

# **CZECH REPUBLIC**



**DEVELOPMENT COOPERATION**

**CZECH REPUBLIC**

**MINISTRY OF INDUSTRY AND TRADE**

**DEVELOPMENT COOPERATION PROJECT**

**CZECH REPUBLIC**

**WITH**

**PARTNER STATE**

**Republic of Moldova**

## **PROJECT NAME**

**Aid for Trade Program - Republic of Moldova "Developing a feasibility study for communication between national registers"**

**IMPLEMENTER**

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## **Program Aid for Trade – Republic of Moldova**

### **"Developing a feasibility study for communication between national registers"**

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# 1. Introduction

## 1.1 Subject of the study

The subject of the contract is the implementation of the Foreign Development Cooperation Project (hereinafter referred to as the "FDC") in the Republic of Moldova - "Developing of a feasibility study for communication between national registers" under the Aid for Trade program in 2018 [1] (hereinafter referred to as "the project" therefore:

- Collect the necessary information and evaluate the existing registers in the Republic of Moldova, i.e. which operating systems and programs are used, what are the versions of applications and databases, how the hosting server is performing where it is used, what communication between systems is, as well as other data necessary to ensure interoperability.
- Based on such a mapped and evaluated situation, identify key registers and IT systems that need to communicate and interact with each other.
- Assess current registers and IT systems that need to communicate and identify imperfections that currently prevent this communication, what are the needs for redress and for their own improvement (upgrade).
- Provide recommendations for updating the current methodology and for a new methodical approach to modernizing public services, along with information on the means and resources needed to do.
- Propose the most appropriate solution to ensure interoperability, taking into account the practices applied in the surrounding states of the region as well as in the EU countries to ensure its functionality, ease of administration and further development, included related costs.
- Prepare and submit a feasibility study (analysis) to the Moldovan partner, to summarize and evaluate the information and findings obtained, and to provide detailed recommendations on the best ways and steps needed to achieve full interoperability between IT systems, equipment, account will also be taken of the security of the system and of the whole network.
- The study will be written in English and Czech, and in the case of a Moldovan partner's wish also in Romanian.
- Carry out up to 4 business trips of about 3 Czech experts to the territory;
- Organize training sessions or round tables during business trips and present and explain to the Moldovan partner the results achieved within the project.

## 1.2. Reason for processing the study

The project is implemented within the framework of the Czech Republic's foreign development cooperation program, Aid for Trade. The essence of Aid for Trade projects is to assist the partner state in increasing the efficiency of public administration, with the subsequent facilitation and liberalization of its trade, building its trade capacities and activities, better integrating the state into the international trading system, assisting the state administration in developing trade policies, and the regulatory framework for trade, the establishment of rules and strategies for removing administrative barriers, the formulation and implementation of internal market rules, the promotion of the business climate, the development of small and medium-sized enterprises, the financial sector etc. In a wider sense, it also involves the development of local production capacities, the building of business support infrastructure, technology transfers and services related to their installation.

The territorial focus of the project is the Republic of Moldova (hereinafter also referred to as the "partner state"). **The project initiator - the Information Society Development Institute.**

**Main Partners:** The main partner is the Information Society Development Institute and other state institutions.

### **Current situation:**

The Republic of Moldova has made significant progress in the area of state administration reform and its modernization, using modern information and communication technologies that enable electronic services to be of the highest quality. The modernization of public services has been the highest priority of the Moldovan government for several years and is contained in a number of government strategies and action plans. The Republic of Moldova has already built its own technical and technological infrastructure, but it is also necessary for established procedures and services to be in line with EU criteria and standards. Despite the fact that Republic of Moldova ranked 65th among the 191 countries surveyed in the UN list, as regards the scope of electronic services, there are still a number of problems with its own exchange of data.

In order to achieve interoperability and efficient interchange of information, the Moldovan side sees as necessary to analyze the individual components which have influence on the interoperability of the whole system, i.e. to determine the current situation and to map the individual systems and registers, their overall functionality, manner and rate of utilization, what operating systems, programs and formats of the data being transmitted are used, the possibility of interacting with other systems as

well as other data needed for overall interoperability and subsequently identifying deficiencies. The survey should include all relevant institutions designated by the Moldovan government, in particular the State Agency for Public Services, which is responsible for the State Registry of Population, the State Register of Legal Entities Law Units, the Moldovan Land and Cadastral Agency, the eGovernment Center, the National Insurance Service, the Ministry of Finance, the Moldovan Tax Administration, the Customs Agency, The Ministry of Economy and Infrastructure, the Ministry of Agriculture, Ministry of Health, the National Company for Medical Insurance, etc. The result should be full interoperability and digitalization of public services by 2020, as is stated in the document "Digital Moldova 2020 Strategy".

