BI REPORT

DQ Strategy

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REVISION HISTORY

Ver.	Description of Change	Author	Date	Approved	
				Name	Effective Date
0.1	Initial draft	Stepan Gasparyan	09/19/2024		

Abbreviations and Acronyms	
EDW	Enterprise Data Warehouse
ETL	Extract, Transform, Load
LND	Landing
BI	Business Intelligence
DQ	Data Quality
UAT	User Acceptance Test
GUI	Graphical User Interface

CONTENTS

1 INTRODUCTION

1.1 DOCUMENT GOAL AND SCOPE

The document describes strategy and techniques for testing a reporting solution. It provides insight into what activities and steps within the activities are needed to ensure that the solution provides end users with the correct data.

1.2 TARGET AUDIENCE

The document is to be used by:

- **EPAM Development and Testing Team** as a guideline of what needs to be tested, how it needs to be tested, what tools are to be used, what acceptance criteria are to be used, etc.
- **Customer Team** – to verify that all the essential testing requirements are covered and that proposed strategies and techniques cover the testing requirement.

2 OVERALL STRATEGY

The BI project will be tested using **Functional testing** - data validation and report functionalities verification; **Non-functional testing** – row level security, performance; **Change-related** verification - regression.

CheckList: For each validation type set of verifications will be designed to check that the data and aggregations are correct, report component or a feature showing the expected behavior. The design of the verifications(cases) will guarantee a sufficient coverage and the necessary depth. All checks will be stored in the “BI CheckList”.

Data Validation: Data validation will be performed using SQL scripts.Will be performed using procedures .

Reports Verification: Report functionality, security and performance verification will be performed manually. Verification cases will be defined based on the Functional and Non-functional requirements specifications.

DQ Strategy is planned to be adopted to fit into limitations, timing, changing requirements and different obstacles.

All testing activities, test artifacts and priorities are straightly meet business goals in order to accurately identify foreground scope of works required to deliver desired quality in very short time.

The scope of work for the test activities defined to the verification of the quality for the eight BI Reports in the following priorities:

1. Power BI dashboard “Sales”
2. Power BI dashboard “Cost”
3. Power BI dashboard “Stocks”

Verification techniques for each particular BI Report area of the Bi project reporting solution will be verified through the following validation types:

- ✓ Data validation between EDW and Source levels (data transformations; data completeness, data quality);
- ✓ Functional verification of the developed Reports;
- ✓ Non-functional verification of the Row level security, Performance testing);
- ✓ Regression testing (change related) using SQL test scripts;
- ✓ Confirmation testing (retesting) in part of verification of all fixed bugs;
- ✓ Smoke testing;
- ✓ Ad-hoc reporting verification.

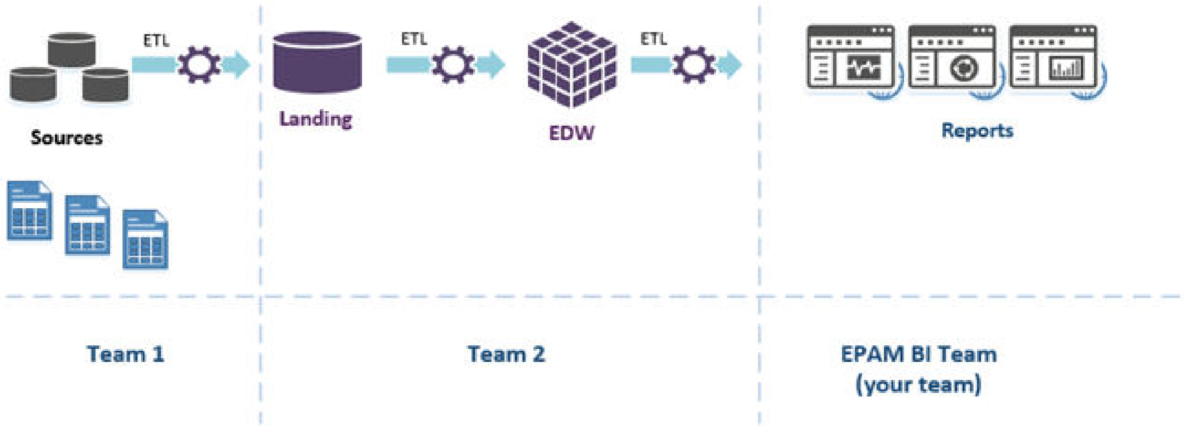
Test activities will be started as soon as:

