# Modernization of Government Services in the Republic of Moldova Project ID No. P148537

## Terms of Reference

### Consulting Services for the Design, Development, Configuration and Deployment of the Semantic Catalog Information System

### 1. Background

The Government of Moldova is determined to fundamentally change the way public services are provided in Moldova through a variety of interventions for modernization of service delivery, which combat corruption, foster a customer care culture, enhance access, as well as increases efficiency in the Moldovan public administration. Therefore, one of the main objectives of the Administration Reform Strategy 2016-2020 is the modernization of public services.

The Government of Moldova, via e-Governance Agency (EGA) as implementing agency is carrying out a World Bank-funded PAR operation, planned for 2017 - 2023- Modernization of Government Services Project – (MGSP) [1.] The e-Governance Agency is responsible for development and implementation of Government e-Transformation Agenda, which intends to ensure country's sustainable development through efficient use of ICT. EGA was established in August 2010 on behalf of the State Chancellery to manage e-transformation activities at governmental level.

The Government of Moldova, in accordance with the Public Administration Reform (PAR) Strategy for the years 2016-2020 (especially the component "Modernization of Public Services") is undergoing a major transformation exercise (qualitative and quantitative) of administrative public services, provided by central public administration authorities through: a) removing outdated public services or merging several services in one; b) increasing access to local public services through various channels; c) reducing the number of documents required for public services, and the delivery time; e) ensuring a high level of satisfaction with the quality of government service delivery.

One of the key areas of e-Governance Agency activity is the implementation of the MConnect interoperability platform. Launched in 2015, MConnect interoperability platform is becoming the key IT Solution that will assure the automated data exchange between IT Systems.

Since there is no inventory of semantic assets available on the territory of the Republic of Moldova, it is difficult to unify and universalize the principles of accessing semantic assets data.

[1] Modernization of Government Services in the Republic of Moldova (http://projects.worldbank.org/P148537?lang=en)

By developing an inventory of semantic assets (called Semantic Catalog), the State Chancellery and the e-Governance Agency, as coordinators of the reform of the modernization of public services, aim to provide tangible results of the reform within a short period of time.

The implementation of the Semantic Catalog would automate the semantic assets inventory processes and ensure access to semantic assets using IT mechanisms, which will significantly boost the continuous development and exploitation of the MConnect interoperability platform.
The following entities are interested or should be involved in the design and proper functioning of the *Semantic Catalog*:

- **e-Governance Agency**, as owner of the *Semantic Catalog*, is financing the project and is an active stakeholder during the information system implementation, launch and operation, including validation and acceptance of the delivered information solution. Also, the e-Governance Agency will provide the MConnect interoperability platform for which through the Semantic Catalog will be configured the categories of data accessible to semantic assets Beneficiaries, data access strategies, and related semantic assets data.
- **Legal entities possessing semantic assets** - as proprietary of semantic assets, whose data will be provided through the MConnect interoperability platform. Semantic Assets Owners will use the Semantic Catalog for the purpose of registering and configuring semantic assets in the Semantic Catalog.
- **The Semantic Catalog** represents a key IT System for configuration and management of the inventory of semantic assets in the possession of legal entities in the Republic of Moldova. In this respect, this IT System will be the key IT resource that will provide up-to-date data on semantic assets available on the territory of the Republic of Moldova and interoperability metadata values for interaction with the MConnect interoperability platform.
- **Semantic Asset**- a data structure describing an entity, event, classifier, service, vocabulary, test data and other data elements (metadata).
- **Legal entities beneficiaries of semantic assets** - as data consumers based on semantic assets reflected in the Semantic Catalog inventory. Semantic Assets Beneficiaries will use the Semantic Catalog to explore semantic assets inventory and to request access data through MConnect.
- **IT and Cyber Security Service** (RO: Serviciul Tehnologii Informaționale și Securitate Cibernetică - STISC), as MCloud owner, is responsible to provide all necessary infrastructure from MCloud in order to host the Semantic Catalog Information System.

## 2. Objective of the Assignment

The Client is looking for an ICT consulting company to develop the Semantic Catalog Information System with demonstrated experience in the design and implementation of similar complexity projects to perform key client-facing activities, and to provide on-going maintenance and technical support.

## 3. Scope of work and Development approach

The scope of work of this assignment is to design, develop, configure, and deploy the information system as a fully functional product with all functionalities in place, according to the specifications iteratively defined by the Client (the indicative set of requirements is listed in **Annex 1** and **Annex 2**) and following the development approach described below.

The development of the solution will follow agile iterative software development principles. Since there are many interpretations of agile software development and in order to avoid misunderstandings, this section provides key technology principles to be used in development of the solution.

**Iterative development**
In contrast to waterfall software development approach, the solution shall be developed in iterations named sprints. This means that the implementation of different functionalities will take place in phases with some modules being in production while others still being in development. The priorities of functionalities included in a sprint will be determined by the Client. Sprint duration will be determined by the Client together with the Consultant.

**Agile development**
The development shall follow agile principles by allowing change and flexibility in implementation. Client will maintain the master list of generic requirements for the solution– *product backlog*, which consists of ordered business and technical requirements as seen by the Client. Items in product backlog are ordered by the Client by their priorities. Client is free to manage the product backlog by adding new items to it, removing items and reordering them as he/she desires. At the beginning of each sprint, the topmost **N** items that fit into a sprint are taken, and a *sprint backlog* is built out of them. Items in sprint backlog are further detailed and distributed to developers. Sprint backlog is not changed during the sprint.

