is displayed.

3. Edit the Scenario Definition details as required. For more information, refer *Add Stress Testing Scenario*.

4. Click **Save** to save the changes.

Copying Stress Testing Scenario

The Copy Stress Testing Scenario facilitates you to quickly create a Scenario definition based on the existing details or by updating the values and remapping the required variables.

To copy an existing Stress Testing Scenario Definition, follow these steps:

1. Select the checkbox adjacent to the Scenario ID whose details are to be duplicated.

2. Click in the Scenario List tool bar. The Copy button is disabled if you have selected multiple Scenario IDs.

3. In the Scenario Definition Copy window, you can:

● Create new scenario definition with existing variables. Specify a new Scenario Name and click **Save**.

● Create new scenario definition by updating the required variables. Specify a new Variable Name and remap the required variables. For more information, refer *Add Stress Testing Scenario*. Click **Save**.

The scenario definition details are displayed in the Scenario Management window.

Deleting Stress Testing Scenario

You can remove only those scenarios which are not mapped to any Stress Definitions and which are no longer required in the system, by deleting from the Scenario Management window.

To delete an existing Stress Testing Scenario Definition, follow these steps:

1. Select the checkbox adjacent to the Scenario ID whose details are to be removed.

2. Click in the Scenario List tool bar.

3. Click **OK** in the information dialog to confirm deletion.

Searching Scenarios

The Scenario Management page allows you to search for scenarios.

To search for Scenarios, follow these steps:

1. Navigate to the *Scenario Management* window.

2. Enter the **Scenario Name**.

3. Click . The filtered list is displayed.

Stress Definition

Stress refers to modeling a series of scenarios to analyze the impact of extreme market conditions and to measure the risk. This module enables you to create a stress definition. You can either specify a stand-alone execution of a Scenario, or map a Scenario(s) to a Baseline Run. The integrated process helps you to assess the impact of a Scenario across multiple areas. You can also view, modify, and delete stress definitions.

This section includes the following topics:

- Accessing Stress Definition
- Adding Stress Definition
- Executing Stress Definition
- Viewing Stress Definition
- Modifying Stress Definition
- Deleting Stress Definition
- Searching Stress Definition

Accessing Stress Definition

To access the Stress Definition page, follow these steps:

1. Select **Oracle Financial Services Enterprise Modeling** from the Application tab.

2. Click to expand Stress Testing.

3. Click **Stress Definition**. The Stress Definition page is displayed.

Figure 51. Stress Definition Page

Adding Stress Definition

Stress definition can be based on stress scenarios or business assumptions. A business assumption is essentially a process comprising of multiple rules which facilitate the computation of the impact of the assumption on base cash flows. Business assumptions are non-variable based.

Scenario based stress testing involves applying simultaneous shocks on multiple variables to assess the impact of scenario on a measure or a set of measures.

To add stress definition, follow these steps:

1. Select from the Stress Definition List tool bar. The Stress Definition Add window is displayed. The Add button is disabled if you have selected any checkbox in the grid.

Figure 52. Stress Definition Page

2. Enter the Stress Definition details as described in the following table::

Table 14. Stress Definition - Field Descriptions

Field	Description
Fields marked in red asterisk (*) are mandatory.	
Stress Name	Enter a name for the stress definition. Ensure that there are no special characters like `, {,},", ', ~, <,>, /, \, and multiple spaces.
Stress Definition Description	Enter the required description for the stress definition.
Segment	Select the Segment from the drop-down list. The list displays all segments mapped to your user group.

Table 14. Stress Definition - Field Descriptions

Field	Description
Base Line Run	1. Click ⬚ and open the Baseline Run browser. The available Baseline Runsin the selected Segment are listed in the Hierarchical pane. **Note**: 2. Select the required Baseline Run based on which stress definition is to be created and click ⬚ . 3. Click **OK**. 4. Click ⬚ and view the selected baseline Run details.
Scenario	If the stress definition is based on variable shocks, select the scenario which you have defined with the required variable shocks. If it is non-variable based as in liquidity risk management, you need not select the scenario. 1. Click ⬚ and open the Scenario browser. The available Scenarios are listed in the Hierarchical pane. 2. Select the required Scenario based on which stress definition is to be created and click ⬚ . 3. Click **OK**.

4. In the *Run Details* grid, all the processes and tasks associated with the selected baseline run is displayed.

- You can insert a new process to the selected Baseline run.

- You can replace a process in the selected baseline run with another process. The process replacement can happen only for the processes which are directly placed under the run.

