

PROPOSED METHODOLOGY AND TECHNICAL APPROACH

DEVELOPMENT TOOLS AND TECHNOLOGIES

MICROSOFT .NET FRAMEWORK

The .NET Framework is an integral Windows component that supports building and running the next generation of applications and XML Web services. The .NET Framework is used to provide the following development features:

- a consistent object-oriented programming environment whether object code is stored and executed locally, executed locally but Internet-distributed, or executed remotely
- a code-execution environment that minimizes software deployment and versioning conflicts
- a code-execution environment that promotes safe execution of code
- a code-execution environment that eliminates the performance problems of scripted or interpreted environments
- a code-integration environment based on the .NET Framework which can integrate with any other code

The main components and features of the .NET Framework are the following:

- Common Language Runtime (CLR)

The common language runtime manages memory, thread execution, code execution, code safety verification, compilation, and other system services. These features are intrinsic to the managed code that runs on the common language runtime. CLR provides the following functions:

- The runtime enforces code access security.
- The runtime also enforces code robustness by implementing a strict type-and-code-verification infrastructure called the common type system (CTS).
- The runtime automatically handles object layout and manages references to objects, releasing them when they are no longer being used.
- The runtime also accelerates developer productivity.
- The runtime is designed to enhance performance. A feature called just-in-time (JIT) compiling enables all managed code to run in the native machine language of the system on which it is executing. Meanwhile, the memory manager removes the possibilities of fragmented memory and increases memory locality-of-reference to further increase performance.
- The runtime can be hosted by high-performance, server-side applications, such as Microsoft® SQL Server™ and Internet Information Services (IIS). This infrastructure

enables us to use managed code to write application business logic using the industry's best enterprise servers that support runtime hosting.

- .NET Framework Class Library

The .NET Framework class library is a collection of reusable types that tightly integrate with the common language runtime. .NET Framework is used to develop the following physical components of Barcode AIS:

- Windows GUI applications (using Windows Forms).
- Applications and web-services (using ASP.NET).
- MS SQL Server database access objects (using ADO.NET).

MICROSOFT SQL SERVER 2017 OR LATER

The MS SQL Server is used to create database server tier of all SIRA's Web-applications.

SQL Server delivers on the Microsoft data platform vision by enabling organizations to run their most mission-critical applications while lowering the cost of managing the data infrastructure and delivering insights and information to all users. This platform has the following qualities:

- **Trusted**—Enables organizations to run their most critical applications with very high levels of security, reliability, and scalability.
- **Productive**—Enables organizations to reduce the time and cost required to develop and manage their data infrastructure.
- **Intelligent**—Provides a comprehensive platform that delivers insights and information where your users want it

SERVICE-ORIENTED ARCHITECTURE (SOA)

Service-oriented architecture (SOA) is a style of [software design](#) where services are provided to the other components by [application components](#), through a [communication protocol](#) over a network. A SOA service is a discrete unit of functionality that can be accessed remotely and acted upon and updated independently, such as retrieving a credit card statement online. SOA is also intended to be independent of vendors, products and technologies.^[1]

A service has four properties according to one of many definitions of SOA:^[2]

1. It logically represents a business activity with a specified outcome.
2. It is self-contained.
3. It is a [black box](#) for its consumers, meaning the consumer does not have to be aware of the service's inner workings.
4. It may consist of other underlying services.^[3]

Different services can be used in conjunction to provide the functionality of a large [software application](#),^[4] a principle SOA shares with [modular programming](#). Service-oriented architecture integrates distributed, separately maintained and deployed software components. It is enabled by technologies and

standards that facilitate components' communication and cooperation over a network, especially over an IP network.

SOA is related to the idea of an [application programming interface](#) (API), an interface or communication protocol between different parts of a computer program intended to simplify the implementation and maintenance of software. An API can be thought of as the service, and the SOA the architecture that allows the service to operate.

MICROSOFT HYPER-V SERVER

Microsoft Hyper-V Server is a free product that delivers enterprise-class virtualization for your datacenter and hybrid cloud. Microsoft Hyper-V Server 2016 provides new and enhanced features that can help you deliver the scale and performance needs of your mission-critical workloads.

The Windows hypervisor technology in Microsoft Hyper-V Server 2016 is the same as what's in the Microsoft Hyper-V role on Windows Server 2016. It is a stand-alone product that contains only the Windows hypervisor, a Windows Server driver model, and virtualization components. It provides a simple and reliable virtualization solution to help you improve your server utilization and reduce costs.

PRELIMINARY PROJECT PLAN

WORK BREAK-DOWN DIAGRAM

The high-level work breakdown structure of the project is given below:

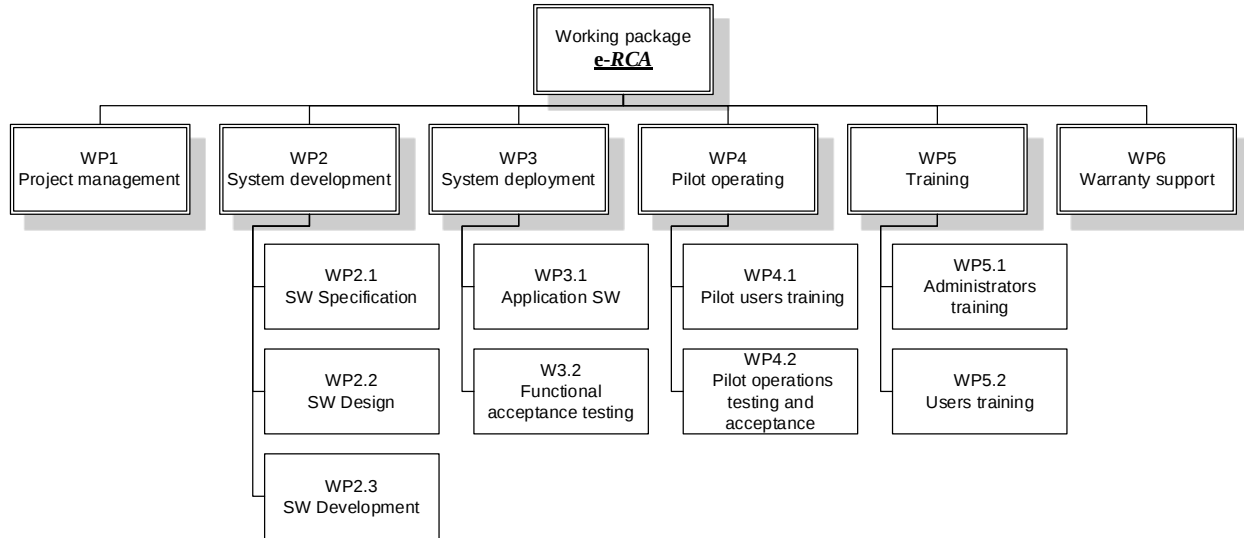


Figure 8. E-RCA implementation process high-level work breakdown structure

PROJECT MANAGEMENT

	WP1
Environmental Activities	None
Prerequisites	The contract is signed and the kick-off meeting is held.
Activities	The project management activities are the following: • Preparation of the Project Plan. • Monitoring of the project progress and ensuring adherence to the project schedule. • Assigning the project resources. • Monitoring that the project is executed within budget. • Participation in meetings with the Purchaser (Steering Committee meetings, monthly progress meetings and technical meetings, if needed). • Preparation of monthly, quarterly and final report. • Problem and issue management.

	• Risk management. • Training of personnel in the procedures to be followed in the project. • Ensuring adherence to the established procedures.
Results	• Project Plan containing the following chapters: ○ Detailed Project Organization Structure; ○ Project Management Plan; ○ Detailed Implementation Schedule; ○ Application Software Design, Development and Implementation Plan; ○ Detailed Implementation Schedule; ○ Training Plan; ○ Pilot Implementation Plan; ○ Pre-commissioning and Operational Acceptance Testing Plan; ○ Data Migration Plan; ○ Coordination and Turnover Plan; ○ Technical Support Plan; ○ Tasks, Time, and Resource Schedules; ○ Roll-out Implementation Plan; ○ Warranty Service Plan. • Monthly Progress Reports. • Quarterly Reports. • Final Project Report.
Verification	Review and approval by Purchaser.
Post Conditions	Acceptance of the deliverables by Purchaser.

SYSTEM DEVELOPMENT

Software requirements specification

	WP2.1
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WP Description	Understand, analyze, design and document the detailed technical requirements to the E-RCA.
Prerequisites	Purchaser's project team members and/or other project teams are available for providing the business requirements and the interfaces with the other systems.
Activities	• Defining essential business requirements to the system (conduct user interviews, gathering information); • Analyzing of identified essential business requirements to the system; • Elaborating of Software Requirements Specification.
Results	Software Requirements Specification (SRS) containing the following information according to both tender and RM Regulation RT-38370656 - 002:2006 "Software life-cycle" requirements: • Introduction ○ Purpose ○ Scope of product ○ Definitions, acronyms, and abbreviations ○ References ○ Overview of rest of the SRS • Overview of Current System ○ Organizational Structure ○ Data Model ○ Functional Model ○ Problems • Logical Model of the Required System ○ Data Model (a set of UML and ER diagrams with detailed description) ○ Data Dictionary ○ Functional Model (a set of UML diagrams with detailed description) • General Description

	○ Product Perspective ○ Product Functions ○ User Characteristics ○ General Constraints ○ Assumptions and dependencies ● Specific Requirements ○ Functional Requirements ▪ Functional requirement 1 ● Introduction ● Inputs ● Processing (UML diagram with detailed description) ● Outputs ▪ Functional requirement 2 ● Introduction ● Inputs ▪ ... ▪ Functional requirement n ▪ ... ▪ External Interfaces ● User Interfaces ● Hardware Interfaces ● Software Interfaces ● Communication Interfaces ○ Performance & Capacity Requirements ▪ Design Constraints ● Standards Compliance ● Hardware Limitations
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	▪ Attributes • Ease of Use • Availability • Transferability/Conversion • Reliability ▪ Other Requirements • Database specifications • Security • Protection of privacy of subjects of information • Recovery • Operational Support • Site Adaptation • Packaging • Installation • Documentation with the application of the model Web Services Description Language (WSDL)) • Training • Appendices • [Index].
Verification	Review and approval by Purchaser.
Post Conditions	Acceptance of the Software Requirements Specification deliverable by Purchaser. E-RCA functional requirements specification is frozen.

Software development

	WP2.3
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WP Description	Based on the Software Requirements Specification (SRS) and Software Design Description (SDD), the E-RCA Development will be performed during this task.
Prerequisites	• Acceptance of the Software Requirements Specification (SRS) by Purchaser; • Software Design Description (SDD) is reviewed and internally approved by Purchaser and Supplier project teams.
Activities	• Actual internal coding, debugging and testing of the E-RCA applications software using appropriate tools and techniques in accordance with SRS and internally approved SDD. • Development of Application System Installation and Configuration Manual; • Development of User Guide; • Development of Functional Testing Plan.
Results	• Application Software Executable Modules; • Functional Testing Plan contains SRS string test scenarios specification and, SRS integration stress test scenarios specification; • Application System Installation and Configuration Manual containing: ○ Introduction; ○ Terminology and abbreviations; ○ Hardware requirements; ○ Installation kit. Necessary additional modules, libraries, and third-party manufacturers, their allowable version; ○ Installation Instructions; ○ Description of necessary settings; ○ List of key messages and actions. • User Guide containing: ○ User instructions which contain an introduction, a description of the user's interaction with the system, and a description of any required training for using the system;

	○ System narrative purpose and description; ○ Input/Output specifications; ○ Samples of original source documents and examples of all input formats (forms or displays); ○ Samples of all outputs (forms, reports or displays); ○ Data entry instructions; ○ References to all documents or manuals intended for use by the users; ○ Description of the system limitations; ○ Description of all error situations which can occur and how to react.
Verification	Approval of the Application System Installation and Configuration Manual, User Guide, Functional Testing Plan deliverables by Purchaser.
Post Conditions	After successful completion of the verification activities, the system can be installed for functional testing. E-RCA application software accepted for functional testing.