**Working product in each iteration**
Each sprint ends up in a working product which is presented to the Client for acceptance in the last day(s) of sprint. The working product shall meet the agreed criteria – Definition of Done (e.g. it must be fully functional, fully tested, accompanied with relevant unit tests, accompanied with relevant documentation where necessary, complete commented source code supplied etc.). Payments will be made upon successful delivery of working packages (one or more working products). In case the deliverables contain defects for reasons not imputable to the Client, the Consultant shall fix them without impacting the time schedule and at no additional costs, including possible visits to Client site. Working products from different sprints can be combined into a release deployed in production at Client's discretion. Any incidents reported by the Client after the release, shall be solved by the Consultant according to the agreed Service Level Agreements (SLAs) as defined in Annex 2, p.10 Support and Warranty requirements.
To ensure that the development team is in position to deliver on time working products, a Client representative –typically named *the Product Owne*r in agile methodologies – is permanently available to the team for answering eventual questions, thus not slowing down the implementation pace.

The Consultant will appoint a Scrum Master from the team of key or non-key experts for the entire duration of the project.
The Scrum Master will be responsible for the day-to-day liaison with the Client; s/he must ensure the internal coordination and guidance of the project experts and the project coordination with external counterparts.
The Scrum Master must also ensure the availability of suitable experts in accordance with the project planning documentation.

**Client involvement**
In contrast with commonly used waterfall model for procurement and implementation of information systems for the government, the Client designated person – Product Owner – will be heavily involved in the development process. The Product Owner will have three core responsibilities:

1. Maintenance of product backlog – the owner will maintain the product backlog up to date, so it reflects prioritized list of desired functionalities;
2. Answering to questions coming from developers – the owner will be at all time available to the development team for answering their eventual clarification questions, thus avoiding complex and formal communication within the project. This is essential to ensure the team has all the information on time to deliver a working product at the end of the sprint;
3. Acceptance of working packages – delivered working packages are presented to the Client for acceptance at the end of each sprint. The Client shall accept the working package or notify the Consultant of any defects during the following sprint.

Although it is not strictly necessary, the Product Owner may participate in team stand up meetings listening for progress and eventual blockers for an immediate reaction.
Product Owner also decides on product releases, as per release plan.
Also, as per the principles of Agile project management methodology, the Client will define the Product Vision Statement and Product Roadmap in order to track progress and to ensure the appropriate product development.

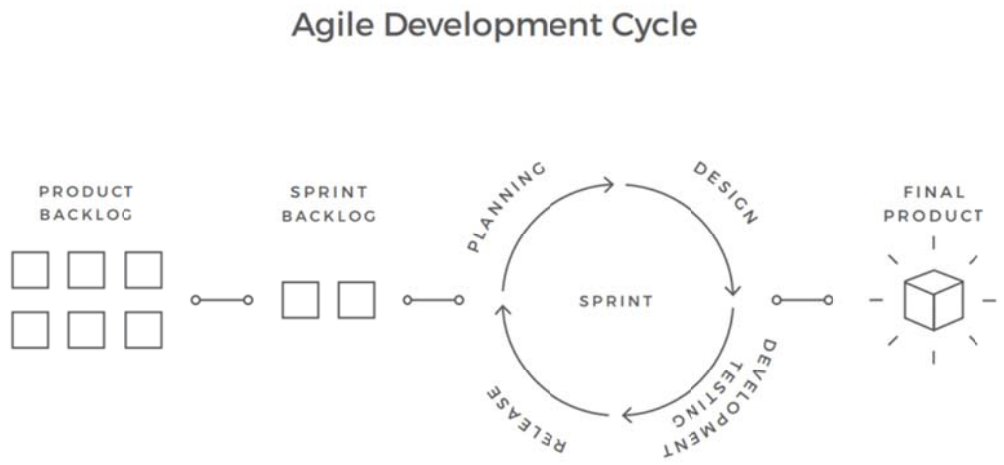



**Figure 1. The indicative illustration of the Agile Development Cycle/Process**

**Warranty**
The Consultant shall provide 3 months of warranty for the developed solution. The warranty period starts after final release. During the warranty period the Consultant shall fix any identified defects.

The development and operations must be in compliance with the legal and regulatory documents listed in **Annex 3**.

**Required technology stack**
To preserve e-Government investments, the solution shall be developed using the latest versions of the following technology stack:

- Programming language is C#.
- ORM is Entity Framework Core.
- Web framework is ASP.NET MVC Core.
- RDBMS is SQL Server.
- Container engine is Docker.
- Container orchestration is Kubernetes.
- Cache server and session store is SQL Server or Redis.

During the development process, the Consultant or the Client may propose use of additional components required for the development and proper functionality of the solution in production. Upon the Client's approval of such components, the costs for them shall be added through amendments to the contract.

## 4. Expected Deliverables

The following deliverables will be provided by the Consultant during this assignment:

1. **A fully functional information system** with all functionalities developed and deployed according to the requirements defined by the Client during the assignment. The Consultant will deliver compilable and documented source code (including third-party tools and libraries, licenses, where applicable and automation scripts).
2. Technical and End-user documentation developed according to the Client's documentation requirements defined in Annex 2.
3. Training sessions and training materials developed according to the Client's training requirements defined in Annex 2.

Please note that any population with or migration of data is not part of this assignment.