  - Select the checkbox adjacent to the process and click ⬚ to replace it with another process. The *Tasks Browser* window displays all the processes which are defined in the selected segment and infodom.

  - Select the required process from the list and click ⬚ . You cannot select a process which is already present in the baseline run.

- You can modify or replace a task within a process with another task.

  - Select the checkbox adjacent to the task and click ⬚ . The Tasks Browser window displays all the tasks which are defined in the selected segment and infodom.

  - Select the required process from the and click ⬚ .

- Select a task and click ⬚ to delete it.

- Select a process and click ⬚ to delete it.

- Set the precedence in which the tasks need to be executed.

■ Click ⬚ adjacent to the Precedence field of a task. The available scenarios/ tasks are listed in the Precedence Browser window.

■ Select the tasks in the order in which they need to be executed and click ⬀ . You can change the order by clicking ⬆ and ⬇ .

● Provide the Parameters for the task in the **Parameters** field.

   Note: If the configuration is set to RRF, then the Parameters field value must be specified within double quotes.

5. Click **Save**. The stress definition details are saved and displayed in the *Stress Definition* window.

Executing Stress Definition

After creating stress definition, you need to create Manage Run Definition. Based on the Run Type (Single Request or Multiple Request), you need to execute the stress definition from Batch Execution window or Batch Group Execution window respectively. You can also monitor the status of stress definition execution.

To execute stress definition, follow these steps:

1. Go to **Rules Framework > Manage Run Execution**. The Manage Run Execution window is displayed.

2. Click ⬚ from the List toolbar. The Manage Run Execution window is displayed.

3. Click ⬚ in the Run field and select the Stress Definition that you want to execute from the Run Selector window. For more information, refer to the *Manage Run Definition* section in the *Oracle Financial Services Analytical Applications Infrastructure User Guide*.

4. Click **Save**.

5. Execute the stress definition:

● If you have selected Type as Single Request in the Manage Run Execution window:

1. Go to **Operations> Batch Execution**. The Batch Execution window is displayed. For more information on how to execute a Batch, refer to the *Execute Batch* section in the *Oracle Financial Services Analytical Applications Infrastructure User Guide*.

2. Click **Execute Batch**.

● If you have selected Type as Multiple Request in the Manage Run Execution window:

1. Go to **Operations> Batch Group Execution**. The Batch Execution window is displayed. For more information on how to execute a Batch Group, refer to the *Batch Group Execution* section in the *Oracle Financial Services Analytical Applications Infrastructure User Guide*.

2. Click **Start**.

To monitor the stress execution:

● For Batch Execution:

1. Go to **Operations> Batch Monitor**. The Batch Monitor window is displayed.

2. Select the Stress Definition whose execution you want to monitor and select the Batch Run details. For more information, refer to the *Monitor Batch* section in the *Oracle Financial Services Analytical Applications Infrastructure User Guide*.

3. Click to start monitoring.

● For Batch Group Execution:

1. Go to **Operations> Batch Group > Batch Group Monitor**. The Batch Group Monitor window is displayed.

2. Select the Batch Group and Run IDs from the drop-down lists. For more information, refer to the *Batch Group Monitor* section in the *Oracle Financial Services Analytical Applications Infrastructure User Guide*.

3. Click **Refresh** to start monitoring

● To view log files:

1. Go to **Operations> Batch Processing Report.** The Batch Processing Report window is displayed.

2. Select the Information Date and Batch Status from the drop-down lists. For more information, refer to the *Batch Processing Reports* section in the *Oracle Financial Services Analytical Applications Infrastructure User Guide*.

Viewing Stress Definition

You can view individual Stress Definition details at any given point.

To view the existing Stress Definition details, follow these steps:

1. Select the checkbox adjacent to the Stress ID.

2. Click in the Stress Definition tool bar. The Stress Definition View window is displayed with the stress definition details along with the mapped scenarios.

3. Click in the Model Variable Shock Mapping toolbar. The Model Variable Shock Mapping window is displayed with the list of variable shocks associated with the selected scenario.

Modifying Stress Definition

You can modify only the Stress Description and Scenario for any selected Stress Definition.

To modify an existing Stress Definition, follow these steps:

1. Select the checkbox adjacent to the Stress ID whose details are to be updated.

2. Click in the Stress Definition List tool bar. The Edit button is disabled if you have selected multiple Stress IDs. The Stress Definition Edit window is displayed.

3. Edit the Stress Definition details as required. For more information, refer to *Add Stress Definition*.

   Note: While editing Stress Definition, you cannot unmap a scenario that is mapped to the stress definition. You can only change the version of the scenario.