SYSTEM DEPLOYMENT

E-RCA software applications installation

	WP 3.1
WP Description	The purpose of this task is to configure, install and verify the E-RCA SW components in E-RCA Data centre infrastructure provided by Purchaser.
Prerequisites	Successful installation of E-RCA SW components in E-RCA Data centre infrastructure.
Activities	• Extraction of S/W Components from the Development Environment; • Installation of the Modules to the Production Environment; • Authentication Scheme; • Parameter Data Set up; • Application Security (User Id with Appropriate Roles);

	• SW Installation Verification (Run of Specific queries against source and target Data Bases to determine the completeness of the transfer); • Execution of indicative / representative Scenarios; • Set up of Data Base and Application Servers (No of Sessions, Concurrency Parameters, etc); • Physical Data Base Construction (Disk size and allocation, Indexing, etc).
Results	Verified installation of E-RCA SW components in E-RCA Data centre infrastructure
Verification	SW installation scripts run successfully.
Post Conditions	Ready to initiate functional testing.

E-RCA Software functional testing

	WP 3.2
WP Description	E-RCA functional testing.
Prerequisites	E-RCA SW components are successfully installed in Data centre infrastructure. Functional Testing Plan accepted by Purchaser.
Activities	Training functional testing users; E-RCA SW functional testing (load and stress testing); Supporting functional testing; Bug fixing; Tuning E-RCA SW operational platform.
Results	Functional testing results; E-RCA SW components Acceptance Certificate.
Verification	Acceptance of the E-RCA SW components.
Post Conditions	E-RCA SW System operationally ready for Pilot implementation.

PILOT IMPLEMENTATION

Pilot users training

	WP4.1
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WP Description	Planning, organizing and executing the implementation of the training of pilot users will be performed in this work package.
Prerequisites	E-RCA SW operationally ready for Pilot implementation. Pilot infrastructure has been built and supports the operation of the E-RCA SW in every Pilot site and workplace. Communication Lines requirements are met.
Activities	• Preparation of detailed pilot users Training Plan (including training materials); • Implement the training courses according to the prepared Training Plan. For more information see the “Training Plan” section of this document.
Results	• Training Plan as described in “Training” section of this document. • Training materials. • Training Implementation.
Verification	Successful attendees obtain certificates of training completion
Post Conditions	Trainees are well educated to operate the system.

Pilot operations testing and acceptance

	WP 4.2
WP Description	Pilot sites operational testing and acceptance
Prerequisites	Pilot sites and workplaces are defined. Environmental requirements of every site and workplace are met. Acceptance of the E-RCA SW has been obtained. E-RCA SW operationally ready for Pilot implementation. Pilot infrastructures (Data centre) including communication channels requirements are met. Successful completion of the migration of pilot sites data. Purchaser’s Pilot users are trained and ready to work with E-RCA SW in operational testing mode.

Activities	Pilot sites operational testing. For more information see the “Pilot Implementation and Operational Acceptance Testing Plan” section of this document.
Results	System Operational Acceptance Certificate.
Verification	Acceptance of the system by the Purchaser.
Post Conditions	E-RCA SW operationally ready for roll-out in production mode.

TRAINING

Administrators training

	WP5.1
WP Description	Planning, organizing and executing the implementation of the training of administrators of the developed system will be performed in this work package.
Prerequisites	System Operational Acceptance Certificate has been obtained.
Activities	• Preparation of detailed Training Plan; • Implement the training courses according to the prepared Training Plan. For more information see the “Training Plan” section of this document.
Results	• Training Plan as described in “Training Plan” section of this document. • Training materials. • Administrators training Implementation.
Verification	Successful attendees obtain certificates of training completion
Post Conditions	Administrators are well trained to support the system production operating.

Users training

	WP5.2
WP Description	Planning, organizing and executing the implementation of the training of users will be performed in this work package.
Prerequisites	System Operational Acceptance Certificate has been obtained.
Activities	• Preparation of detailed Training Plan (updating training materials used on pilot stage);

	Implement the training courses according to the prepared Training Plan. For more information see the “Training Plan” section of this document.
Results	- Training Plan as described in “Training Plan” section of this document. - Training materials. - Users training implementation.
Verification	Successful attendees obtain certificates of training completion
Post Conditions	Users are well trained to work with the system.

WARRANTY

	WP 6
WP Description	This Work Package describes how the Supplier will assure the requirements for repair according to the Contract and the Technical Requirements.
Prerequisites	Operational Acceptance of Complete and Integrated System Certificate has been signed by Purchaser.
Activities	- Technical support; - Warranty Service; - User support/Hot User line; - Technical Assistance. For more information see the “System maintenance plan” section of this document.
Results	Warranty services
Verification	Acceptance of provided services
Post Conditions	

APPLICATION SOFTWARE DESIGN, DEVELOPMENT AND IMPLEMENTATION PLAN

APPLICATION SOFTWARE LIFE-CYCLE

E-RCA application software life-cycle is based on the list of phases and activities which are planned to be performed by us during the Project to put E-RCA into production mode successfully.

E-RCA application software design, development and implementation project passes through the following main phases:

- Inception**

The Inception phase mainly refers to the project planning and the organization of the project teams to be involved in the software development life cycle. It includes all the required actions before the initiation of the actual development of the system. Such actions include the following:

- Kick off meeting with all major parties involved;
- Development of working relationship with Supplier's key users;
- Establishment of the working teams and the Steering Committee;
- Preparation of the Project Plan;

Some of the major results of this phase are the following:

- Customer's project team allocating;
- Working relationship between Supplier's and Customer's project team's are established;
- Steering Committee is established and its member understand their tasks, rights and obligations;
- Detailed Project Plan and schedule containing:
 - Detailed Project Organization Structure;
 - Project Management Plan;
 - Application Software Design, Development and Implementation Plan;
 - Detailed Implementation Schedule;
 - Training Plan;
 - Pilot Implementation Plan;
 - Pre-commissioning and Operational Acceptance Testing Plan;
 - Data Migration Plan;
 - Coordination and Turnover Plan;
 - Technical Support Plan;
 - Tasks, Time, and Resource Schedules;
 - Roll-out Implementation Plan;
 - Warranty Service Plan.

