TERMS of REFERENCES
(Firms selection)
FOR THE PERFORMANCE AUDIT OF MOLDLIS
(MOLDOVAN LAND INFORMATION SYSTEM)

for
LAND REGISTRATION AND PROPERTY VALUATION PROJECT
Project ID No. P161238

INTRODUCTION

The Government of the Republic of Moldova and International Development Association (IDA) signed a Financing Agreement (FA) which became effective on 14 January 2019 for the Land Registration and Property Valuation Project (hereinafter the Project). The Project aims to improve the quality of the land administration and property valuation systems and to enhance transparency of the property taxation system.

The Project consists of four components: (A) First Property Registration; (B) Property Valuation; (C) Land Administration System Strengthening; and (D) Capacity Building and Project Management.

Component A 'First Property Registration' will support the first registration of public and private land in Moldova and strengthen the data quality for records already in the land register. This component will also organize mandatory public displays and public awareness campaigns to ensure citizens are engaged and aware of the procedures, activities, and benefits during first property registration

Component B 'Property Valuation' will support extending the system of mass valuation to incorporate those properties not currently included and to carry out a revaluation of the properties that are already in the mass valuation system, but have not been revalued since 2008. In the process, the objective is to provide periodic revaluations for several purposes including property taxation. The use of updated valuations for property taxation is expected to generate additional tax revenues and to enhance the fairness with which property taxation is levied by ensuring that taxpayers make payments related to the current market values of their properties.

Component C 'Land Administration System Strengthening' will support the strengthening of the land sector in Moldova by facilitating policy dialogue and conducting a review of the existing institutional and regulatory frameworks, proposing improvement where possible. It will also encourage a development of simplified business processes and modernization of cadastre services through use of ICT, and support development of NSDI.

Component D 'Capacity Building and Project Management' will support capacity building at stakeholder agencies and institutions to ensure the smooth implementation of project activities and support project sustainability, as well as provide support for project implementation.

A full description of the Project is provided in the document "Project Appraisal Document" (PAD) and Loan Agreement (LA). The PAD is considered as a part of the necessary background materials to be understood by interested parts.

Implementation is entrusted to the Project Implementation Unit (hereinafter PIU) of the Public Services Agency (hereinafter referred to as PSA).

Regarding **MOLDLIS** – a Real Property Information System in Moldova, a national IT solution for land administration and mass valuation. At this moment (from 2013), the state of MOLDLIS - **not implemented yet**, it has been develop by Sinergise Limited company (www.sinergise.com), funded by Norwegian Mapping Authority, to be used by PSA.

MOLDLIS comes to replace the current cadastral systems that are morally outdated and that can hardly cope with the flow of information, the requirements for interoperability with other systems and cyber security.

The main destination of MOLDLIS is to ensure the process of registration of real estate objects, property rights over them, assessment of the value of real estate for tax purposes, as well as the exchange of data with third parties through the government interoperability platform MConnect. MOLDLIS is hosted on the common government platform MCloud and incorporates the services and technological solutions offered by the e-Government Agency, such as: MPass authentication and authorization service, MSign electronic signature service, MPay electronic payment service. MOLDLIST will contain several modules, amongst the most important being:

- Case management and Workflow;
- Register of Physical Objects - advanced topology GIS for management of cadastral parcels, buildings and building parts, utility information and other spatial data;
- Legal Register of Rights;
- Valuation Register;
- Document Management, integrated with governmental eArchive;
- WEB portal and related e-services integrated with the e-Government portal.

MOLDLIS technologies:

- PostgreSQL / PostGIS database;
- Java Topology Suite (JTS) for Advanced Spatial Operations;
- Jasper Reports for statistics and reports;
- Enterprise Service Bus (ESB) WSO2;
- Programming languages: Java, JavaScript;
- GDAL, OGR toolkit for support of all required spatial formats;
- Giselle WebGIS libraries for server side spatial operations, storage and management of spatial data. Giselle WebGIS supports use of standardized OGC web-services (WMS, WFS) either for incoming or outgoing data. Therefore it will be easy to integrate it with existing infrastructure (BusinessCad, AddressRegiste, Inventory, etc.). Additionally, as Giselle Web supports all vector and raster operations, including tiled cache, we can on Client's request add some of the services, which should originally be served by existing infrastructure and rendering of maps;
- Floor plans: Inventory.