- All Functional and Non-functional requirements specifications and mappings defined and approved by the responsible person (Non-functional requirements such as security and performance can be defined later but no later than 2 days after the start of the test activities);
- Checklist for the data validation and functional requirements verification is designed to check that the data is correct and each component or a feature showing the expected behavior;

Test methods, which will be applied during the verification, are:

- SQL queries – will be performed on the EDW to validate data quality between database and BI tool levels; SQL queries on the LND level will be performed for the issues investigations in case of any data discrepancies are found;
- Manual testing – is considered as the method for the report functionalities, GUI, security verifications and regression;

General DQ activities and responsibilities through the BI Report project are shown in the Figure below.



3 FUNCTIONAL TESTING

3.1 DATA VALIDATION

For data validation we will use such testing techniques as: Data Completeness, Data Transformation and Data Quality via data comparison between EDW,LND and Source layers, including data issues investigation (via SQL queries) in case of any data discrepancies are found.

3.1.1 Data Completeness Verification

Objectives: By testing data completeness, we want to ensure that all expected data was loaded from the EDW level to the BI Report tool and no data or data accuracy loss occurred. This includes validating that all records, record fields, full contents of each record field are processed completely.

Scope: All data stored in a fact and dimension tables at EDW level and data available at BI Reports.

Test Case Techniques:

- ✓ Compare data between EDW and BI Reports using test SQL scripts;
- ✓ Compare data results displayed on the charts between BI Reports and EDW data
- ✓ Verify that all needed filter values available in each filter/prompt;
- ✓ Compare data between LND and EDW using SQL queries in case of any data discrepancies will be found, etc.

Verification Technique: SQL queries on EDW level; Manual comparison of the displayed data in the BI Report.

Entry Criteria:

- EDW-BI Report Attributes Mapping completed;
- LND-EDW Attributes Mapping completed (for the data discrepancies investigation);
- Data loaded to the EDW test;
- Test Environment and database are available;

- DQ Checklist developed and finalized;
- Developed Report deployed to the test environment;
- Smoke Test passed.

Quality and Acceptance Criteria: Results of data should represent clear analysis.

3.1.2 Data Transformation Verification

Objectives: By testing data transformation correctness we want to ensure that the data transformations logic implemented at BI Report level works exactly according to the specification.

Scope: All data transformations and aggregations described in the functional specification and mapping document.

Test Case Techniques:

- ✓ Verify all aggregations to be performed clearly without any unexpected results.

Verification Technique: SQL queries on EDW level; Manual comparison of the displayed data.

Entry Criteria:

- EDW- BI Report Attributes Mapping completed;
- LND-EDW Attributes Mapping completed (for the data discrepancies investigation);
- Data loaded to the EDW test;
- Test Environment and database are available;
- Implemented Report deployed to the test environment;
- Smoke Test passed.

Quality and Acceptance Criteria: Results of data aggregation correctness.

3.1.3 Data Quality Verification

Objectives: By testing input data quality and volume we want to ensure that the contents of the input data meet expected quality criteria (such as data is of expected type, is within expected boundaries, is of expected accuracy).

Scope: All data stored in a fact and dimension tables at EDW level and data available at BI Reports.

Test Case Techniques:

- ✓ Check data objects for duplicates, check null values handling;
- ✓ Verify data for data types;

Verification Technique: SQL queries; data analyzing in the EDW; manual comparison of the displayed data in the BI Report.