4. Click **Save** to save changes.

Deleting Stress Definition

You can remove the stress definitions which are no longer required in the system, by deleting from the Stress Definition Summary window.

Note: Sress definitions, which use PR2 Base Line Run and has batch registered for processing, cannot be deleted. However, Stress definitions, which use RRF Base Line Run, can be deleted irrespective of whether it has batch registered for processin.

To delete a Stress Definition, follow these steps:

1. Select the checkbox adjacent to the Stress ID whose details are to be removed.

2. Click in the Stress Definition List tool bar.

3. Click **OK** in the information dialog to confirm deletion.

Searching Stress Definition

The Stress Definition page allows you to search specific model execution request.

To search for Stress Definition, follow these steps:

1. Navigate to the Stress Definition page.

2. Enter the Stress Definition Name.

3. Click . The filtered list is displayed.

APPENDIX A   *References*

This section of the document consists of information related to intermediate actions that needs to be performed while completing a task. The procedures are common to all the sections and are referenced where ever required. You can refer to the following sections based on your need.

R Scripts and Oracle R Enterprise (ORE) Statistical Functions

Data usage when R script is used entirely

While defining a model scripted in R, user can select **Dataset** and **Variables** to assign data (table columns) to the R/ ORE objects used within the script. Oracle Financial Services Enterprise Modeling application prepares data from the dataset, variables and other attributes like filters chosen for the model and will make the same available as user specified R objects/ frames.

No specific treatment is required in the script for using the data. User can just have an R data.frame object say 'GDP' and a variable (table.column) assigned to it and use 'GDP' as is in the script.

Data usage when ORE native implementation is employed - Oracle Financial Services Enterprise Modeling application - Specifics to be considered

The data which is prepared from the dataset and variables as explained in the previous section, will be available in this case as a named ORE ore.frame object ('OFSDATASET') when ORE native implementations are used (that is, when the **Is ORE implementation used?** checkbox is selected). Hence, the R objects(data) must always be accessed through the ore.frame object 'OFSDATASET'.

For instance, if two objects say 'x' and 'y' are used and dataset/ variables are chosen for 'x' and 'y' in the model definition, then the objects 'x' and 'y' should be accessed in the script as 'OFSDATASET$x' and 'OFSDATASET$y' respectively.

An illustration to explain the R and ORE cases is given in the following section:-

For a simple regression model which is entirely scripted in R, that uses a dataset and three variables (DependentVariable, IndependentVariable1 and IndependentVariable2), the user should not select the **Is ORE implementation used?** checkbox. In this case the R script is as follows:

```
art.mod<-lm(DependentVariable ~ IndependentVariable1 + IndependentVariable2)
art.summ<-summary(art.mod)
coef( art.summ )
art.summ[[ "r.squared" ]]


#do some line plots
new.x.datafrme = data.frame(x=seq(from=range(IndependentVariable1)[ 1 ],to=range(
IndependentVariable1)[2],length=length(DependentVariable)))
```

Here the variables chosen for the model are accessed directly in the script as IndependentVariable1, IndependentVariable2, and DependentVariable.

Whereas for a parallel ORE implementation of the same (a dataset and three variables DependentVariable, IndependentVariable1 and IndependentVariable2) using ORE statistical functionalities, user must check the **Is ORE implementation used?** checkbox and the script is as follows:

```
art.mod<-ore.lm(DependentVariable ~ IndependentVariable1 + IndependentVariable2,
data=OFSDATASET)
art.summ<-summary(art.mod)
coef( art.summ )
art.summ[[ "r.squared" ]]
```

```
#do some line plots
new.x.orefrme = data.frame(x=seq(from=range(OFSDATASET$IndependentVariable1 )[ 1
],to=range(OFSDATASET$IndependentVariable1)[2],length=
length(OFSDATASET$DependentVariable)))
#perform some operations on the new data
```

Here the variables chosen for the model are accessed from OFSDATASET as
OFSDATASET$IndependentVariable1, OFSDATASET$IndependentVariable2,
OFSDATASET$DependentVariable.

Data Handling

It is highly recommended that data required from the database should be pulled through the framework provided
mechanism, that is, using dataset and variables and not with any explicit DB connections. This ensures proper
security, authenticity, and auditing.

Auditing is enabled in the definition windows by introducing audit trials that captures and displays the user details
and the date of creation/ modification, along with comments.