I. Objective

The main objective of the assignment is to complete an independent quality review of the contract implementation and MOLDLIS source code and to provide recommendation for the necessary actions and activities for the performance and continuity of the MOLDIS (contract management, IT management and technical), to ensure the successful implementation of MOLDLIS and to make the necessary tools available to the Project.

II. Scope of work and tasks

The Consultant must deliver a Performance Audit Work Plan, Audit Report and a Final Report.

The Consultant will deliver a Performance Audit *Work Plan* within 2 weeks of the Contract start date. This will include timing, staffing and any assumptions about responses from the client. The Work Plan will propose the Quality Profile that will be used in the "

Perform Analysis of MODLIS Source Code" (see below). The Consultant must also indicate which software (architecture) quality attributes it will use to describe the MOLDLIS software quality.

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The PSA will then provide comments and/or accept the Performance Audit Work Plan within 2 weeks from its delivery.

The specific objectives of the consultancy services (which need to be included in Work Plan) are to:

Contract management:

- Analysis of the documents establishing the system (contract, requirements, terms, etc.), in order to identify the roles and responsibilities of participants in the process of developing and implementing the system. Please note that these documents are available in English;
- Analysis of current state of execution of the project in terms of execution of the contractual provisions, technical tasks and planned activities. Delivery of a Contract Requirements Tracking table, which will indicate what has been delivered/accepted/not completed or not accepted;
- Prepare recommendations for project re-planning, adjusting/supplementing contractual provisions (including financing aspects) with a view to restoring the current situation, completing system development, implementing and ensuring continued support and maintenance. Please note that the recommendations have to be prioritized (High, Middle, Low).

Technological and performance management:

- Architecture and technologies used in line with eGovernment policies (interoperable, cloud-able, MPass integration, MSign, MPay, MConnect, etc.);
- Identification of the technologies used (platforms, software licenses);
- Development/recommendation of the load and stress testing method according to the system performance requirements set out in the MoldLIS ToR\Technical specifications;
- Develop recommendations to modernize the elements of the system that are not aligned with contemporary policies and technologies.
- Perform Analysis of MODLIS Source Code, based on Non-Disclosure Agreement.

The Consultant must assess and reach conclusions about the quality of the MOLDLIS by looking at the software tools, software layer architecture and the overall quality (as described in the next section "

Perform Analysis of MOLDLIS Architecture"), as well as performing source code artefacts analysis (i.e. Statistical Analysis), based on Non-Disclosure Agreement between client, consultant and Sinergise Ltd, Slovenia.

Analysis of the source code can be carried out with a variety of semi-automatic tools (e.g. Sonar[1]) or manually as long as metrics are generated for the chosen Quality Profile (see below). The Consultant must advise and reflect on the type of metrics and their threshold to be used in the Quality Profile, and assess the actual values for the MOLDLIS source code in a statistical analysis. For example, a Quality Profile contains desired thresholds for:

› Comments.
› Complexity.

[1] http://www.sonarsource.org

- Number of Classes.
- Class Response.
- Source Code Rules.
- Lack of Cohesion of Methods.
- Package Tangle Index.
- Test Case & Unit Test Coverage.

Comments
This metric refers to comment/code ratio. Good programming practice needs to have at least of 70% of relevant comments in the coding. The Consultant must assess the (in-line) comments that have been used in the MOLDLIS source code.

Complexity
The complexity for source code is determined by the number of the branching statements (if, for, while…). General indicators for this source code complexity are: 1-4 branching statements for low complexity, 5-7 for moderate complexity, 8-10 for high complexity, and 11+ is assess as very high complexity. The Consultant must assess the complexity in the MOLDLIS source code.

Classes
Number of Classes

This metric shows the total number of classes, packages and methods, as well as the total number of getters and setters. Good programming practice shows the visibility of a class within a single screen; the average lines of code (LOC) per class should not be more than 100. The Consultant must assess the number of classes, packages and methods, getters and setters that have been used in the MOLDLIS source code.

Class Response

The Response for Class (RFC) metric gives the total number of responses of a class to other class/classes. If the RFC for a class is large, it means that there is a high complexity, which may cause maintainability issues. Good practise shows that this value for a class should not exceed 100. The Consultant must assess class responses that have been used in the MOLDLIS source code.

Source Code Rules
This metric refers to the level of compliance to rules with regard to source code, such as rules that are used in rule engines like Check style, PMD and Find Bugs. The Consultant must define a basic set of rules to be part of the Quality Profile chosen for the MOLDLIS.