Some of the major critical success factors of this phase are the following:

- Purchaser and Supplier equally understand Project scope, vision and expected results;
- Environment for the meetings is allocated and corresponds to project standards.

- **Developing**

This phase includes the following activities:

- Gathering existing documentation (laws, regulations, business rules and business-processes descriptions, documents templates and flows, users activities and responsibility areas, etc);
- Interviewing and clarification meeting with Purchaser project team key-members;
- Analyzing the identified requirements;
- The Software Requirements Specification (SRS) development;
- The Software Design Description (SDD) development;
- Actual coding;

- Releases issuing and testing of the application systems using appropriate tools and techniques.

Major results of this phase to be provided to Customer are the following:

- The Software Requirements Specification (SRS) containing information according to both tender and RM Regulation RT-38370656 - 002:2006 “Software life-cycle” requirements;
- The Software Design Description (SDD) containing information according to both tender and RM Regulation RT-38370656 - 002:2006 “Software life-cycle” requirements;
- E-RCA Final Release installation package including:
 - E-RCA service image for virtual machine;
 - E-RCA application installation;
 - E-RCA application User’s Guide;
 - E-RCA application Administrator’s Guide;

Important critical success factors of this phase are the following:

- There is committed user involvement;
- Outstanding issues and questions can be resolved in a timely manner;
- The project team identifies key issues for transition;
- The Supplier’s and Purchaser’s project managers and team leaders estimate and plan accurately;
- Good change control procedures place a strong focus on maintaining the defined functional scope of the project;
- The project team reacts immediately to indications of performance bottlenecks and estimating errors.

- **Transiting**

The major goal of this phase is to install the new application systems in production environment, prepare Purchaser users for leveraging and administering the application system, deploy and roll-out and put the system into operation. In this project the transiting phase will consist of three stages:

- System deployment (during this stage the E-RCA application software will be deployed and functionally tested);
- Pilot (during this stage the E-RCA will be implemented on chosen pilot sites: end-users are trained, each site historical data are migrated into E-RCA database; Pilot sites are put into production operation);
- Roll-out (during this stage the E-RCA will be implemented on each other sites: end-users are trained, each site historical data are migrated into E-RCA database, All sites are put into production operation);

Major results of this phase to be provided to Customer are the following:

- E-RCA meets all acceptance criteria and is installed in production environment (signed Installation Certificate);

- Users are trained to use the system;
- Historical data are migrated from legacy systems into E-RCA database;
- E-RCA is implemented on each site and put into production operation (signed Pilot Acceptance Certificate and Final Acceptance Certificate);
- The intellectual property rights of the custom developed software solution are transferred to the Purchaser.

The critical success factors of this phase are the following:

- The delivery and installation of the production hardware and software environment are on time and successful.
- Users are committed in their involvement and have a sense of ownership in the final system;
- There are no changes to the specifications of the functionality and the data at this stage;
- The technical architecture (Data Centre, central and local level sites) is on target to support the expected data volumes and number of users;
- The Pre-Pilot Testing, Pilot and Final Operational Acceptance Testing are successful;
- There is a well-constructed, organized, and understood problem resolution system.

SOFTWARE DEVELOPMENT METHODOLOGY

The methodology that planned to be used for the development of the E-RCA is expressed by a process-based systems development methodology. A process is a cohesive set of related tasks that results in one or more key deliverables. The software development methodology for E-RCA includes the following processes to handle the development activities and produce the relevant deliverables:

Software Requirements analysis.

This process provides a clear understanding of Purchaser requirements and expectations of application software. It is a set of recurrently executed activities:

- Gathering existing documentation. The material gathered include catalogue of forms and documents such as:
 - All relevant actual Laws, Legislation and other clarification documents published and explaining the implementation of the relevant Law or Legislation;
 - All relevant internal instructions, business processes descriptions and rules;
 - All document templates and patterns, used in relevant business processes with its attributes and verification rules descriptions.
 - User activities, tasks and responsibility areas.
- Interviewing and clarification meeting with Purchaser project team key-members allows to systemize gathered information for better understanding both by Supplier and Purchaser project teams and for using in elaboration of Software Requirements specification;
- The Software Specification elaboration activity allows to define the functionality of the system that satisfies the business needs of the organization. Software Requirements Specification (SRS) contain the following information according to both tender and RM Regulation RT-38370656 - 002:2006 "Software life-cycle" requirements:
 - Introduction
 - Purpose

- Scope of product
 - Definitions, acronyms, and abbreviations
 - References
 - Overview of rest of the SRS
- Overview of Current System
 - Organizational Structure
 - Data Model
 - Functional Model
 - Problems
- Logical Model of the Required System
 - Data Model
 - Data Dictionary
 - Functional Model
- General Description
 - Product Perspective
 - Product Functions
 - User Characteristics
 - General Constraints
 - Assumptions and dependencies
- Specific Requirements
 - Functional Requirements
 - Functional requirement 1
 - ~ Introduction
 - ~ Inputs
 - ~ Processing
 - ~ Outputs
 - Functional requirement 2
 - ~ Introduction
 - ~ Inputs
 - ~ ...
 - Functional requirement n
 - ...
 - External Interfaces
 - ~ User Interfaces
 - ~ Hardware Interfaces
 - ~ Software Interfaces
 - ~ Communication Interfaces
- Performance & Capacity Requirements
 - Design Constraints
 - Standards Compliance
 - Hardware Limitations
 - Attributes
 - Ease of Use
 - Availability
 - Transferability/Conversion
 - Reliability
 - Other Requirements
 - Database specifications

- Security
- Protection of privacy of subjects of information
- Recovery
- Operational Support
- Site Adaptation
- Packaging
- Installation
- Documentation
- Training
- Appendices
- [Index].