For instance, here is a sample script where data is fetched from the DB directly (not through framework). This way
of accessing the database resident data in a model is not recommended.

```
con<-dbConnect(Oracle(),"userName","password")
qry<-"select EventLoss as Y, CardType as X1, AccBalance as X2, CustSalary as X3 from
CustTable where  Default= 'Y' "
res<- dbSendQuery(con, qry)
OperationalData<-fetch(res)
dbDisconnect(con)

#Model Logic
NewRegModel<-lm(Y~X1+X2+X3, data= OperationalData)
Plot(NewRegModel)
NewRegModel
```

Here is how a script for the same purpose can be created for accessing data via framework dataset and variables.
Define 'EventLoss', 'CardType', 'AccBalance', and 'CustSalary' from the table 'CustTable' as variables in the Oracle
Financial Services Enterprise Modeling application. while defining the model, select these variables and assign them
to R objects (the R names used within the script) say, 'IndepVariable1', 'IndepVariable2', 'IndepVariable3' and
'DepVar' from the Configure Inputs window.

```
#Assuming EventLoss, CardType, AccBalance, CustSalary from #CustTable are defined as
variables in a data set, and that #dataset is selected for variable assignments to the
respective R #variable names: Y, X1, X2, and X3.

NewRegModel<-lm(DepVar ~ IndepVariable1+ IndepVariable2+ IndepVariable3)

#The variables are made directly available to the R
#environment by the framework

Plot(NewRegModel)
NewRegModel
```

Logging

R processing log that captures script processing information, any warnings, errors or exceptions from the script, gets generated in the database server at '$ORACLE_HOME/dbs', since the R executable runs completely on the database server. Purging of the files is recommended at a regular basis.

Fitting and Prediction Using R Script

In order to support fitting and prediction using R script, the output objects can be stored in datastore using ore.save() during fitting and retrieve it using ore.load() during prediction.

ore.save() saves an R object or a list of R objects to the specified datastore in the current user's schema of the connected database.

ore.load() loads all of the R objects stored in a specified datastore from the current user's schema of the connected database.

For more information, refer to the *Oracle® R Enterprise User's Guide* (E36761-08).

The approach to use ore.save() and ore.load() is explained with the following example:

R scripting

Fitting:

```
fit<-lm(y~x)
ore.save(fit, name='regression_fit', overwrite=TRUE)
```

`ore.save()` will store the R object 'fit' in the datastore with the name 'regression_fit'. overwrite is a logical value specifying whether to overwrite the datastore if it already exists; the default is FALSE.

The overwrite flag is set to true to make sure that ore.save() does not fail. This is one way of doing it; otherwise the user's script should check for the existence of the datastore object.

Prediction:

```
ore.load('regression_fit')
predict<-predict(fit)
```

`ore.load()` is going to load all the R objects in the datastore 'regression_fit'.

From the datastore user should know the R object name to be used in the predict call.

ORE scripting

The approach is same as explained above, but the **Is ORE implementation used?** checkbox to be checked.

Fitting:

```
ore_fit<-ore.lm(y~x, data=OFSDATASET)
ore.save(ore_fit, name='ore_regression_fit', overwrite=TRUE)
```

Prediction:

```
ore.load('ore_regression_fit')
predict<-ore.predict(ore_fit,  newdata=OFSDATASET)
```

List of Prepackaged ORE Techniques

The table lists the prepackaged ORE Techniques.

Table 15. List of Prepackaged ORE Techniques

Button	Description
Regression Techniques	• R_Linear Regression • R_GLM Logistic Regression • R_Stepwise Regression
Clustering Techniques	R_K-means Clustering
Correlation Techniques	• R_Kendall Rank Correlation • R_Pearson Correlation Coefficient • R_Spearman Rank Correlation

List of NAG Techniques

The OFSAA Infrastructure aims to address the statistical computation needs of a Bank for its operations. The techniques that are supported including the regression models as well as Static Variable Transformations are as follows:

Table 16. List of NAG Techniques

Button	Description	
Business Models	Credit Risk	• CashFlow Model • Conditional Default Model • Credit Metrics Structural Model • Distribution Fitting based Future Value Model • Historical Loss Distribution Fitting Model • Historical Pool Average Default Rate Model • Merton Model • Time to Default Model • VAR Reader
	Market Risk	• EWMA Model • GARCH Model • Market Risk VaR Model
	Operational Risk	Loss Distribution Approach
Statistical Techniques	Analysis of Variance	Two Factor Without Replication
	Classification and Regression Trees	• Entropy • GINI
	Copula	• Cook-Johnson • Empirical • Gaussian • Gumbel - Hougaard • Student t
	Data Analysis	• Bivariate Analysis • Descriptive Statistics
	Factor Analysis	• Maximum Likelihood Extraction Method • Principal Component Extraction method
	Goodness of Fit Tests	• Anderson - Darling Test • Chi-Square Test • Kolmogrov-Smirnov Test