Lack of Cohesion of Methods
This metric refers to the cohesiveness property of classes, and indicates the number of "connected components" in a class. A connected component is a set of related methods and fields. There should be only one such component for each class. If there are 2 or more components the class should be split into smaller classes. Low degree cohesion means that the component's contents are an unrelated jumble of actions, often put together because of time-dependencies or convenience. The Consultant must assess the degree of cohesion in the MOLDLIS source code.

Package Tangle Index
This index refers to how tangled the software packages are, optimal would be to have no cycles at all. This metric provides the values of dependencies to cut in order to get a less tangled package. The Consultant must assess this index in the MOLDLIS source code.

Test Case & Unit Test Coverage
This metric shows coverage of each function, statement, decision and condition in unit testing, a.k.a. as White Box testing. Good practise dictates that the test cases and Unit tests should at least cover 80% of the entire source code. The Consultant must assess a few relevant examples of test case & unit test coverage in the MOLDLIS source code.

Perform Analysis of MOLDLIS Architecture:
The Consultant must review and reflect on the MOLDLIS Architecture and the chosen and recommended hardware equipment and software components. The Consultant should also review the actual licences required for all MOLDLIS components.

The Consultant must review the software quality based on a clear and transparent standard or methodology. As one of the candidates for the standard to be used, the Consultant may consider ISO 9126 or one of its predecessors (e.g. McCall (1977), Boehm (1978), FURPS, etc.). The standard "ISO/IEC 9126 Software engineering - Product quality", an international standard for the evaluation of software quality[2, 3] is divided into four parts addressing: quality model; external metrics; internal metrics; and quality in use metrics. *Examples* of the MOLDLIS software (architecture) quality attributes that should be assessed and reflected upon are:

- Features/Functionality.
- Security
- Reliability
- Usability.
- Efficiency.
- Serviceability/Maintainability

The Consultant must indicate in the IT Audit Work Plan a final list of quality attributes to be reviewed.

Features/Functionality
Features and functionality of the MOLDLIS are documented through the functional and non-functional requirements, use cases and processes and are subject to the completeness check as described in the section "**Error! Reference source not found.**". These attributes indicate the existence of a set of functions and their specified properties. The functions are those that satisfy stated or implied needs.

- Suitability.
- Accuracy.
- Interoperability.
- Modularity.
- Portability.
- Functionality Compliance.

Security
Should consider hardware, network, software application, database, and data'. Security issues are of major concern for the MOLDLIS due to the legal status of the records being handled, the multi-agency network and the access to be afforded to the public. The Consultant must therefore pay particular attention to:

- User authentication procedures
- User authorisations
- Record security
- Record integrity.
- Measures to prevent malicious and accidental changes to database records

Reliability
Reliability defines the capability of the MOLDLIS to maintain its service provision under defined conditions for defined periods of time through attributes:

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[2] http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=22749
[3] http://en.wikipedia.org/wiki/ISO/IEC_9126

- Maturity.
- Fault Tolerance.
- Recoverability.
- Reliability Compliance.

Usability

Usability only exists with regard to functionality and refers to the ease of use for a given function. The ability to learn how to use MOLDLIS (learnability) is also a major sub-characteristic of usability.

- Understandability.
- Learnability.
- Operability.
- Attractiveness.
- Usability Compliance.

Efficiency

This characteristic is concerned with the system resources used when providing the required functionality. The amount of disk space, memory, network etc. provides a good indication of this characteristic. A set of attributes that bear on the relationship between the level of performance of the software and the amount of resources used, under stated conditions are:

- Time Behaviour.
- Resource Utilisation.
- Efficiency Compliance.

Serviceability/Maintainability

Serviceability often termed as supportability is the ease with which repair and maintenance can be performed. The ability to identify and fix a fault within a software component is what the maintainability characteristic addresses. Maintainability is impacted by code readability or complexity as well as modularization. See previous section “
Perform Analysis of MODLIS Source Code”, which will provide input to this assessment. Documentation in context of MOLDLIS is also a serviceability factor.

- Analysability.
- Changeability.
- Stability.
- Testability.
- Maintainability Compliance.