In this way, the business requirements are transformed into detailed software specifications. Based on successive workshops with denominated representatives of the Purchaser, the proposed detailed requirements to the system is verified and validated.

Software design and actual coding

This process consists of the following activities:

- Software Design Description (SDS) elaboration giving a clear understanding how the software system is going to be structured to satisfy the requirements identified in the SRS. The SDD is a translation of the requirements into a description of the software structure, software components, interfaces, and data necessary for the implementation phase. The SDD contain the following structured information according to both tender and RM Regulation RT-38370656 - 002:2006 “Software life-cycle” requirements:
 - Introduction
 - Purpose
 - Definitions, acronyms, and abbreviations
 - References
 - Overview of rest of the SDD
 - Decomposition Description
 - Module Decomposition
 - Module 1 Description
 - Module 2 Description
 - ...
 - Data Decomposition
 - Data Entity 1 Description
 - Data Entity 2 Description
 - ...
 - Dependency Description
 - Inter-module Dependencies
 - Data Dependencies
 - Interface Description
 - Module Interface
 - Module 1 Description
 - Module 2 Description ...
 - Detailed Design

- Module Detailed Design
 - Module 1 Details
 - Module 2 Details
 - ...
 - Data Detailed Design
 - Data Entity 1 Details
 - Data Entity 2 Details
 - ...
 - Packaging
 - Special Program Overlay Provisions
 - Software Release
 - Special Notes
 - Appendices
 - [Index]..
- Creating physical database instance. The result of this activity a relational database including effective indexing and database object security;
 - Application software modules designing, building and debuging. It is the main part of the custom application development process. It guides the developers through the design of the application and the creation of the working application code according to SRS and SDD prescriptions.
 - Application software modules internal testing will include all necessary actions to provide a software product corresponding to the Purchaser expectations. During testing period the developed application release passes through the following levels of testing:
 - Unit testing verify the functionality of a specific function (document, report, user interface, process, etc) of application;
 - Integration testing allows to expose defects in the interfaces and interaction between integrated modules;
 - System testing tests a completely integrated system to verify that it meets its requirements.

Testers generate metrics and make final reports on their test effort and whether or not the software tested is ready for release. Also the Pre-pilot testing plan with functional testing scenarios will be developed.

- Issuing the “release candidate” of developed application software which is ready to be functionally tested and accepted by Purchaser during the installation acceptance procedure.
- Developing application software documentation including:
 - Application System Installation and Configuration Manual containing:
 - Introduction;
 - Terminology and abbreviations;
 - Hardware requirements;
 - Installation kit. Necessary additional modules, libraries, and third-party manufacturers, their allowable version;
 - Installation Instructions;

- Description of necessary settings;
- List of key messages and actions.
- and User Guide describing the parts of the service designed for different roles of users and containing the following information including that for Administrator's role:
 - User instructions which contain an introduction, a description of the user's interaction with the system by different roles, and a description of any required training for using the system;
 - System narrative purpose and description;
 - Input/Output specifications;
 - Samples of original source documents and examples of all input formats (forms or displays);
 - Samples of all outputs (forms, reports or displays);
 - Data entry instructions for all user roles;
 - References to all documents or manuals intended for use by the users with different roles;
 - Description of the system limitations;
 - Description of all error situations which can occur and how to react

APPLICATION SOFTWARE DEPLOYMENT AND FUNCTIONAL TESTING

Successful result of this process is installed application software ready for further implementation during Pilot or Roll-out processes. Deliverables provided after successful finishing this process are: application software installation package and system documentation.

The following activities must be executed during this process:

- Installing and tuning E-RCA on functional testing environment;
- Training functional testing users;
- Application software functional testing;
- Supporting functional testing;
- Bug fixing;
- Issuing final release of application software.

The main verification document is Installation Certificate signed by Purchaser which means that application software function characteristics are in accordance with Purchaser's requirements and expectations and ready for further Pilot implementation.

All tests will be conducted in the production environment, which is consisted of the E-RCA Data Centre and defined testing environment, with the presence of the Purchaser's Project Manager and other assigned functional officials. Members of the Supplier development team will also participate and assist Functional Testing Team users in executing the acceptance tests. A brief description of the role and responsibilities of the Functional Testing Team members involved in the Pre-Pilot Testing is presented in the following table.

Roles	Responsibilities
Project Manager	Project Manager will be responsible for successful execution of the Functional Tests. His objectives will be to plan, organize, manage and control the Functional Testing.
Functional Testing Team	Testers will conduct tests for the modules developed. Testers will be responsible for executing the test cases according to the instructions described in the test procedures, report results of the tests filling in test execution logs.

Initially all testers will be provided with Test Case forms. The template of such Test Case form is presented in the following table:

TEST CASE

Project	
Work Package	
Unit	
Tester	
Date	
Number	Test cases should have a unique identifier
Hardware	The H/W required so as to carry out the test case is specified
Software	The system and S/W application, which is required, so as to carry out the test case is specified
Inter-case Dependencies	A list of test cases which have to be executed prior to the execution of test case are specified, if such exist.

BRIEF DESCRIPTION

A brief description of what features / items are tested during the execution of a test case is specified.

INPUTS

All inputs required so as to execute the test case are specified. Some inputs may be specified by values, while others, such as constant tables or transaction files, may be specified by name. Any relationships between inputs are also specified (sequence, timing, etc). Some inputs may be output(s) of other test cases.

OUTPUTS

All predicted outputs generated from the execution of the test case are specified. Outputs include all messages (e.g. error messages, etc) generated by the system, which translates into traversing all exception handling routines.

The testing will be executed with the sequence of steps imposed by the test procedures in the Pre-Pilot Testing Plan (the functionality of the system is checked with a set of test procedures which consist of one or more test cases).