Table 16. List of NAG Techniques

Button	Description	
	Monte Carlo Simulation for Continuous Distributor	• Beta • Burr • Chi - Square • Empirical • Exponential • Gamma • Generalized Pareto • Gumbel • Log Gamma • Log Logistic • Log Normal • Log Weibull • Multivariate Normal • Pareto Distribution • Snedecor F • Student t • Truncated Burr • Truncated Exponential • Truncated Gamma • Truncated Gumbel • Truncated Log- Gamma • Truncated Log- Logistic • Truncated Log- Normal • Truncated Pareto • Truncated Uniform • Truncated Weibull • Uniform • Univariate Normal • Weibull
	Monte Carlo Simulation for Discrete Distributions	• Binomial • Negative Binomial • Poisson
	Multivariate Methods	• Discriminant Analysis • Hierarchical Clustering • k-means • k-means and Boundary Based Prediction

Table 16. List of NAG Techniques

Button	Description	
	Non-Parametric Tests	• Kruskal Wallis • Mann Whitney • Median Test • Run Test • Sign Test • Two sample KS Test • Wilcoxon Sign Rank
	Optimization techniques	• Linear Programming • Quadratic Programming
	Parametric Tests	• Two Sample t-Test
	Regression Techniques	• Generalized Linear Models - Gamma errors • Generalized Linear Models - Gaussian errors • Linear Regression • Linear Regression with Mixed Effects - ML • Linear Regression with Mixed Effects - REML • Logistic Regression • Monte Carlo Expectation Maximization • Poisson Regression • Stepwise Regression
	Simultaneous Equations	• Hermitian Linear Equations • Simultaneous Linear Equations with Choleskey Factorization • Simultaneous Linear Equations with LU Factorization
	Time Series	• ARIMA • Autocorrelation • Cross Correlation between two Time Series

Table 16. List of NAG Techniques

Button	Description	
	Transition Matrix	• Transition Matrix - EWMA • Transition Matrix - Linear Regression • Transition Matrix - Multi Factor • Transition Matrix - Stepwise Regression • Transition Matrix - Time Series
	Variance Covariance and Correlation Matrix	• Kendall Rank Correlation • Pearson Correlation Coefficient • Spearman Rank Correlation

Prediction Techniques

The table lists the Prediction Techniques used in Oracle Financial Services Enterprise Modeling Application

Table 17. List of Prediction Techniques

Button	Description
Regression Techniques	• Generalized Linear Mixed Models with Gamma Errors • Generalized Linear Mixed Models with Gaussian Errors • Linear Regression • Logistic Regression • Linear Regression with Mixed Effects - ML • Linear Regression with Mixed Effects - REML • Monte Carlo Expectation Maximization • Poisson Regression • Stepwise Regression
Clustering	• K-means and Boundary Based Prediction • Discriminant Analysis • Hierarchical Clustering
Classification and Regression Trees	GINI
Factor Analysis	Principal Component Extraction Method
Time Series	ARIMA

Transition Matrix

Transition Matrix is a statistical technique used across multiple applications in OFSAA. Transition Matrix is defined as a set of measures that quantify the probability of moving data from one state to another. Transition Probability defines the probability of transitioning data from one state to another over the time interval. The time interval and the horizon on which probabilities are estimated are derived from the User Input in the model definition interface.

Transition Matrix technique parameters are completely based on historical data. You can create multiple transition matrices and calibrated a set of data. For example institutions may calibrate different transition matrices for wholesale and retail exposures.

You can calibrate the parameters of a Transition Matrix technique by defining the required options in the Model Definition window. The Model Definition window within the Model Management section of Oracle Financial Services Enterprise Modeling application consists of the following five different types of transition matrix techniques. Click on the required section to view the details.

- Transition Matrix - EWMA
- Transition Matrix - Linear Regression
- Transition Matrix - Multi Factor
- Transition Matrix - Stepwise Regression
- Transition Matrix - Time Series

Transition Matrix - EWMA

In EWMA (Exponentially Weighted Moving Average) method the Decay factor is the mandatory parameter required as user input. There is no calibration associated with the EWMA Model. The framework predicts transition probabilities based on user input of decay factor and time interval.

Transition Matrix - Linear Regression

Linear Regression method is used to establish relationship between Explanatory Variable(s) with a Scalar Variable. Linear Regression technique uses Linear functions for data modeling which can also estimate the unknown model parameters.