## 5. Reporting Requirements

The following reports will be provided during the assignment:

a) Sprint Report, including release notes, breakdown and duration of tasks implemented during the sprint, velocity, issues and outstanding problems, proposed actions to be taken;

b) Next Sprint Backlog, including breakdown and estimated duration of tasks proposed to be implemented during the next sprint, resources that the Consultant expects to be provided by the Client and/or actions to be taken by the Client;
c) Training reports, submitted after each training session, including:
- Participants list;
- Training session agenda;
- Training materials (presentations, labs etc.);
- Trainees test results;

## 6. Timing

The tasks defined under the current contract are estimated to be performed in 12 months – 9 months for development and 3 months of warranty period.
If new functionalities will be identified by the Client based on users feedback and subject to satisfactory performance, the contract can be extended based on the same fee rates.

## 7. Institutional arrangements

**The Client** is responsible for all administrative and procedural aspects, contract and financial management, including acceptance and payment of deliverables/reports expected under the Contract, general project responsibilities and efficient coordination with stakeholders.

A Product Owner will be appointed by the Client and will coordinate and decide on all issues related to the technical elements of the Contract. The Product Owner will issue the administrative notice on the start date of the implementation of the contract and other administrative duties.
The Client will provide the following:
- infrastructure resources for testing and production environments;
- code repository, issue tracking system, CI/CD environment, task management system via the Client's subscription in Azure DevOps. The Consultant shall not include Azure DevOps subscription in its financial proposal;
- Training facilities.

The **Consultant** will ensure that adequate working conditions (workspace/office premises for experts, office equipment, computers, communication facilities, etc.) and services are provided to the Consultant's staff during the lifetime of the project.
The Consultant will be responsible for the day-to-day management of the project team and availability of necessary resources.

The Consultant will organize the Kick-off meeting and initial Backlog discussion at its premises. All Consultant's Key Experts as specified in the section defining the qualification requirements, shall participate in the Kick-off meeting and initial Backlog discussion. The costs associated with the Client's presence at the Kick-off meeting will be covered by the Client and shall not be included in the Consultant's financial proposal.

The Consultant will ensure visits to the Client site to provide training to end users.

In case the deliverables contain defects and/or there are delays for reasons not imputable to the Client that may impact project outcome, the Consultant may be requested to visits to Client's site in order to solve the project issues.

The communication languages will be Romanian or English.

The Consultant shall work under the supervision of the appointed Product Owner and report to the Client's Chief Digital Officer.

## 8. Qualification Requirements

**Consultant qualifications requirements**

The Consultant shall furnish documentary evidence (including information about the completed contracts and contact information of clients from whom the references could be taken or whom the Client may, when necessary, visit to familiarize themselves with the systems put into operation by the Consultant) to demonstrate that it meets the following experience requirements:

1. Have been in operation for at least five (5) years with main part of its business being the development of information systems.
2. Experience in conducting projects similar size and complexity developing web applications proven by at least two (2) contracts with the development phase finalized in the last three (3) years. For ongoing projects, copies of acceptance documents of the entire software solution shall be provided.
3. Experience in software development using agile software development principles (as described in the scope of work and development approach section of the ToR) would be an asset. This shall be demonstrated by presenting the project methodology describing the role of the client.
4. Demonstrated experience using required technology stack would be an asset.

**Staff qualifications requirements**

The Consultant shall provide a team of the following key experts:

- Key expert 1. *Senior software developer*
- Key expert 2. *Software developer*
- Key expert 3. *Software developer*
- Key expert 4. *Software developer*
- Key expert 5. *Software Tester*
- Key expert 6. *Trainer*

Each key expert must meet at least one the following requirements:

- Proven experience in web UI design and development using responsive frameworks, progressive web apps
- Proven experience in database design, development and optimization
- Experience in systems' integration, API design and development using SOAP/REST
- Experience with unit testing
- Experience in DevOps practices
- Experience in system analysis.

Per total the entire team of the proposed key experts must meet all the above requirements. Offers which will not demonstrate that the team covers the above requirements may be subject of disqualification.

For proposed key experts the CVs need to be submitted, demonstrating the minimum qualifications requirements, as detailed below:

**Key expert 1.** *Senior software develope*r:
The senior software developer shall oversee that all reporting obligations are fulfilled in a timely manner to a high-quality standard.

- University degree in Computer Science or another relevant domain
- At least 7 years of experience in software development
- Participated in at least 2 software development projects in the last 3 years using agile approach
- At least 3 years of experience in software development using C#, Entity Framework, ASP.NET MVC, SQL Server and a dependency injection framework
- Certifications in any technology from the required technology stack is an asset
- Ability to communicate in Romanian or English

**Key Expert 2, 3, 4. *S****oftware developer*:**

- University degree in Computer Science or another relevant domain
- At least 5 years' experience in software development
- Participated in at least 2 software development projects in the last 3 years using agile approach
- At least 3 years of experience in software development using C#, Entity Framework, ASP.NET MVC, SQL Server and a dependency injection framework
- Certifications in any technology from the required technology stack is an asset
- Ability to communicate in Romanian or English

**Key Expert 5.** *Software Tester*:

- University degree in Computer Science or another relevant domain
- At least 3 years' experience in software testing in projects of similar complexity
- Proven experience in software testing analysis and design
- Proven experience in automated testing
- Proven experience in performance (load and stress) testing
- Proven experience in security testing
- Certification in testing or any technology from the required technology stack is an asset
- Ability to communicate in Romanian or English

**Key Expert 6. *Trainer***:

- University degree in Computer Science or another relevant domain
- Proven experience in conducting training sessions for end-users and IT specialists in at least 2 similar projects
- Proven experience in writing technical and end-user documentation

- Experience in on-line training development using Moodle e-learning system is an asset
- Ability to communicate in Romanian
- Knowledge of English is an asset

**Annexes**

## Annex 1. The *Semantic Catalog* Business Requirements

### 1. Introduction and definitions

This Annex contains an indicative set of business requirements reflecting the functionality of the *Semantic Catalog*.