Test the MOLDLIS System

The Consultant should carry out such tests on the MOLDLIS software as deemed appropriate. Specifically, the Consultant must carry out tests that:

- Measure the overall performance of the system against the specifications.
  - Access and response times.
  - Any relevant network or hardware performance criteria (e.g. communications capacity or bandwidth).
  - Estimates to be made for a fully working system with all offices.
- Identify the hardware, software or communications components causing significant under performance, if any – for specific use cases or business processes where appropriate.

Provide Conclusion on Deliverable Quality

The Consultant will recommend how the MOLDLIS should proceed from the time of the evaluation. The Consultant will also identify current and potential risks, and compile an up to date risk register.

This risk register will detail a unique description of each risk, the likelihood of the event occurring, the severity and impact of the effects of the potential event, and the steps which could be taken (and who should be responsible) to reduce or eliminate each risk.

Support from the Client

The client will provide all necessary facilities for the Consultant to carry out his duties including provision of the latest version of the Source Code for the MOLDLIS. The client will provide remote access to MOLDLIS application.

Implementation and sustainability management

- Evaluation of the implementation Plan, approved by the PSA, identification of risks of non-implementation and development of recommendations for the re-planning of activities and the definition of implementation steps;
- Develop recommendations on the methodology for transitioning the system (from the existing system to MOLDIS);
- Developing sustainability recommendations - long-term maintenance and development planning.

III. Working conditions:

The Consultant will work remotely, being provided with office space at PSA, upon request. The Consultant will be required to attend meetings relevant to the assignment at the PSA premises or project partners locations. The communication with designated PSA and Supporting agencies staff will be by emails, phone calls, virtual and personal meetings, at meetings, the consultant should provide translation in Romanian or Russian if necessary. The Consultant will work in close collaboration with PSA relevant staff. The consultant will be provided with all the necessary documentation for the project, the main list of which is attached below:

1. Agreement between the Agency for Land Relations and Cadastre of Moldova and the Norwegian Mapping Authority on implementation of a project "Real Estate Registration System for Moldova", 7 May 2012;
   - Addendum no.1574 of 07.09.2018 on amending the Contract between the Agency for Land Relations and Cadastre of the Republic of Moldova and the Norwegian Mapping Authority on implementation of a project "Real Estate Registration System for Moldova" of May 7, 2012;
2. Agreement for the development of software between Sinergise Ltd, Slovenia and Statens Kartverk – Norwegian Mapping Authority, Agency for Land Relations and Cadastre of Moldova and State Enterprise "Cadastru", Moldova co-sign he agreement, of 24.04.2014;
   - Amendment no.1 of 17.09.2014 to Agreement for the development of software;
   - Amendment no.2 of 12.01.2016 to Agreement for the development of software;
   - Amendment no.3 of 14.10.2016 to Agreement for the development of software;
   - Amendment no.4 of 22.08.2017 to Agreement for the development of software.
3. Terms of Reference (ToR)
   - MOLDLIS Requirements Volume 0: Background Information and Guidelines;
   - MOLDLIS: Technical Requirements Volume 1: General requirements;
   - MOLDLIS: Technical Requirements Volume 2: Register of Physical Objects;
   - MOLDLIS: Technical Requirements Volume 3: Legal Register of Rights;
   - MOLDLIS: Technical Requirements Volume 4: Real Estate Valuation;
   - MOLDLIS: Technical Requirements Volume 5: E-Services;
   - MOLDLIS: Technical Requirements Volume 6: Auxiliary Modules and Integration;
   - MOLDLIS: Non-Technical Requirements Volume 7: Implementation Requirements;
4. Business Process Analysis (BPA)
   - Change request;
   - Background;
   - Cadastral Works;
   - Legal Works;

- Valuation;
- Provision of information.

5. Information & Communication Technology Requirements Specifications (ICT Requirements)
6. Software Requirements Specifications (SRS intermediate)
   - 1.1 General Architecture and Infrastructure;
   - 1.2 Security;
   - 1.3 Data Migration;
   - 2 Register of Physical Objects;
   - 3 Legal Register of Rights;
   - 4 Real Estate Valuation;
   - 5.1 Web portal
   - 5.2 Direct Services & e-Gov Port;
   - 6.1 Register of persons;
   - 6.2 Classifiers;
   - 6.3 Statistics;
   - 6.4 Case Management;
   - 6.5 Document Management;
   - 6.6 Address Register Integration;
   - 6.7 Integration with Inventory;
7. Software Architecture Description (SAD intermediate)

Also, please note that the User Manual is available in the system. All documentation is available in English.