Regression scenario: Suppose you want to learn more about the purchasing behavior of customers of different ages. You can build a model to predict the ages of customers as a function of various demographic characteristics and shopping patterns. The prediction can then be done using a regression algorithm.

Transition Matrix - Multi Factor

The Multi Factor technique of model calibration refers to the process of estimating measures such as the Average Z-Score (difference between Standard Deviation from Mean), Average Transition, and so on. The historical data is transferred to the Sandbox Information Domain for model calibration. The following are the steps required for the estimation of the above measures:

Calculate the historical average transitions.

Calculate the z-scores.

Subtract the average z-score from each historical time series.

In addition to calculating realized z-scores, the calibration process also computes the average z-score for each row of historical z-score time series and a parameter Alpha which is the standard deviation of average z-score shifts.

Transition Matrix - Stepwise Regression

In stepwise regression, the independent variables are selected automatically and the model is constructed in an iterative fashion. The three approaches for achieving the stepwise regression are:

- **Forward Selection**: In which the inclusion of a variable completely depends on its statistical significance.

- **Backward Elimination**: In which the included candidate variables are tested for xsstatistical significance and are eliminated as they fail.

- **Combination**: This includes both Forward Selection and Backward Elimination process in which the variables are tested at different steps (check points) to determine whether they need to be carried along or not.

Transition Matrix - Time Series

Time series regression includes a series of data points considered at consecutive time intervals. This type of analysis is done to validate the time series data and to extract the statistics of the data under consideration. This model can also predict the future values using the previously observed values.

APPENDIX B   *User Groups*

User Groups

Table 18. User Groups

User Group Name	User Group Description
Modeling Administrator	User mapped to this group will have access to all the menu items for Enterprise modeling and will be have authorization rights for sandbox population, model deployment and modeling technique authorization.
Modeler Group	User mapped to this group will have access to all the menu items for Enterprise modeling but will not have authorization rights for sandbox population, model deployment and modeling technique authorization.

User Group - Role Mapping

Table 19. User Group to Role Mapping

Group Name	Role Name
Modeler	Alias Access
Modeler	Alias Read Only
Modeler	Alias Write
Modeler	Atomic excel upload write
Modeler	BMM Hierarchy Access
Modeler	BMM Hierarchy Read Only
Modeler	BMM Hierarchy Write
Modeler	BMM Processor Access
Modeler	BMM Processor Read Only
Modeler	BMM Processor Write
Modeler	Batch Access
Modeler	Batch Read Only
Modeler	Batch Write
Modeler	Config excel advanced
Modeler	DEFQ Manager
Modeler	DEFQ write
Modeler	DI Write
Modeler	DMM Write
Modeler	DQ Access
Modeler	DQ Advanced
Modeler	DQ Read
Modeler	DQ Write
Modeler	DT Write
Modeler	Dataset Access
Modeler	Dataset Read Only
Modeler	Dataset Write
Modeler	Derived Entity Access
Modeler	Derived Entity Read Only
Modeler	Derived Entity Write
Modeler	Dimension Access
Modeler	Dimension Read Only
Modeler	Dimension Write
Modeler	ETL Analyst
Modeler	Essbase Cube Access
Modeler	Essbase Cube Read Only
Modeler	Essbase Cube Write
Modeler	MDB Write
Modeler	MF Access

Table 19. User Group to Role Mapping

Group Name	Role Name
Modeler	MF Advanced
Modeler	MF Read
Modeler	MF Write
Modeler	Manage Run Access
Modeler	Manage Run Read Only
Modeler	Manage Run Write
Modeler	Measure Access
Modeler	Measure Read Only
Modeler	Measure Write
Modeler	Obj Migration Access
Modeler	Obj Migration Read
Modeler	ObjectAdmin advanced
Modeler	Oracle Cube Access
Modeler	Oracle Cube Read Only
Modeler	Oracle Cube Write
Modeler	Process Access
Modeler	Process Read Only
Modeler	Process Write
Modeler	Rule Access
Modeler	Rule Read Only
Modeler	Rule Write
Modeler	Run Access
Modeler	Run Read Only
Modeler	Run Write
Modeler	STF Access
Modeler	STF Advanced
Modeler	STF Read
Modeler	STF Write
Modeling Administrator	Alias Access
Modeling Administrator	Alias Authorize
Modeling Administrator	Alias Read Only
Modeling Administrator	Alias Write
Modeling Administrator	Atomic excel advanced
Modeling Administrator	Atomic excel upload write
Modeling Administrator	BMM Hierarchy Access
Modeling Administrator	BMM Hierarchy Authorize
Modeling Administrator	BMM Hierarchy Read Only
Modeling Administrator	BMM Hierarchy Write
Modeling Administrator	BMM Processor Access
Modeling Administrator	BMM Processor Authorize