*Semantic Catalog* – the information system representing an inventory of semantic assets, including management of their lifecycle[2].

*Semantic Asset* – an identifiable set of reference data (code lists, taxonomies, dictionaries etc.) and data describing other data (metadata) used for data exchange to ensure the same meaning of the data (semantic interoperability)[3].

Conceptual semantic asset structure:

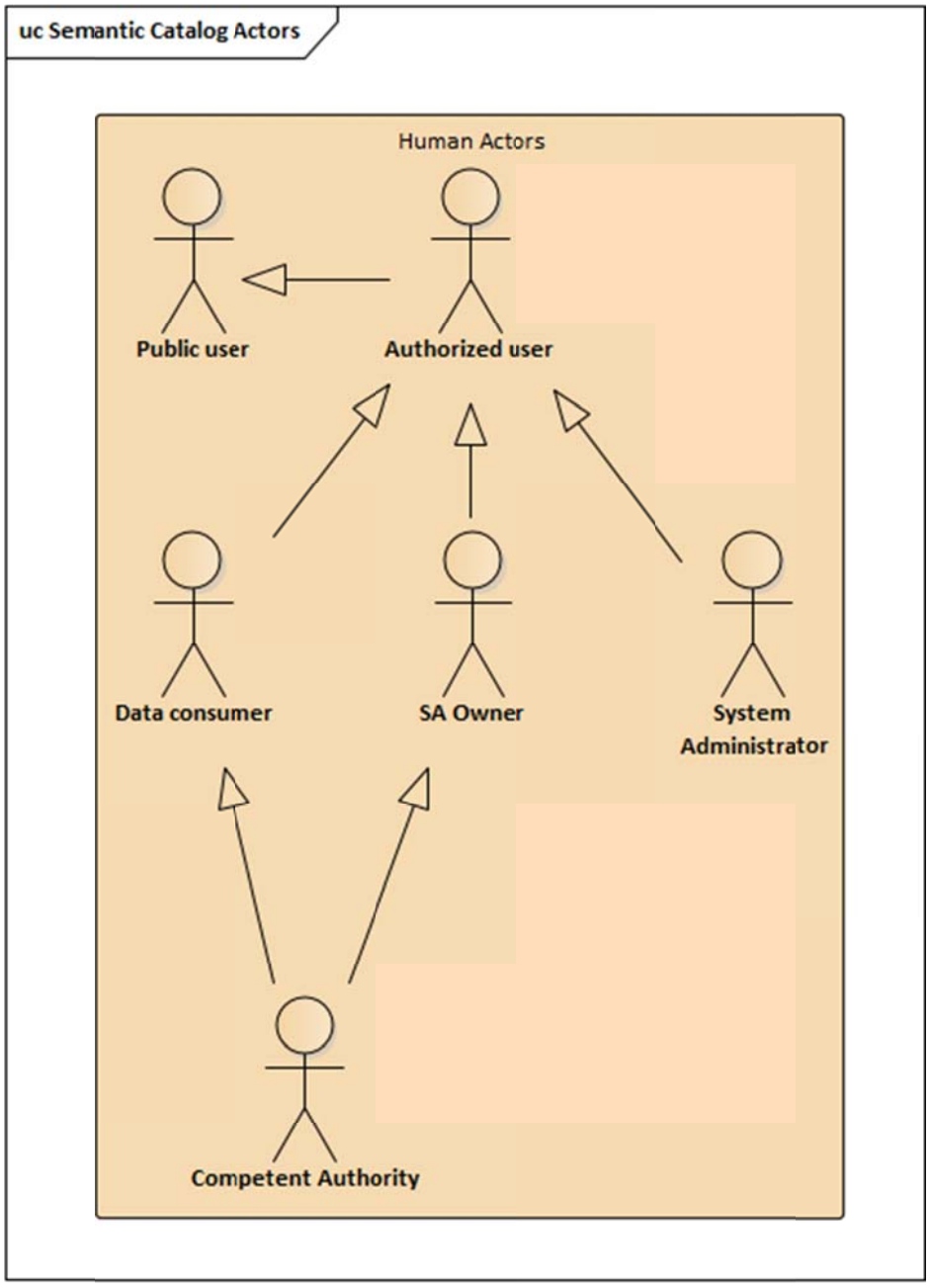
- asset identifier;
- asset name;
- asset owner;
- references to legal basis for the asset;
- asset categories;
- asset description;
- asset version number;
- asset status (draft, submitted, approved-active, approved-obsolete, rejected);
- asset type from a predefined list of types (entity, event, classifier, service, vocabulary, test data, etc.);
- asset attributes, including attribute type (primitive type or reference to another semantic asset or inline type definition), validation rules for each attribute, attribute multiplicity, attribute description;
- validation rules;
- relationship and references to another assets (like parent type, derived types);
- specific values (for classifiers, etc.)
- sample data (sample valid instances, requests, responses, etc.);
- version history;

*Data exchange request* – an official request for accessing data defined in semantic catalog, through interoperability platform MConnect[4].