The results of the test will be reported in the Test Case Execution form presented in the following table:

TEST CASE EXECUTION
GENERAL INFORMATION

Project
Test Plan Reference
Work Package
Date

TEST CASE EXECUTION LOG

Test Case	Pass/	Comments	Actual	Error Log	
Number	Fail		Results	Number	Approval
			(For Fail)	(For Fail)	

The log will be forwarded to the development team for analysis and resolution of the problems reported. After the end of the functional testing, an Acceptance Test Summary Report will be issued by Supplier depending on the Functional Testing results:

ACCEPTANCE TEST SUMMARY REPORT

Project:
Release:
Date:

Application / Subsystem:

Participants:

Test Procedures

Test Results

Test Cases Planned	Test Cases Checked	Test Cases Passed	Test Cases Failed	Defects Found	Severities			
					1	2	3	4

Conclusion / Comments

Approval

Reviewed by (PL):

Date:

Approved by (PM):

Date:

Appended to the report will be the Test Case Execution forms and the error logs.

The defects found during the functional testing will be addressed immediately to Supplier development team. Any defects remaining open at the end of the functional testing will be corrected in the final release of the application to be used on the Pilot stage.

The criteria for the successful completion of the functional testing are indicated below:

- No severity 1 defects.
- No severity 2 defects.

All defects remaining open at the end of the functional testing will be corrected before the final version of the application to be put in operation.

The classification of defects as severity 1, 2, 3 and 4 are defined as presented in the following table:

Severity	Classification	Functionality	Effect on System
1	Critical (blocking defect)	A major error occurred and no workaround exists.	The test cannot be evaluated further. Abnormal termination of the program, numerical errors, or requirements that are not implemented errors graded level 1 severity.
2	High (severe defect)	A major error occurred but a software workaround exists.	Abnormal termination that can be worked around with different user input, small errors in final results or minor failures in implementing requirements are classified as level 2 severity.
3	Medium (minor defect)	Minor omission or minor defect in functionality.	An incorrect report format or an incorrect description in a display or message are classified as cosmetic errors, as are deficiencies that make the software difficult to use but that are not in violation of the requirements and specifications.
4	Low (annoying defect)	A “cosmetic” error was found	No impact on corresponding component(s).

Also an exploratory testing (ad hoc testing) method can be performed by Functional Testing Team. It is a creative, intuitive process, and involves test design and test execution at the same time. This is the opposite of structured testing (predefined test procedures). This approach does not require significant advanced planning and is tolerant of limited documentation for the target of the test. Instead, this approach relies mainly on the skill and knowledge of the tester to guide the testing.

COORDINATION AND TURNOVER PLAN

The assurance that the Purchaser's management and key users will be sufficiently experienced and trained to be capable of assuming the full responsibility for the system operation, post implementation development requirements and other support, maintenance and enhancement tasks at the completion of the Supplier's contractual obligations, is ensured via certain aspects of the project implementation strategy.

These aspects are the following:

- "Know-How" transition;
- Purchaser's management and key users involvement and participation.

"KNOW-HOW" TRANSITION

The best absorption of the methodology that will be used as well as the active involvement of Purchaser's functional key users and IT staff is of significant importance for the construction of E-RCA .

This will be achieved during workshops that will take place during the requirements analysis and system design. In these workshops several tasks will take place, such as the illustration and explanation of functional requirements, the presentation of the methodology, presentation of deliverables and feedback from it. These tasks require the active involvement of Purchaser's functional key users and IT staff.

The participation of Purchaser's functional key users and IT staff to the assimilation of what the system should do (methodology, construction, use of the system) also is essential and imperative.

At the end of the project all used methodology and technology along with custom application software source codes will be transferred to the Purchaser.

PURCHASER'S MANAGEMENT AND KEY USERS INVOLVEMENT ROLES

The Purchaser's users are distinguished along two knowledge dimensions: business domain experience and computer experience. This imposes two user categories, the functional key users and IT staff respectively.

The above-mentioned user categories will participate to all phases of the project with different roles.

These roles and their descriptions are:

- Business Expert

This role participates in interviews and working sessions. It provides documented information about business objectives, and the processes and business requirements necessary in order to achieve project objectives. This role also is responsible to review the content of the analysis documentation to ensure that it accurately describes the business and requirements of the organization.

- System Design Reviewer

This role is responsible to review the content of the design documentation to ensure that the specified business requirements are accurately and usably implemented.

- Data Migration Expert

This role is responsible for providing the existing system data structure, format, relations and verification rules description. It will be also responsible for the review of the data migration design document, as well as for data verification after conversion existing data into the new system.

- Trainee

Trainee is the consumer of a training program. A trainee may be a future Tester or User or IS Operations Staff or Application Administrator.

- Tester

Testers are responsible for test script execution. They record test results during testing activities and document test faults. They re-test after when the problems are resolved.

- User

The user is a member of Purchaser's staff who actually uses the production system. Their responsibility is to be a consumer of the training program and report problems with the production system.

- IS Operations Support Staff

The IS Operations Support Staff is responsible for operating the new system. They are consumers of the training program.

- System Administrator

The System Administrator is responsible for administrating the system infrastructure of the developed system including hardware configuration, installation and maintenance, ensuring daily backup, first line support for problems with the system software.

- Database Administrator

The Database Administrator is responsible for administrating the database management system including monitoring the system resources, data definition thru database tables, table spaces, transaction requirements resource allocation, indexing the data, etc.

- Application Administrator

The Application Administrator role is responsible for user's roles, profiles and access rights management and production support. This role is also responsible for scheduling the execution necessary batch processes.

PILOT IMPLEMENTATION PLAN

A pilot implementation is an activity undertaken in the context of E-RCA development and implementation to test a system in a production environment and thereby learn about the fit between the system and its organizational use situation and about changes necessary for full-scale production.

PILOT IMPLEMENTATION SCOPE

Pilot implementation scope is as following:

- To evaluate the usefulness and usability of the system;
- To improve the system design based on user feedback, practical use experience, and observed results (“objective measures” – e.g. productivity or quality data);
- To identify necessary or available changes in the work organization and processes in which the system will be embedded;
- To provide input to production implementation strategies and plans based on users’ reactions to the Pilot;
- To prepare E-RCA for production operation.