Table 19. User Group to Role Mapping

Group Name	Role Name
Modeling Administrator	BMM Processor Read Only
Modeling Administrator	BMM Processor Write
Modeling Administrator	Batch Access
Modeling Administrator	Batch Advanced
Modeling Administrator	Batch Authorize
Modeling Administrator	Batch Phantom
Modeling Administrator	Batch Read Only
Modeling Administrator	Batch Write
Modeling Administrator	Config excel advanced
Modeling Administrator	DEFQ Manager
Modeling Administrator	DEFQ access
Modeling Administrator	DEFQ advanced
Modeling Administrator	DEFQ authorize
Modeling Administrator	DI Write
Modeling Administrator	DMM Write
Modeling Administrator	DQ Access
Modeling Administrator	DQ Advanced
Modeling Administrator	DQ Authorize
Modeling Administrator	DQ Read
Modeling Administrator	DQ Write
Modeling Administrator	DT Write
Modeling Administrator	Dataset Access
Modeling Administrator	Dataset Authorize
Modeling Administrator	Dataset Read Only
Modeling Administrator	Dataset Write
Modeling Administrator	Derived Entity Access
Modeling Administrator	Derived Entity Authorize
Modeling Administrator	Derived Entity Read Only
Modeling Administrator	Derived Entity Write
Modeling Administrator	Dimension Access
Modeling Administrator	Dimension Authorize
Modeling Administrator	Dimension Read Only
Modeling Administrator	Dimension Write
Modeling Administrator	ETL Analyst
Modeling Administrator	Essbase Cube Access
Modeling Administrator	Essbase Cube Authorize
Modeling Administrator	Essbase Cube Read Only
Modeling Administrator	Essbase Cube Write
Modeling Administrator	MDB Write
Modeling Administrator	MF Access

Table 19. User Group to Role Mapping

Group Name	Role Name
Modeling Administrator	MF Advanced
Modeling Administrator	MF Authorize
Modeling Administrator	MF Read
Modeling Administrator	MF Write
Modeling Administrator	Manage Run Access
Modeling Administrator	Manage Run Read Only
Modeling Administrator	Manage Run Write
Modeling Administrator	Measure Access
Modeling Administrator	Measure Authorize
Modeling Administrator	Measure Read Only
Modeling Administrator	Measure Write
Modeling Administrator	Obj Migration Access
Modeling Administrator	Obj Migration Advanced
Modeling Administrator	Obj Migration Read
Modeling Administrator	Obj Migration Write
Modeling Administrator	ObjectAdmin advanced
Modeling Administrator	Oracle Cube Access
Modeling Administrator	Oracle Cube Authorize
Modeling Administrator	Oracle Cube Read Only
Modeling Administrator	Oracle Cube Write
Modeling Administrator	PR2 Administrator
Modeling Administrator	Process Access
Modeling Administrator	Process Advanced
Modeling Administrator	Process Authorize
Modeling Administrator	Process Read Only
Modeling Administrator	Process Write
Modeling Administrator	Publish Metadata
Modeling Administrator	Rule Access
Modeling Administrator	Rule Advanced
Modeling Administrator	Rule Authorize
Modeling Administrator	Rule Read Only
Modeling Administrator	Rule Write
Modeling Administrator	Run Access
Modeling Administrator	Run Advanced
Modeling Administrator	Run Authorize
Modeling Administrator	Run Read Only
Modeling Administrator	Run Write
Modeling Administrator	STF Access
Modeling Administrator	STF Advanced

Table 19. User Group to Role Mapping

Group Name	Role Name
Modeling Administrator	STF Read
Modeling Administrator	STF Write

Command Line Utilities

This section consists of information related to Command Line Utility. You can refer to the following sections based on your need.

Command Line Utility for Object Migration

There are three approaches available for object migration namely Command Line Object Migration Utility, Object Migration from Administration>Utilities, and Metadata Archive/Restore available in Data Module Management. You can choose an approach based on whether the objects you intend to migrate are supported in that approach. Command Line Object Migration is the common integrated approach and is recommended over other methods. The Data Source should be created for the Sandbox Infodom in the target setup as prerequisite for the migration of R / ORE based models.

Offline Migration: XML tag and values need to be modified in **OBJECTMIGRATION.XML**

In ObjectMigration.xml, the object code for ETL should be app name followed by tilde, source name followed by tilde and then extract name.

```
<OBJECT Code="AppName~SourceName~ExtractName" Type="122" />
```

For information on Migrating Objects, refer *Command Line Utility* section in *Oracle Financial Services Analytical Infrastructure Applications User Guide*.