### 2. Semantic Catalog Actors

[2] Law 142/2018, art.10, art.3
[3] Law 142/2018, art. 3
[4] Law 142/2018, art.6, art.7

The Actors of the *Semantic Catalog* are described in the figure below:




- **Public user –** a human actor representing an anonymous public user. This user can explore the Semantic Catalog public interface (search for semantic assets, view and download details of the semantic assets, access public reports and performance indicators etc.);
- **Authorized user –** a human actor representing an authenticated user based on its electronic identity, who is authorized to use the Semantic Catalog non-public functionalities.

- **Data consumer** – a human actor representing an organization requesting access data through MConnect, based on semantic assets.
- **Semantic Assets Owner** – Representative of an organization owning semantic assets.
- **Competent Authority** – Representative of the *Competent Authority as per law 142/2018* which is in charge of management the *Semantic Catalog,* reviewing and approving data access requests.
- **System Administrator** – A user who is in charge of technical administration of *Semantic Catalog.*

## 3. Business functions of the Semantic Catalog

**UC01: Explore public content of the Semantic Catalog**

Public user can explore content of the *Semantic Catalog* by:

- searching semantic assets;
- listing categories;
- listing semantic asset owners;
- viewing semantic asset details;
- downloading technical specifications for a semantic asset (CSV, XSD, JSON schema, WSDL, etc.);
- referencing semantic asset by using user friendly URL;
- view statistics about semantic assets.

**UC02: Login**

Public user can login into *Semantic Catalog* using MPass[5] in order to access additional functionalities if authorized.

**UC03: Logout**

An authorized user can sign-out of *Semantic Catalog* thus closing a working session.

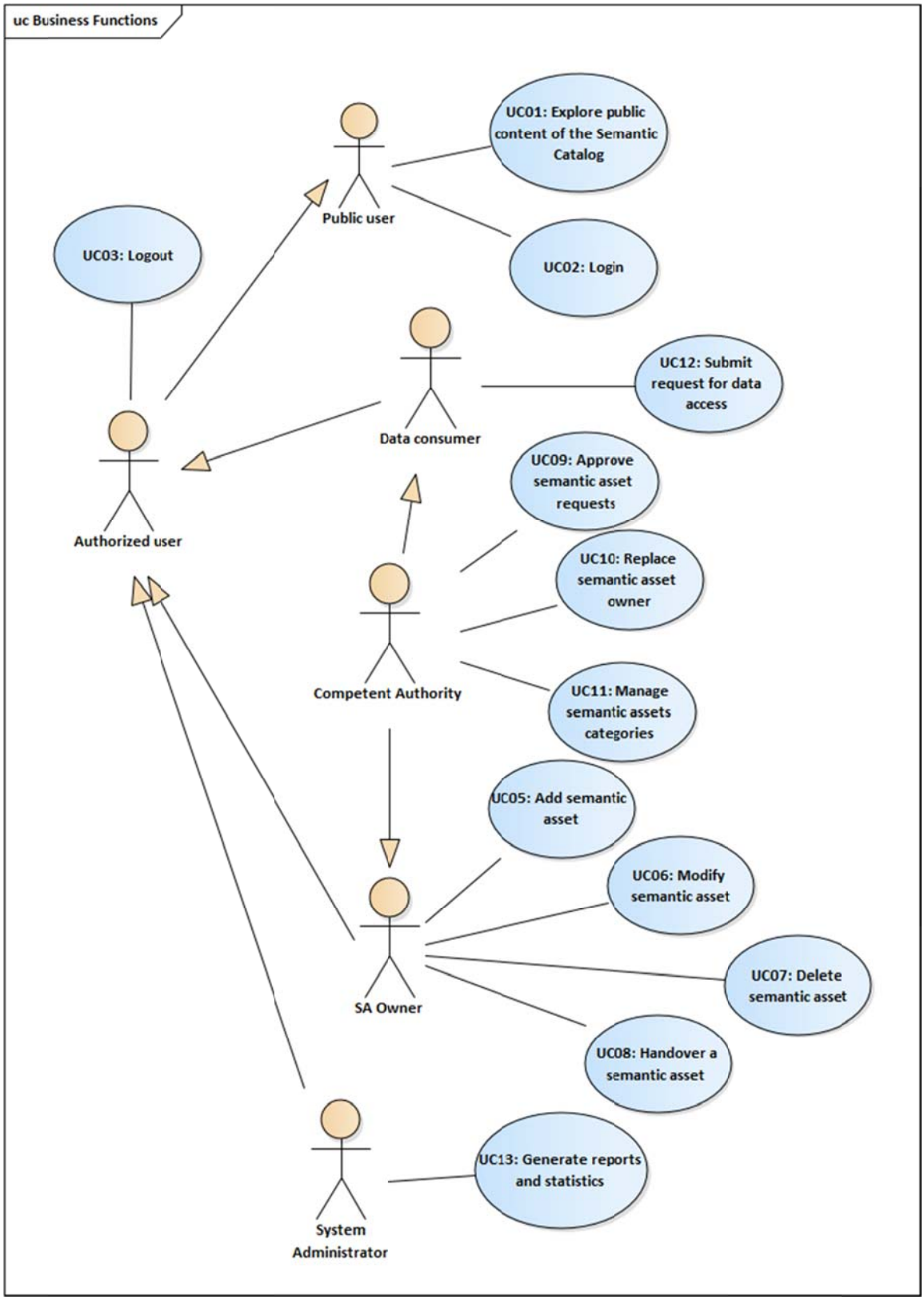
**UC04: *User management (out of scope)***

Before defining new semantic assets, an organisation (owning semantic assets) must designate a person as a representative of the semantic asset owner to manage its assets.