Entry Criteria:

- EDW-BI Report Attributes Mapping completed;
- LND-EDW Attributes Mapping completed (for the data discrepancies investigation);
- Data loaded to the EDW test;
- Test Environment and database are available;
- Developed Report deployed to the test environment;
- Smoke Test passed.

Quality and Acceptance Criteria: Data is considered to have sufficient quality, if within expected boundaries, had expected accuracy and data type.

3.2 REPORTS VERIFICATION

Reports verification of the BI Reporting solution will be primary focused to ensure that all developed report functionality and user interface shown in the BI Reports are correct and accessible to the end users from a performance and security standpoint.

Reports verification of the BI Report solution will consist of the two main areas: Report Functionality verification and Report User Interface verification.

3.2.1 Report Functionality Verification

Objectives: By the report functionality verification, we want to ensure that all required functionalities of each separate report were developed as expected, based on the functional specifications.

Scope: All report functionalities described in the functional specifications of each report. E.g. prompts, filters, sorting and drilling options, export to Excel and PDF etc.

Test Case Techniques:

- ✓ Verify that all functionalities and report options such as prompts, filters, drilling, sorting options, data and time and so on are accessible and work as required;
- ✓ Verification of the summarized report options (buttons/controls for the possibility to sum, count, avg., total);
- ✓ Verify that links/buttons from detail report to chart and vice versa are accessible and work as required;
- ✓ Verify export functionality etc.

Verification Technique: Manual verification; SQL queries.

Entry Criteria:

- Functional and Non-functional Specifications completed and approved by the responsible person;
- Test Environment is ready and available;

- Implemented Report deployed to the test environment;
- Smoke Test passed.

Quality and Acceptance Criteria: All functionalities of each separate report should work as it was described in the functional requirements specification.

3.2.2 Report Graphical User Interface Verification

Objectives: By the GUI testing, we want to ensure that the user interface provides the user with the appropriate access and navigation through the report options. Within the BI Report project, we also want to ensure whether the product operates correctly in configurations with various browsers and screen resolution.

Scope: All objects related to the User Interface (such as fonts, colors and visualizations) described in the design requirements under all required browsers and screen resolutions.

Test Case Techniques:

- ✓ Check the whole report displaying in required browsers and screen resolutions;
- ✓ Check standard colors, fonts, header and footer;
- ✓ Check graphs, grids, prompts, filters, widgets layout on the page, etc.

Verification Technique: Manual verification.

Entry Criteria:

- Design Requirements defined and approved by the responsible person;
- Supported web-browsers and screen resolutions defined and approved by the responsible person;
- Test Environment is ready and available;
- Implemented Report deployed to the test environment.

Baseline:

- Design Requirements.

Quality and Acceptance Criteria: There should be no any discrepancies between defined design requirements and developed design in the particular report.

3.2.3 Ad hoc Verification

Objectives: By the Ad hoc verification we will conduct all verifications specified above: data validation (data completeness, transformations, quality).

The main feature of the Ad hoc testing is to ensure that:

- each attribute can be successfully joined with the appropriate measure without any exceptions (Joins verification);
- each measure is calculated correctly with all possible attributes joined with (Measures verification);
- each attribute joined with all other attributes and measures displays correct data (Attributes verification);

Scope: All measures and attributes related to particular report area.

Test Case Techniques:

- ✓ Join each separate measure and all possible attributes from different dimensions and apply only required filter(s) (if any) to get the most extensive dataset for the comparison with SQL query results;
- ✓ Join all measures related to the particular report area and all possible attributes from different dimensions and apply only required filter(s) (if any) to get the most extensive dataset for the comparison with SQL query results;
- ✓ For each dimension folder, pick all attributes and run report to verify that any attribute is not mapped properly;
- ✓ Check the dimension hierarchy;

Verification Technique: SQL queries; manual verification, ad hoc reports.