In the digitization process, the Moldovan side sees the following problems in particular:

- Insufficient communication between individual state institutions and between departments within individual offices.
- In some cases, payment for data provision is required by one state institution to another state institution.
- Technical barriers - incompatibility, heterogeneous systems and environment, undefined standards, insufficient documentation, methodical approach, etc.

### **1.3 Authors**

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### **1.4 The Aim of the Study**

The main aim of the project is to analyze the existing system and its individual components and to find the optimal possibility for ensuring interoperability, included proposals for different solutions.

### **1.5 The Expected applications of the study results**

The team of authors (also team only) assumes the following benefits and effects for the partner state Republic of Moldova:

- creating prerequisites for improving the **interoperability of public administration information systems, assuming use by others information systems** of state administration and self-government, especially under the program "Strategic program for governance technological modernization nr. 710 on sept. 20th 2011 including already existing and upcoming projects such as MSign, MPass, MPay, MConnect, MCloud and National Service BUS,
- continuity to the existing Semantic Catalog project,
- creating prerequisites for seamless and flawless communication between public administration organizations and the private sector with foreign countries,
- easier and faster software development,
- implementing central data management to reduce the economic costs associated with the performance of administrative work, communications and business,
- creating a prerequisite for implementing advanced data sharing technologies such as ETL and ESB.



## **2. Default conditions for processing the study**

### **2.1 Description of the current state**

Only the information provided in the tender dossier [1] (hereinafter referred to as TD) could be considered at the time of designing the solution. Detailed data could be found only during the project implementation. The tender dossier showed that the Republic of Moldova currently has one of the main objectives of building information society in the Republic of Moldova in accordance with the criteria and standards in force in the EU.

To solve this task, the Government of the Republic of Moldova adopted Resolution 392 of 19 May 2010 on the establishment of an e-Government Center [2] as the central IT institution for institutions in the Republic of Moldova with a aim to creating a normative legal and institutional basis for the development of the information society, the providing of high-quality public services to citizens and also the provision of implementation of electronic services in various sectors.

However, individual state institutions in the Republic of Moldova already developed and put into operation their own different IT systems, such as the Ministry of Finance [7], the National Social Insurance Company [8], the Ministry of Agriculture [6] and others, some of which are in the process of development e.g. Address Register Information System [4], Parliament Information System [9].

Recall that the basic concept of strategic development of the Republic of Moldova is contained in the Moldova 2020 National Development Strategy: 7 Decisions for Economic Development and Reduction of Poverty [3]. In this national development strategy, the key role of collecting, processing and delivering credible information to public authorities, businesses and citizens is crucial.

This requires that information between public administrations was shareable and interchangeable.

The e-Government Center has responded to this request by elaborating a number of documents, in particular [9], [10], [11], [12], [13], [14] and by creating a Semantic Catalog [15]. The final act of these demanding activities was the Resolution of the Government of the Republic of Moldova No 20282/2018, which adopted a Law on data interchange and interoperability. This concerns in particular the intent to ensure the interoperability of the electronic systems of the different institutions, i.e. to enable them to communicate, share and interchange information together, thereby improving public administration services, businesses and citizens [4]. Currently, it is necessary to analyze the current state and the main existing systems and the possibilities of data transmission between them. The purpose is to systems especially offices with a

certain link to trade and the development of the economy, to be able to communicate, share and interchange information with one another.

## 2.2 The list of analysed information systems

On the basis of the analysis of sources provided by the Moldovan side, the following information systems were selected for the detailed analysis of data interfaces:

- The Population Register (Registrul Populației)
- The Register of Legal Persons (Registrul Unităților de Drept)
- The Address Register (Registrul adreselor)
- The Cadastre (Registrul bunurilor imobile)
- The Tax Register (Registrul Fiscal)
- The Vehicle Register (Registrul Unităților de Transport)
- The Register of Immigrants (Registrul Imigranți)

## 3 The used methods in processing

### 3.1 Themes

The further development of the information system must respect and at the same time co-create the conditions for informatisation of society, which is a process of wide application and interconnection of technical, program and standardization **means, or complete systems** for retrieving, processing, transmitting, disseminating and using information as a general foundation of the society knowledge. It is a process to change and substantially improve the vast majority of technologies used in social production and other areas of society, leading to the intellectualization of all work and the actual democratization of society.