Competent Authority representative and the *Semantic Catalog* administrator is designated by EGA in the same manner.

These designations happen outside of the *Semantic Catalog* and the authorisation information is provided by MPass as one of authentication attribute.

[5] https://mpass.gov.md


uc Business Functions
Public user
UC01: Explore public content of the Semantic Catalog
UC02: Login
UC03: Logout
Data consumer
UC12: Submit request for data access
Authorized user
Competent Authority
UC09: Approve semantic asset requests
UC10: Replace semantic asset owner
UC11: Manage semantic assets categories
SA Owner
UC05: Add semantic asset
UC06: Modify semantic asset
UC07: Delete semantic asset
UC08: Handover a semantic asset
System Administrator
UC13: Generate reports and statistics

**UC05: Add semantic asset**
Semantic asset owner can add new semantic assets by defining and submitting them for approval.
Semantic asset definition includes at least the following:

- specifying the asset type from a predefined list of types (entity, event, classifier, service, vocabulary, test data, etc.);
- setting all required properties;
- validating asset consistency;
- generating asset identifier;
- saving to drafts (optional);
- submission to *Competent Authority* for approval.

**UC06: Modify semantic asset**
Semantic asset owner can select an existing and active or draft semantic asset and modify. Each modification of an approved asset implies creating a new version of it. The modifications are performed like initial asset definition.
The new version uses the same identifier and an incremental version number.

**UC07: Delete semantic asset**
Semantic asset owner can request deletion of an active asset.

**UC08: Handover a semantic asset**
The semantic asset owner can request the reassignment of the ownership to another organization by specifying the legal reasons and suggesting the new owner.

**UC09: Approve semantic asset requests**
The Competent Authority approves the semantic asset registration, modification, reassignment and deletion requests. The changes semantic assets are effective upon approval.
In case of inconsistences in semantic asset definition the Competent Authority will reject the request with appropriate documented reason.

**UC10: Replace semantic asset owner**
The Competent Authority can replace the asset owner. The reasons for owner replacement may be explicit request from current asset owner, ordinary asset assignment, reassignment as result of institutional reforms or as a result of inconsistent registration (duplication, collision, overlap, etc).

**UC11: Manage semantic assets categories**
The Competent Authority can manage semantic asset categories by creating, modifying, deleting categories and subcategories. The categories are used by the semantic asset owners for organising semantic assets.

**UC12: Submit request for data access**
The authorized user can fill in, upload or reference relevant documents, sign the request for data access through MConnect platform and submit it to Competent Authority for

processing. The request shall reference existing semantic assets from the Semantic Catalog or request specific semantic assets (new, modified or combined semantic assets).
The request for data access will be processed by the Competent Authority in an external system which will receive the requests through an API which will be defined during the implementation phase.

**UC13: Generate reports and statistics**
The Competent Authority, semantic asset owner and system administrator can generate pre-defined administrative reports based on events of the Semantic Catalog.
The type of the reports will be defined during the implementation.

**Annex 2. The Semantic Catalog Technical Requirements**

## 1. Documentation requirements

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| **User Documentation** | The Consultant will prepare and deliver the following documentation for end-users:<br>• Interactive guidance included in user interface of Semantic Catalog<br>• Downloadable user manual in PDF format for Semantic Catalog, Administrator, etc.<br>All end-user documentation will be provided in Romanian. |
| **How-To video tutorials** | The Consultant will prepare How-To video tutorials for Semantic Catalog main functions. The tutorials will be provided in Romanian |
| **Technical documentation** | The Consultant will prepare and deliver the following technical documentation:<br>• System architecture documentation (including description of models in UML language, which will include a sufficient level of details of the system architecture)<br>• Test strategy<br>• Compilable and documented source code for applications, components and unit tests developed within the project<br>• System installation and configuration manual (including code compilation, container image build scripts, system installation, hardware and software requirements, platform description and configuration, backup and disaster recovery procedures).<br>All technical documentation will be provided in English. |
| **API documentation** | The Consultant will prepare and deliver:<br>• API integration guide<br>• Integration samples in .NET and Java<br>• Human and machine-readable description in a standard description language (e.g. WSDL or Swagger).<br>All API documentation will be provided in English. |

## 2. Training requirements

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| **Training sessions** | The Consultant will provide on-line training sessions using developed e-learning modules for the following target groups:<br>• Semantic Catalog Administrators from eGA and STISC.<br>• Semantic Catalog beneficiaries<br>• Semantic Asset owner.<br>The consultant will provide trainings for the following target groups:<br>• Semantic Catalog Administrators from eGA and STISC.<br>• Semantic Asset owner. |
| **Training materials** | • Training documentation – curricula, training courses (manuals, video tutorials, quizzes, etc.) for administrators, service providers |

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| | and end-users (individuals and businesses) developed in e-learning platform based on Moodle.<br>• All training content/materials will be provided in Romanian language. |

### 3. Rights requirements

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| **Perpetual software license** | The Consultant grants to the Client the rights to run and use entire solution with all included software components with no constraints on time, location and offered functionality. |
| **Redistribution rights** | The Consultant shall grant to the Client the right to re-distribute the solution.<br>While the Client does not intend to re-distribute at a massive scale it still envisions the need to transfer the software solution to another state agency due for example to potential reorganization. Also, the Client might get the opportunity to re-deploy the entire e-Government platform (Semantic Catalog) elsewhere. |
| **Full data rights** | The Client keeps full rights on data created by the means of this solution. |
| **Open data format** | The solution stores the data in an open format or includes mechanisms to extract data from the system in an open format thus enabling the capability to transfer/migrate the data to another system. |