Entry Criteria:

- EDW-BI Report Attributes Mapping completed;
- Data loaded to the EDW test;
- Test Environment and database are available;
- Developed Report deployed to the test environment;
- Smoke Test passed.

Quality and Acceptance Criteria: All attributes mapped properly, there are no any exceptions appeared during joining a valid attribute and measure. Each measure is calculated correctly with all possible attribute joined with. Each attribute joined with all other attributes and measures displays correct data.

4 NON-FUNCTIONAL TESTING

Non-functional testing is the verification of the quality characteristics of the reporting solution. It refers to aspects of the software that may not be related to a specific function or user action such as security, performance, usability, compatibility or graphical user interface. Within BI Report reporting solution row level security, performance and graphical user interface testing types will be conducted as part of non-functional testing.

4.1 SECURITY TESTING

Objectives: Row level security testing is a type of software testing that's done to check whether the product is secured or not. It checks to see if the reporting solution is vulnerable to attacks.

Security testing strategy is defined based on the following requirements:

1. Only defined users can have access to the the product.
2. All users have "execute only" permission. (They will not be allowed to edit attributes/metrics);
3. User specific permissions (restricted data in report) and different report privileges (edit, save, share report, subscribe) are not defined as requirements to implement.

The group-based access to the specified report areas will be provided in BI Report Non-functional requirements document.

Scope: Access level verification.

Test Case Techniques:

DQ strategy from the security testing standpoint will be performed on the following logical levels:

- ✓ Access level verification - ensure that users from specified groups can access to specified reports:
  - only authorized users have access to the separate report area;
  - only users assigned to specified group have access to the report areas allowed for this group;
  - users cannot have access to the not allowed for this group report areas;

Verification Technique: Manual verification.

Entry Criteria:

- Non-functional requirements (from the security standpoint) document finalized and approved by responsible person(s)
- Developed Report deployed to the test environment and verified from the data quality standpoint.

Quality and Acceptance Criteria: Only defined in the Non-functional requirements specification users can have access our product.

4.2 PERFORMANCE TESTING

Objectives: By performance testing, we want to ensure that data loads, queries and report generation perform within expected time frames.

Scope (assumption): Execution time for each report area with the most used set of attributes and measures; Execution time for each report area with the max possible set of attributes and measures (or the max data volume retrieved).

Test Case Techniques (assumption):

- ✓ Join the most used set of attributes and measures related with the one separate report area, run report, measure report execution time and compare results with the time limitations defined at the performance requirements;
- ✓ Join all possible attributes and measures (or the max data volume expected) related with the one separate report area, run report, measure report execution time and compare results with the time limitations defined at the performance requirements;

Entry Criteria:

- Non-functional requirements document (from the performance standpoint) finalized and approved by responsible person(s)
- Developed Report deployed to the test environment and verified from data quality standpoint.

Quality and Acceptance Criteria: Execution time of each report area meets conditions.

5 USER ACCEPTANCE TESTING

Enterprise Data Warehouse is built for reporting solution, several reports (intelligence cubes) that are consumed by business users. Users are the ultimate stakeholders who decide whether the whole thing is worth their trust or not, whether the business questions are answered or not, whether the interfaces are easy to use or not, and so on.

So, **User Acceptance Testing** is targeted on business users, who know their data and know how to use it. The purpose of UAT is to verify that reporting artifacts meet user's expectations and needs. That usually includes:

- ✓ Correctness of data (if comparison reports available);
- ✓ Graphical usability: layout, control elements (prompts, filers, sorts, drill-downs, links, etc.);
- ✓ Time of delivery, format of delivery, etc.

UAT of the BI Report reporting solution will be conducted for each separate report area as soon as all testing activities are completed and responsible person accepts user story related to the delivered report area, according to the approved schedule and priorities of the product deliverables described in the BI Report Project and test schedule.