*The conditions* under which the information system is operated simultaneously are given by means of technical development. This development developed a corresponding division of labor and specialization and administrative activities. The tendencies that created demanding information processes have been constantly amplified, creating large sets of indicators with little reliability and limited ability to communicate, especially about the crucial social processes. At the same time, inconsistent and little interrelated sets of information on technical, economic and social processes were created. As a result, there are a number of relatively separate information systems, whose functions lead to duplication and non-systemic use.

*The process of informatization of the public administration* requires fundamentally to change the starting points, forms and methods of work and to create the conditions for the implementation of such instruments that correspond to the newly emerging information needs of the society. Only in this way can we greatly facilitate the

implementation of current processes in society, streamline the administrative works and unify the relationships between the various actors of the reproduction process of society. It also creates the conditions for a substantial increase in population activity and, as a result, will provide everyone who is interested with the necessary amount of information for management, business and other activities.

*The basis of the modern information provision of the society* is an information system based on the corresponding computer technology, information technology and organization of information processing, computer networks and especially on the content of this system - a uniformly identified and characterized base of data.

Obviously, if we want to move the algorithmizable part of human activity to the computer technology, to free the creative invention of man, we have to create a human-machine interface. The vast knowledge wealth of people needs to be transformed so that they can be transformed into means of modern computer and information technology. It is an objective necessity, because an ever-expanding knowledge of man gives rise to more and more information. In order for this information to be used by man-creator, through and using modern techniques, it must be uniformly organized, identified and characterized. Otherwise, there will be obstacles that make communication difficult and investment in modern technology will become virtually dead.

Therefore, one of the most important and also the most difficult tasks of creating a modern information system is *to build a unified data base*. Her creation is based on the essentiality to use computing for the ever-increasing amount of information processed for management and governance. This increase in the amount of information is objective and results from the growing knowledge of man and the processes he manages in society, in particular:

a. From needs that are due to the necessity of communication between man and machine, where mediators become modern information technologies interconnected with the production base.

b. From necessity to create conditions for mutual communication between the individual elements of the society's reproduction process at both horizontal and vertical level.

Deploying computing, building of data bases, and creating computer networks necessarily requires that the content of individual databases to be uniquely identified and characterized. Otherwise it would not be possible to communicate at the desired level. The transferred information would be incomparable, inaccessible, and the necessary equivalents could not be found in the data bases of each part of the reproduction process, needed for decision-making at different levels of control.).

c. From the objective fact that orientation the society's production potential to its needs will require dynamic changes in the structure of individual parts of the reproduction process by which public administration and business will respond to

ever-changing consumer demands. The absence of a unified data base greatly complicates the course of these changes and slows down the response to these emerging requirements (see the current situation).

d. From knowledge that each implemented organization structure is fully related to the records and possibilities of the information system. Due to the integration and internationalization of the society's reproduction process, the creation of dynamic organization structures within the Republic of Moldova as well as the non-state (joint enterprises), the information system must also create a suitable environment. It is clear from the experience of advanced countries that the process of unifying databases has been going on for many years. Public administration and business (enterprises) are currently greatly decentralizing their powers to lower parts and leaving them with a number of decisions, but at the same time they carry out a rigorous control of the implementation of the projects adopted. However, they need a perfect and reliable, unified information system. This development is also significantly affected by state authorities and through them also transnational organizations (UN, ISO, CEN, CENELEC, etc.). An example is the development and implementation of a UN / EDIFACT [27] system for public administration, commerce and transport.

e. From need to create a "dictionary" in the field of work with informations, which together with "grammatical rules and sentence composition" allows assembling of information elements into sentences and algorithms according to the needs of the governing bodies, thus ensuring the comparability of the generated information on the reproduction process of society.

### **3.2 Basic characteristics of the Unified Data Base**

The documents show that standardization of the data base and data management is solved only for some information systems and services. Controlled production of data structures within e-Government has not yet been achieved.

The content part of the current e-Government is composed of a number of partial information systems and services, which develop independently, do not have a unified philosophy of creation and processing technology. This creates problems of mutual communication and comparability of information output.

### **3.3 Two approaches to creating an information system**

There are currently two concepts of building an information system. The first one is based on the basis of a set of indicators and the other is based on a unified data base.

**The conception** of the content part of the information system, which **is based on the set of indicators**, creates the content of the information system, the basis of which (indicator) is the quantity that is under to significant changes resulting from the

knowledge, management needs and analyzes of those who make up these indicators. The indicator is a quantity that is burdened with a considerable dose of subjectivism, and as an aggregate quantity **no longer allows to reverse analyze the factors from which it is composed**. This establishes the need to create additional information resources in each new look at the phenomena that the indicators describe, which ultimately leads to the multiplicity and inconsistency of the information systems being operated.