ASSUMPTIONS

Pilot Implementation Plan is based on the following assumptions:

- E-RCA meets all acceptance criteria and is installed in production environment (signed Installation Certificate);
- Pilot workplaces are well equipped and ready for implementation;
- Pilot users are motivated enough for active participating in all planned Pilot activities including parallel working with existing and new systems during the transition period.

PILOT IMPLEMENTATION ACTIVITIES

Then the pilot system will be implemented at the selected pilot sites, training materials will be prepared and training will be provided to a group of users who participate in the E-RCA application software pilot implementation. The pilot system users will carry out real operations with the E-RCA during the agreed period, registering their commentaries, possible errors and the proposals for improvement of the E-RCA elements.

Proceeding from the results of the experimental operation of the E-RCA, the Supplier’s project team will refine the system and prepare the pre-final version of E-RCA system for full-scale implementation, which will be also put into experimental operation and accepted by the Purchaser.

During this stage all pilot users will be well trained and the system will be put into pilot operation.

Table 1 illustrates the list of activities to be performed during Pilot implementation phase of the Project:

Table 1. List of Pilot Implementation activities

#	Activity	Expected results	Responsibility
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1	Pilot users training	Pilot users are trained and ready for pilot experimental testing of E-RCA	Purchaser - pilot users as trainees, training facilities (premises, equipment, etc.) Supplier – trainers and training materials
2	Entering initial pilot data (migration if necessary)	Initial pilot data are entered (historical data are migrated) into the new E-RCA database	Purchaser – entering data Supplier – pilot users support (consultancy)
3	Experimental pilot operation		
3.1	Identify cases to be executed and legacy systems results to be used as verification points for the new system	Cases are identified and documented, users understand resulting reports to be produced by the system	Purchaser
3.2	Execute cases (parallel working with legacy systems) and compare results with results produced by legacy systems	Cases data are entered into the system and necessary reports are produced and contain expected results	Purchaser (pilot users)
3.3	Document comments on application functionality	Approved by Purchaser documented comments on application functionality	Purchaser (pilot users)
3.4	Provide technical support	Technical support service for pilot users	Supplier
3.5	Refine application according to pilot users comments	E-RCA application releases refined according to pilot users comments	Supplier
3.6	Provide final version of E-RCA application	E-RCA is ready for production on pilot sites	Supplier
3.7	Accept Pilot Implementation results	Operational Acceptance Certificate	Purchaser (Project manager)
4	Production		
4.1	Shut Down Legacy Systems and go to the production of E-RCA	Legacy Systems are stopped, E-RCA is in production mode	Purchaser (management decision)
4.2.	Start warranty support	Warranty support&maintenance	Supplier

PILOT IMPLEMENTATION CRITICAL SUCCESS FACTORS

The critical success factors of the Pilot implementation are the following:

- Users are committed in their involvement and have a sense of ownership in the final system;
- There are no major changes to the specifications of the functionality and the data at this stage;
- The system operation environment is on target to support the expected data volumes and number of users;
- The Functional Testing is successful;
- There is a well-constructed, organized, and understood problem resolution system.

PILOT TASKS AND DELIVERABLES

Pilot tasks and deliverables are listed in the table below:

Task	Deliverable
Data Migration (see the “Data migration plan” chapter of this document)	
Elaborate Pilot Data Migration Requirements Specification	Data Migration Requirements Specification containing: • Data Collection Requirements • Data Conversion Requirements • Pilot Data Migration Work Plan
Data Migration Modules Design & Build	Tested Data Migration module (application)
Data Migration Execution	Converted and Verified Data
Training	
Produce User Class Materials	User Guides
Prepare Training Installation	Training Installation
Train Pilot Support Team	Trained Pilot Support Team
Train Users	Trained Users
Experimental operating	
Carry out real operations during the defined period	Results of the experimental operation (List of comments)
Refine the system and prepare the final version	Final version of the E-RCA including updated documentation
Transition	
Operational Acceptance	Operational Acceptance Certificate

Shut Down Legacy Systems and go to the production Management decision

Start warranty support

Warranty support&maintenance

TRAINING PLAN

APPROACH

A group of up to 8 users will be trained with regard to system functionality. A group of 2 administrator will be trained regarding various administration tasks and procedures and implementation details of the system modules. The duration of the training will be not less than 3 sessions of 3 hours each for the users group and 3 sessions of 3 hours each for the administrator group. If necessary the number of sessions will be increased. All trainees will be provided with necessary training materials in accordance with provided training courses.

The preferred location for the training is the Purchaser premises, if there is insufficient accommodation for a number of parallel courses, and then alternative locations in Chisinau and other major cities will have to be identified. It is the responsibility of Purchaser to organize the necessary training facilities in accordance with the Training schedule to be agreed between Purchaser and Supplier. A provisional schedule needs to be agreed.

Users, providing reports, will be supplied with "User's Guide" educational materials. These materials are available on the portal www.raportare.md in the relevant sections and are sufficient for SCA and MFO user.

ASSUMPTIONS

All users to be trained will have to have received basic computer skills training prior to attending the relevant courses.

All users will be familiar with the business processes of the area they are assigned to be trained.

COURSE REQUIREMENTS SPECIFICATIONS

The detailed Training Plan delivered includes the following:

- Specification of the facilities and equipment required for each course. In particular, the following subjects will be quantified:
 - Items (disposal and non disposal);
 - Computing Resources (Hardware and Peripherals – Operating System / Network/ Application Software).
- Course Schedule

This section of the Plan provides a matrix for schedule of the courses. The information needed should be included in a table of the following structure:

Course Code	Class Code	Location/ Room	Class Start Date	Class End Date	Number of Attendees	Start Time	Class Set Up Date	Trainer
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The table should be filled by the trainers.