6 REGRESSION TESTING

Such BI ecosystem changes as data loads, changes in ETL processes, modifications and bug fixes, routine software upgrades to the database, the ETL engine, and the BI platform can modify or even corrupt pre-existing information within the EDW or in the report areas, therefore to verify that these changes do not break things that used to work before.

Objectives: The goal of the regression testing is to make sure that all modifications produced on the EDW and BI tool levels do not cause regress of the product quality.

Scope (assumption):

- The most used datasets (limited by the required (or the most used filters);
- SQL queries generated during data aggregations;
- All necessary objects of the report such as report filters, grids and graphs etc.;
- Generated documents: Excel, PDF;
- Performance changes for the report generation.

Test Case Techniques:

- ✓ Verify each report area before deployment to production.
- ✓ After new developments moving from the test environment into production.
- ✓ Verify all modifications related with requested changes are deployed to prod.

- ✓ Verify all modifications related with bug fixes are deployed (Confirmation testing) using test scripts;
- ✓ Verify report areas after new developments moving into test environment (Smoke test). Test scripts will be used;

Verification Technique(s): SQL test scripts.

Entry Criteria:

- Developed Report deployed to the test environment and verified from data quality standpoint;
- Changes applied to the report area (bug fixes, change requests) moved to the test environment.

Quality and Acceptance Criteria: All new changes are verified before going to production.

7 TEST LEVELS

7.1 SMOKE TEST

Smoke Test is performed to quickly assess the readiness of the product for further deeper and thorough testing. Smoke Test is performed to quickly assess the readiness of the product for further deeper and thorough testing. It includes verification of major functions on the one most often used such as user authorization and permission verification for users/groups, major report functionalities and GUI in a default configuration of the browser/screen resolution, data consistency verification for the most used by end users dataset previously saved as baseline.

If Smoke Test failed, DQ team sends notification and suspends testing until corrected version of the product is available.

7.2 CRITICAL PATH TEST

Critical Path Test will be performed after Smoke Test is passed. The goal of the Critical Path Test is to find bugs that could affect the major functionality/dataset of the report that is most important for the product users.

7.3 EXTENDED TEST

The Extended Test's goal to find bugs related to the non-typical but still possible and likely scenarios (e.g. entering the incorrect data into the fields, incorrect combination attributes and measures, boundary data validation and so on).

Extended Test will be performed after Critical Path Test is passed using ad hoc testing approach based on business domain knowledge. It will be used also as acceptance tests for the release candidate build.

8 DEFECT TRACKING

Defect (bug) is any anomaly observed between the requirements specification/mapping document and the operation of software produced under the scope of the BI Report project.

Jira as a bug tracking tool will be used for bug reporting and status tracking. The bug metrics and statistics will be included in the test results reports.

8.1 ISSUE TYPES

All defects within BI Report project will have the following types: Bug, Issue, Change Request and New Feature.

- **Bugs** (BG) are defects found during testing phase;
- **Issues** (IS) are problems which might block the testing or development process. Normally issues have higher priority than bugs;
- **Change Requests** (CR) are requests to modify or enhance existing functionality;

8.2 BUG SEVERITY DEFINITION

The level of bug's importance shows an impact on application reliability and robustness. Set out by DQE.

Following Severity definitions are available in JIRA system and will be used on the BI Report project for the bug importance indication:

- **Critical** – whole report area, or module crashes or is not accessible;
- **Major** – a problem in major functionality(data), no workaround is known;
- **Minor** – a problem with workaround, secondary features do not work properly;
- **Trivial** – cosmetic flaw (GUI generally).

8.3 BUG PRIORITY DEFINITION

Bug priority represents the importance of fixing a bug, and reflects a business decision as to how soon that bug should be fixed.

Bug priority will be reviewed and updated if needed by PM/PO/any key person on the project in accordance with the business needs changes.

Priority of a defect is defined as below:

- **Critical -** Bug should be fixed ASAP;
- **Major** – Very important functionality. Bug should be fixed in a short terms;
- **Minor** - Least important defect that can be fixed at the last of all.