The indicator-oriented, and above-mentioned purpose-built content of the information system furthermore, in organizations it creates the appropriate organizational structure of data collection and data processing, which is in contradiction with the real management and information needs of the public administration and business (reproduction sphere). Two information systems must be created in the law - one that is necessary for the management of public administration and business (the reproduction process) at the first level of management, and the other, which enforces the set of indicators needed to meet the requirements of administrative higher levels of management and center. As a result of this situation, there is a discrepancy between the management information of the centers (indicators characterizing the development of the economy) and the actual state, represented by the customer-supplier relations at the level of the corporate management level (neither the needs of the enterprises nor the consumers are satisfied).

Conception of the modern information system are based on **elementary orientation**, uniform characteristics and identification of its content, function and uniform technologic provision, technical equipment and communication networks. This makes it possible to create systems of interconnected decentralized databases of different actors in the reproduction process.

### **3.4 Unified Data Base (UDB)**

UBZ is a technology system that is intended for databases in the target conditions. It is a set of organization-methodological and technological tools that make the information process about the phenomena and processes of the society reproduction. It includes a unified system of data description and data coding, standards of organizational and methodical character, and software to work with catalogs and its own data bases.

*The basis for the quality of the content of a unified data base* is an unambiguously defined, characterized and identified element relating to the lowest carrier of the observed phenomena and the lowest monitored unit for a given level of control. Elements create a set of characteristics that can be used to describe the reproduction process of a society. By combining these elements or elements of algorithms and sentences, individual entities can obtain intentionally targeted information sentences - standards that are the subject of their interest. In order for these functions to be

provided, the element must be a synthesis of the objective characteristics of a given social phenomenon, not merely a sum of subjective requirements.

As a whole, UBD creates an **environment for mutual** communication between individual entities at both horizontal and vertical level. The basic building block of the UBD system is element unambiguously describing the given phenomenon (identification number of the natural person, name, surname, gender, day, month, year, street, house, block, flat, official form, bank code, currency, document type, diagnosis etc.). These elements are then composed simple propositions (date, organization identification code, address, postal code, bank details, type of document, ownership form etc.). From the combinations of simple propositions and elements, modules are created (basic information about the person, basic information about the means of transport, family data, basic information about the employee, the patient etc.), characterizing a certain part of the monitored phenomenon. A set of data, usually from various information systems, is created to monitor and evaluate the overall phenomenon e.g. Air Quality in Chisinau, Numbers of Secondary School Learners, Fluctuations of State Administration Employees, etc.

The basic methodological and organizational tools of the unified data base are:

### 3.4.1 Catalogue of Data Elements and Value Domains

*The Catalogue of Data Elements and Value Domains* contains a set of data elements and value domains for a given area. Data elements are the basic building blocks from which consist of algorithms and information sentences. The basic starting point in the definition of elements is the process of mutual interaction between the identified social phenomenon, its characteristics and the information needs that are given to the level of knowledge, material, spiritual and management needs of society. A gradual analysis of the mutual relations of generally valid natural relations leads to the observed phenomenon gradually breaks down into a series of elements whose elementary level is given by the level of control to which they are referenced. The more this level is reduced, further division occurs and gradually conditions are created for the elements thus created to meet the requirements of usability in various information views on the observed social phenomenon or process.

This architecture is chosen to exclude, as much as possible, repeating the description of each phenomenon creating the possibility of duplication in the system, creating rigid rules for manipulation with its individual components, simplifying the possibility of penetration by system levels and thus increasing the variability of its use. In practice, this means that the UBD system can create an **object-oriented homogeneous data base whose every element (element, statement, module) has its own identity and can be operated independently of the way it is stored.** This allows each entity to create customized intrusions into the data base, regardless of the agreed standards (statements, certificates, listings, copies, abstracts, orders,

invoices, business information, product, etc.) within a given syntax. This enables the entity to obtain the information it needs at the moment without having to change the way the data is stored, the data organization, etc. Similarly, registers of enterprises, products, services, jobs, workers, etc. can be generated without the need for the purpose-datafiles.

The current development brings with it the necessity of mutual communication - through computers and communication computer networks – i.e. it requires the creation of not an individual but a common communication language. At the same time, it creates the conditions for establishing of unified described and structured distributed data bases that will be maintained at the point of origin of the information and will provide information for management and information processes, both horizontally and vertically, using agreed standards or individually created sentences.