### 4. Architecture requirements

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| **Open standards** | The solution architecture shall be based on relevant open standards. The solution architecture shall not use proprietary standards. |
| **Service Oriented Architecture** | The solution shall be based on a Service Oriented Architecture. |
| **Hosting environment** | The solution shall not include any hardware components and upon finalization will be deployed on governmental cloud environment (MCloud). |
| **Running environment** | System shall run on Docker container engine and shall not depend on specific host OS instance. Building container images shall be automated. (refer to the following link for details: https://docs.docker.com/develop)<br>Running in a container-based environment, the application must be elastic, including when adding/removing application container instances (above minimum required instances for HA), changing of configurations and system parameters has no impact on any work in |

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| | progress, such as any active sessions, requests, etc. |
| **Multiple sites** | The solution architecture shall ensure high availability including during new versions deployment and the possibility to run simultaneously on multiple sites |
| **Browser compatibility requirements** | The system shall be compatible with latest two major versions (to be considered at the time of system acceptance) of following web browsers: Chrome, Safari, FireFox and Edge. |
| **API for integration with governmental platform services and third-party systems** | The Semantic Catalog Information System shall expose API for functionalities to be consumed by governmental platform services (at least for MPass, MSign, MLog, MNotify) and by third party systems.<br>The full list of logically applicable APIs and their format will be detailed during analysis and design stages. |
| **Detailed data model** | System's detailed data model shall be described fully in a machine-readable data scheme for example using a DDL language for relational databases.<br>The Consultant shall coordinate the detailed data model schema format with the Purchaser in advance. |

## 5. System Integration requirements

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| **Governmental platform services integration** | • MPass shall be used to authenticate users<br>• MSign shall be used to sign and verify electronic signatures<br>• MLog shall be used to journal business critical events. The events that are business critical will be defined at analysis and design stages and must be configurable.<br>• MNotify shall be used for notifications.<br>• MConnect interoperability framework to exchange data with external information systems.<br>• Semantic Catalog will run on the MCloud platform. |
| **Open data integration** | The Semantic Catalog shall publish agreed sets of data in machine-readable format to Open Data portal located at date.gov.md using its API. |

## 6. System Performance requirements

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| **Asynchronous processing** | System shall use asynchronous processing whenever possible to perform any input-output. |

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| **Concurrent users** | The system must be capable to allow simultaneous activity of minimum 50 users at level of *Beneficiary of Semantic Assets, Owner of Semantic Assets, Competent Authority, System Administrator* and over 100 users at level of *Public User*. |
| **Concurrent system requests** | The system shall be designed to respond (via API requests) to at least 200 concurrent external system requests. |
| **Response time** | Response time for system functions shall be under 3 (three) second. The Consultant shall list the exceptions, if any, and discuss/agree them with the Client at analysis and design stages. |
| **Daily transactions** | The system must be capable to allow activity of over 1000 authorized users of category *Beneficiary of Semantic Assets, Owner of Semantic Assets, Competent Authority, System Administrator.* |
| **Yearly transactions** | • The system must be capable to allow yearly activity of over 10000 users of category *Public User.*<br>• The system must be capable to annually process and store over 1000 electronic forms of requests for authorization of legal entities to *Semantic Catalog,* semantic actives registration/update, and access to data of semantic actives. |
| **Key performance Indicators** | The system shall meter and expose its key performance indicators. The Consultant shall propose the list of indicators and discuss/agree them with the Client. |

## 7. User Interface requirements

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| **Multilanguage User Interface** | The system shall support multilanguage user interface. This support includes data type specific formats (such as date, time, time spans, currencies, etc.). The system front-end interface will be delivered with at least Romanian, Russian and English interfaces. The system back-end shall be delivered at least in Romanian. The default language for User interface shall be the Romanian. |
| **User Interface accessibility** | User interface shall conform at least to Level A of Web Content Accessibility Guidelines 2.0.<br>https://www.w3.org/TR/WCAG20/ |
| **Responsive/Adaptive design** | The system user interface shall automatically adapt to various display resolutions. Minimal display width is 480px.<br>The system's UI shall be implemented using progressive web application (PWA) technologies and shall be functional on mobile devices. |
| **Contextual help** | User Interface elements shall include Tips and Hints for user interface elements. |
| **Client support** | All pages shall include client support contacts. |
| **Bookmarks** | All major *Semantic Catalog* pages shall be bookmarkable and the User shall be able to access bookmarked pages later. |

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| | The bookmarkable pages will be defined at analyzing stage. |
| **Friendly URLs** | *Semantic Catalog* shall use friendly URLs for accessing its pages.<br>URL for semantic assets and their previous versions shall be stable. |