- Class Schedule

This section provides a matrix per course that will include the schedule of who is to attend each class. Each class is identified by course code, title and duration. The information needed should be included in a table of the following structure:

Class Code	Location/ Room	Class Start Date	Trainee	Trainee Contact Information
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The table should be filled by the trainers except for the trainee data that should be provided by the Purchaser.

After the completion of the training courses, the project manager must issue a training acceptance certificate form within reasonable time (i.e. 5 days) in order to be certified that the scheduled classes have indeed taken place.

SYSTEM MAINTENANCE PLAN

The E-RCA will be covered by warranty and post-warranty maintenance and support services for 12 months after acceptance. The warranty includes all modules that were developed and supplied in this information system.

The Supplier ensures support to the user and Information System functionality. This support consists of the following groups of activities:

- Technical support;
- Warranty Service;
- User support/Hot User line;
- Technical Assistance.

The Supplier guarantees providing following developed and supplied software warranty services during 12 months from acceptance date without any additional charge:

- Deliverables media changing;
- Bags fixing (reactive modification of a software product performed after delivery to correct discovered problems/bags) up to 3 business-days;
- Patches (modification of a software product after delivery to detect and correct latent faults in the software product before they become effective faults);
- Call Centre service in business-days 5/8 (respond to any maintenance call made within 1 business-day);
- Purchaser's IT support staff "hot-line" consultancy by phone or e-mail 5/8;
- On-site service if required, next business-day;
- On site visit if required, next business day.

All incidents are handled according to the following process:

1. The end user reports to the Purchaser's IT support staff, personally, by phone, via FAX or by electronic mail any problem or malfunction of the system or requests assistance.
2. Purchaser's IT support staff attempts to resolve the problem. If the problem is resolved at this level the incident is closed.
3. If the Purchaser's IT support staff cannot resolve the problem and if the problem is related to the system implemented in frame of this project the problem is escalated to Supplier Helpdesk for further investigation.
4. Supplier's Helpdesk personnel:
 - a. Using its troubleshooting experience and its knowledge about the specific system tries to find a resolution to the problem or to pinpoint as accurately as possible the cause of the problem.
 - b. Informs Purchaser's IT support staff on the status of the specific problem and the status of the whole system as well.
5. In case Supplier's Helpdesk personnel cannot resolve the problem escalates it to the appropriate Second Level Support team.
6. The engineers of the Second Level Support team inform the Purchaser's IT support staff for their actions and the results/ status of the problem they have been assigned to resolve.
7. The Second Level Support team has access to all necessary tools for the resolution of problems (bugs of system software, application software, upgrades, patches, etc)
8. In case the problem cannot be resolved remotely, the engineers of the Second Level Support Team, having available all the needed information, visit the site and correct the problem (setup

application, install patches) and collect all the necessary information to update the application if needed.

9. The Supplier's Helpdesk keeps a database to track and monitor all incidents.

It is available to Purchaser's IT support staff to get assistance in resolving of more complex technical issues by phone. Requests can be made via the "hot-line" and/or e-mail and a proper Supplier's Helpdesk engineer will take a call or call back.

Upon Purchaser agreement Supplier's engineer will install advanced remote services capability to obtain automatic alerts from the system on a continuous basis. These alerts will inform Supplier's Helpdesk staff of any problems that have or may develop. This is important, especially in lights out Non-Stop Server systems, where Systems Administrators are not always in attendance. Availability of Remote Services will depend on the local telecommunications situation and used hardware/software platform.

Upon Purchaser's IT support staff request proper Supplier's engineer will perform on site intervention to make necessary activities under warranty and post-warranty support: diagnosis, setup, repair, software update, etc. Supplier's engineer will have up to 4 hours to prepare system intervention (software media, tools, etc.) and up to 1 hour to achieve by car the MIA Headquarter in Chisinau.

CHANGE ORDER PROCEDURE

TYPE OF MODIFICATIONS

Change can occur as the result of a variety of events. External impacts may affect the project. Internal changes may be initiated to save money, avoid risk, reduce timelines, or produce a better deliverable. Customer changes may be adopted to increase or decrease the functionality of the solution. Technical changes may be required to overcome challenges in design.

All the changes that have impact to the scope, schedule and/or budget of the project should be accepted according to the change management process. No changes will be initiated until properly documented and approved.

PROCEDURE

Request for change

The Request for Change process is used when a change has been identified that requires approval to proceed. A Change Request Form will be used whenever a change has been discovered or is being contemplated. The intent of such a form is to fully document the change, identify the change impact, determine the best approach for managing the change, and to obtain the approval of all affected parties prior to initiating any change action.

Review change request

Every proposed change must be formally documented and submitted for approval using the Change Request Form. The Supplier reviews the Change, analyses the scope of the request, and agrees with Purchaser on the impact of performing the change request. If Purchaser accepts the impact (cost and/or

time slippage), the Customer assigns the resources required to evaluate the impact and suggest possible responses.

Evaluate proposed change

The assigned resources evaluate the Change Request to determine the potential impact, risk and complexity of the request. Simple changes that do not affect the contractual obligations, may be prioritized, assigned, and activated on the authority of Project Managers.

Complex changes, changes with significant risk potential or those that effect the contractual obligations between Supplier and Purchaser must be thoroughly evaluated and authorized before any action is taken.

Evaluation of the proposed change may involve the following actions:

- Evaluating the scope of the potential change to determine business, and technological impact.
- Determining the effects the change may have on completed and planned deliverables.
- Assessing the possible impact of the change, an additional plan and/or project procedure(s) may be necessary.
- Identifying any modifications required to the project baseline and/or contract documents.
- Estimating the resource effort and costs associate with completing the change and determine the costs of the not addressing the change.
- Providing a recommendation on the priority of the change.

The Supplier ensures that all required change control procedures are followed and the requests are dealt with in a timely and cost-effective manner.

Approval of change

The Supplier reviews and presents recommendations for dealing with the Change Request to the Steering Committee. Steering Committee is responsible for making the decision of implementing the recommended changes.

MANAGEMENT

Once the necessary approval has been obtained, the Project Plan and contract are revised as required, and the change action is initiated.