Prerequisites

For Modeling Framework and Stress Testing objects:

* For Production infodom, it is assumed that the data model upload is already done.

* Migrate the Sandbox before you migrate your Models. This is important since you can migrate Models to the same Sandbox across environments.

* The availability of the application with same APP_ID in source and target environment is a prerequisite for Sandbox Migration.

* After migrating logical sandbox between environments, the user group mapping has to be done manually.

* If the "Data model upload required" checkbox is selected for the sandbox definition, the infodom code provided in SANDBOXINFODOM attribute should be a clean infodom where no model upload is done.

* For the third party techniques, the jar files/executables created will not be migrated. You have to copy those manually.

* Ensure that the technique name in the source system and the target system are the same, that is additional R_ should not be appended to the technique name, when migrtaed to the target system.

* Do not perform Technique migration between infodoms, it is not allowed. However, you can perform Technique migration between environments.

* Create Data Source for Sandbox Infodom to migrate R or ORE based models.

> **Note:** Migration of models from logical sandbox to regular sandbox is not supported. That is, it is supported from one logical sandbox to another logical sandbox or from one schema based sandbox to another schema based sandbox.

Objects Supported for Command Line Migration

Table 20. Objects Supported for Command Line Migration

Object Name	Object Type ID	Support for Wildcard Select ALL Option	Support for Implicit Dependency [1]	Object Code
SANDBOX [2]	1300	No	Yes	System generated code
VARIABLE	1301	Yes	Yes	System generated code
TECHNIQUE	1302	Yes	Yes	System generated code
VARIABLE SHOCK	1303	Yes	Yes	System generated code with '_' and Version number
SCENARIO	1304	Yes	Yes	System generated code with '_' and Version number
MODEL	1305	Yes	Yes	System generated code with '_' and Version number
STRESS	1306	Yes	Yes	System generated code

Note:
1. When Models are migrated along with the sandbox, the dependent metadata of models is also migrated.
2. Dependency migration of models, done independently, is not supported. Since the dependent metadata for a model can be in the production infodom, a user who is granted rights to the sandbox may not have rights to the production infodom to create these dependent metadata. This would create a conflict and hence dependency migration of models cannot be done.
The ideal approach is step (1) given above. However, if you go for step (2), it is treated as an incremental case where only the model definition is modified. For any additions in production infodom (technique addition or variable additions), migrate the additions independently.

Command Line Utility for Compiling Non-Self Executable Libraries

The Non-Self executable Third Party techniques defined must be compiled prior to executing the models based on such techniques. For compiling such techniques, a command line utility called TechniqueBuilder.sh is provided. For using this utility, the C/C++ compiler must be installed on OFSAAI server. Libraries of type ('.so' and '.a') for C/C++ and ('.class' and '.jar') for JAVA are supported for now.

The `TechniqueBuilder.sh` utility resides under `$FIC_DB_HOME/bin` area.

Prerequisites

- C/ C++ compiler (g++ for Linux, xlC_r for AIX and CC for Solaris) must be installed on OFSAAI server. In case of Multitier setup, you must install on the OFSAAI FIC DB tier. You must also set the compiler path accordingly in the PATH variable present in `.profile`.

- If JAVA libraries are part of Non-Self Executable Third party Techniques, then ensure that JAVA_HOME variable is set and pointing to the JDK Installed Directory in `.profile`. Else this step is not required.

- All the external Non-Self Executable libraries must be placed under the `$FIC_DB_HOME/lib/MF_EXTERNAL_LIBS/lib` folder.

- If the C/C++ library contains any Include Header files, then those files should be placed under `$FIC_DB_HOME/lib/MF_EXTERNAL_LIBS/`include folder. Else this step is not required.

To run this utility from the console:

1. Navigate to *$FIC_DB_HOME/bin* of OFSAAI FIC DB tier.

2. Execute the following command:
   `./TechniqueBuilder.sh`

3. This command compiles all the techniques that are based on Non Self Executable Third Party algorithms. Once compilation is successful, the 'libTPPlugin.so' library will be updated in the `$FIC_DB_HOME/lib` path.

Oracle Financial Services Enterprise Modeling application

8.0.4.0.0 User Guide

Oracle Corporation

World Headquarters

500 Oracle Parkway

Redwood Shores, CA 94065

U.S.A.

Worldwide Inquiries:

Phone: +1.650.506.7000

Fax: +1.650.506.7200

www.oracle.com/us/industries/financial-services/

ORACLE®