## 8. System maintenance requirements

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| **System logs** | The system shall log its various actions and events in a structured manner. Logging shall be configurable and based on extensible logging framework (such as log4net, nlog, etc.). Logging framework shall minimally support JSON format and the following targets: console, rolling files, UDP and HTTP POST. |
| **Log levels and event log records** | • The system shall differentiate events and actions it logs into at least following levels: Critical, Error, Warning, Info, Debug<br>• Critical and Error level events shall be logged only for non-recoverable error that require human intervention.<br>• Event log records will include at least:<br>• the type of the event<br>• timestamp when the event took place<br>• event level<br>• system component that produced the event<br>• user/user agent, IP that triggered the event<br>• information object identifier affected<br>• textual details about the produced event |
| **Graceful shutdown** | The system shall implement graceful shutdown, i.e. shutting down an application container instance at any time shall not impact any work in progress, such as any active sessions, requests, event logs, etc. |
| **Source code** | The Consultant shall supply all the source code for system components that are not available as COTS from third parties.<br>The source code shall use package managers for dependencies to 3rd party libraries. All prerequisite software must be part of container image definition and based on public container repository. |
| **System deployment** | The Consultant shall supply the deployment procedure and supporting tools for this. Deployment procedure shall cover all the prerequisites before proceeding to system installation. The deployment shall be automated and include database structure initialization and seeding. |
| **System upgrades** | System upgrades shall be automated, including database upgrade/downgrade scripts or code. To enable rolling upgrades in production environment, the recommended practice is to perform database breaking changes in incremental changes. |

## 9. Security requirements

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| **Secure architecture** | The system shall be secure by design and comply with the relevant requirements specified in GD 201 from 28.03.2017 (http://lex.justice.md/md/369772/).<br>The Consultant shall supply documentation describing this design and |

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| | supporting evidences that such a design is secure.<br>Note that the Consultant will coordinate with the Purchaser the format of the documentation, supporting evidence and list of requirements to comply with. |
| **Least privilege principle enforcement** | The system's components shall rely on the least privilege principle and run under such a limited privilege account under the OS rights model.<br>The documentation shall highlight each of the system's components required privilege level and considerations that force use of that level or access. |
| **Secrets and addresses** | Secrets (passwords, private keys and certificates, connection strings) and addresses of external services shall be clearly delineated in configuration documentation and easily modifiable via automated scripts. |
| **Secure communication channels** | All system's communication with external systems or users takes place over encrypted communication channels. |
| **No Username/Password authentication** | The system shall rely on authentication via MPass. Other forms of user authentication shall not be used. |
| **Minimize personal information storage** | The system shall minimize the amount of personally identifiable information stored. For example, there is no need to store a user's First and Second names since this will be provided after authentication by MPass.<br>The system shall comply with the relevant requirements related to personal data processing specified in GD 1123 from 14.12.2010 (http://lex.justice.md/md/337094/)<br>Note that the Consultant shall coordinate with the Purchaser the list of requirements to comply with. |
| **Secure against OWASP Top 10 vulnerabilities** | The system shall include security controls for all its components for at least OWASP Top 10 vulnerabilities. Refer https://www.owasp.org/index.php/Category:OWASP_Top_Ten_Project |
| **Health-check API** | The system shall expose readiness and health-check API via a HTTP GET requests. The health-check shall check the health of as many system components as possible. In case of health check error, a human-readable error message shall be returned. |
| **Users' roles management** | The users and their roles will be managed in MPass. The system shall retrieve the users' roles from MPass. |
| **Session expiration** | The system shall include a session expiration mechanism when after a specific period of inactivity, the user is required to authenticate again. The period of inactivity shall be configurable and by default it is 15 mins. |
| **Input validation** | All input data shall be validated on client and server side. |
| **User content** | User content can be captured in text format only. The system shall |

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| | forbid entry of special characters used for formatting and markup of special Web content.<br>Otherwise all UNICODE characters shall be possible to enter/view by system's components. |
| **Unauthorized access attempts** | Unauthorized access attempts<br>When the system registers unauthorized access attempts it shall:<br>• log such attempts with at least ERROR level<br>• provide users with a warning message that access is not authorized and that abuse will be investigated |
| **Data integrity** | The Consultant will ensure data integrity by providing appropriate solution for prevention of unauthorized internal activities (for ex. deletion of authorizations records directly from database). |

## 10. Support and Warranty requirements

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| **Support** | During the warranty period the Consultant shall provide necessary technical assistance to the Client; |
| **Warranty** | During the warranty period the Consultant shall:<br>• fix all defects reported by the Client;<br>• solve all incidents reported by the Client according to the agreed SLAs;<br>Note: The response and resolution time shall not exceed 60 minutes for non-critical errors and 15 minutes in case of critical errors.<br>The incidents shall be solved within 2 working days for non-critical errors and within 4 working hours for critical errors starting from escalation time. Hourly progress report will be provided for critical errors. |

**Annex 3. Relevant legal codes and regulations that govern the business processes and procedures that will be automated with the System.**

1. Law nr.142/2018 on data exchange and interoperability - http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=376762.
2. Law nr.91/2014 on electronic signature and electronic document - http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=353612.
3. Law nr.71/2007 on registries - http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=325732.
4. Law nr.982/2000 on access to information - http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=311759.
5. Law nr.133/2011 on personal data protection - http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=340495.
6. Government Decision nr.211/2019 regarding the interoperability platform (MConnect) - http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=379993
7. Government Decision nr.656/2012 regarding the approval of the Interoperability Framework Program – http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=344700
8. Government Decision nr.710/2011 on approving strategic Programme of technological modernization of government (e-Transformation) - http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=340301
9. Government Decision nr.128/2014 on Government single technological platform (MCloud) - http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=351760.
10. Government Decision nr.1090/2013 on the governmental electronic service of authentication and access control (MPass) - http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=351035.
11. Government Decision nr.405/2014 on the governmental electronic integrated service for digital signature (MSign) - http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=353239.
12. Government Decision nr.708/2014 on the governmental electronic journaling service (MLog)- http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=354589.