All project documentation that will be presented is co-confidential and cannot be submitted to third parties.

IV. Work Products / Deliverables

The Consultant must deliver a Performance Audit Work Plan, Audit Report, and a Final Report with recommendation.

4.1. Performance Audit Work Plan

The Consultant will deliver an Audit Work Plan within 2 weeks of the Contract start date. This will detail the proposed timing of the audit including the time to be allocated to individually identified members of the Consultant's team; the timing of visits to be made to the PSA.

The PSA will provide comments and/or accept the Work Plan within 2 weeks of delivery.

4.2. Audit Report

The Audit Report will present the results of the Audit with details of where deliverables have addressed the requirements and whether these met the specifications completely, partially, or not at all. It will also detail any requirements that have not been addressed. The report will detail the quality of the application and supporting software as determined by the Consultant's software analysis and on-line testing as requested above. The Audit Report will be delivered within 8 weeks of IT Audit Work Plan being accepted.

The PSA will provide comments and/or accept the Audit Report within 2 weeks from delivery.

4.3. Final Report

The Final Report will include the Audit Report as an Annex and Recommendations for the future upgrade/improvements, as needed. This report will also include a diary of the Consultant Company's activities during the Contract, a description of the methodologies followed and the rationale for them. The Final Report and presentation will be delivered to the PSA within 10 weeks of Performance Audit Work Plan being accepted.

The Recommendations in the Final Report will, on the basis of the Audit Report, identify potential actions required to improve the quality of MOLDLIS. The Recommendations may point to

possible further changes or amendments to the Contracts/Technical documentation/Software as appropriate and will identify any gaps in the implementation.

A Review of the Final Report will be completed within two weeks of its delivery and will be subject to approval by the PSA. The Consultant will revise the Final Report according to agreed comments within a period of two week from receipt of the comments.

V. Duration of the contract

The duration of the contract will be 4 months after the commencement of services.

VI. Place of work and language of the contract

Two missions to Chisinau are requested – one at the beginning and one at the end to present the draft final report, including the key findings and recommendations. The rest of the time can be from home base. The travel will depend on the covid-19 restrictions.

The working language of the contract is English and all reports should be submitted in English.

VII. Profile of Consultant

5 years of experience (proved by company references) in ICT consulting services in carrying out performance and quality IT audits on multi-agency information systems including:

- Software and IT Testing and Auditing experience in a distributed environment preferably in the context of land administration and web browser-based presentation of graphical/geographical data;
- ISO9001 and ISO27001 accreditation;
- Contract and IT Management skills;
- System and software architecture analysis;
- Application performance testing.

The Consultant/Company should demonstrate proven experience in quality audits, performed during the last 3 years, where the system has similar complexity and size;

It is also desirable that at least one member of the Consultant's team has excellent Romanian/Russian skills.

The Consultant must have no Conflicts of Interest as described in the Guidelines.

M = Mandatory; D = Desirable

M	Solid Project Management and Contract Management experience in IT quality audits of complex information systems (proven relevant experience in project planning, resource planning related to IT projects)
M	Significant experience in software development contract management;
M	Comprehensive knowledge of methods, technologies and quality standards for contract management, project management, system and software development.
M	Strong analytical skills and understanding of needs and issues of public registers;
M	ISO or equivalent software audit certification
M	Solid experience in the IT quality audits of complex information systems.
M	In-depth understanding of the software development lifecycle and be able to communicate on project status, issues, and resolutions.
M	Solid experience with testing modern IT and web software IT architecture projects.
M	Experience in the testing of software in both 'black box' (code unseen) and 'white box' (code available) environments.
M	Excellent reporting and writing skills preferably in the context of software auditing.

M	Excellent English language skills.
M	Comprehensive knowledge of IT Architecture elements related to performance, security, authorisation and authentication.
M	Excellent English language skills. Knowledge of Romanian/Russian language will be considered as an advantage.
D	Experience in developing governmental or other public IS would be an advantage;
D	Certificates in the field of the IT systems management;

VIII. Selection

The selection of the Consultant will be conducted in accordance with the World Bank Procurement Regulations for IPF Borrowers, dated July 2016, revised November 2017.

Deliverables will be the basis for the payment schedule. All documents will be submitted in draft for comments and then final. All final documents must be present in English language. The payment will be done upon the submission of final version of the deliverable.