#### **3.4.2 Organization-methodical tools providing:**

- *The conditions for a unified approach to data base creation and effective division of labor between individual teams.*
- *Regulations for the creation of information standards obligatory for basic communication at the horizontal and vertical levels (character alphabet, rules for XML schema creation, rules for description and registration of data elements, rules for data interchange, standards for communication with the center, etc.), but also the principles of creation of information sentences, reports, data sets for individual communication between the individual participants in the process.*

#### **3.4.3 Technological provision - software products that enable:**

- updating and fast orientation in catalogs of data elements,
- searching of information standards and creating own information sentences,
- interlinking with data bases, working in computer networks.

## **3.5 Application of International Standards ISO / IEC 11179, ISO 7372, ISO 9735**

### **3.5.1 ISO / IEC 11179 Information technology - Metadata registries (MDR)**

#### **3.5.1.1 Purpose of ISO / IEC 11179**

The International Standard ISO/IEC 11179, Metadata registries (MDR), addresses the semantics of data, the representation of data, and the registration of the descriptions of that data. It is through these descriptions that an accurate understanding of the semantics and a useful depiction of the data are found.

The purpose of the seven-parts standard ISO / IEC 11179 [18], [19], [20], [21], [22], [23] [24] [25], under the general title Information Technology - Metadata Registries (MDR) is describe process of normalization and registration of data elements to ensure their comprehensibility and shareability. Normalization and registration of data elements as described in ISO / IEC 11179 allows the creation of a shared data environment with much less time and effort than required by conventional data management techniques.

ISO / IEC 11179 provides specific guidance on the formulation and maintenance of individual descriptions of data elements and their semantic content (metadata), which must be used for a consistent and standardized way of creating a data element. The standard also provides instructions for setting up a data element register.

Efforts to facilitate open data interchange through the international community through the electronic interchange of information have led to ISO / IEC 11179, which supports:

- facilitating the acquisition and registration of data,
- speeding up access to and use of data,
- simplified data manipulation using intelligent software based on the characteristics of the metadata described,
- the developing data metamodel for CASE and archives,
- facilitating electronic data interchange and sharing.

The set of ISO / IEC 11179 standards favors interoperability based on a unified data base between information systems and people:

- within organizations;
- between different organizations;
- independently of software and hardware on geographical, organizational, and political boundaries.



Metadata of data elements and their domain values are stored in the Data Elements Register. It is used to record, administration (including update) and support data sharing. Registering data elements and their value domains is a process of documenting metadata. It must be done at the data element level to increase and maximize their semantic value. ISO / IEC 11179 allows the end user to interpret the intended meaning convincingly, correctly and unambiguously.

### **3.5.1.2 Basic principles of application of ISO / IEC 11179**

Each part of ISO / IEC 11179 assists with different aspects of formulating data elements and must be used in conjunction with other parts.

**ISO / IEC 11179-1**, [18] *Framework*, establishes relations between individual parts and provides the necessary advice for their use as a whole.

**ISO / IEC 11179-2**, [19] *Data Element Classification* specifies a set of attributes applicable to the development of classification schemes of data elements and their components. Upon completion of the data element formulation, the data element may be registered by the registration authority where it will be maintained in the data element register

**ISO / IEC 11179-3**, [20] *Registry metamodel and basic attributes* states that the attributes of the data elements and related metadata are specified and registered as metadata items in the metadata registry (MDR).

The structure of a metadata registry is specified in the form of a conceptual data model. The metadata registry is used to keep information about data elements and associated concepts such as "data element concepts", "conceptual domains" and "value domains." Generally, these are all referred to as "metadata items". Such metadata are necessary to clearly description, record, analyse, classify, and administer data.

When considering data and metadata, it is important to distinguish between types of data / metadata and instances of these types. Clause 5 through 11 of this part of ISO / IEC 11179 specify the types of metadata objects that form the structure of the metadata registry. The metadata registry will be populated with instances of these metadata objects (metadata items), which in turn define types of data, e.g. in an application database. In other words, instances of metadata specify types of application level data. In turn, the application database will be populated by the real world data as an instance of those defined datatypes.

This part of ISO / IEC 11179 applies activities including:

- a) the definition, specification and content of metadata registries, including the interchanging or referencing among various collections of data elements;
- b) the design and specification of application-oriented data models, databases and message types for data interchange;
- c) the actual use of data in communication and information processing systems;
- d) interchange or reference among various collections of metadata;
- e) the registration and management of semantic artifacts that are useful for data management, data administration and data analysis;
- f) the interrelation and mapping of concept systems with other concept systems, e.g. to support efforts to converge on consistency through harmonization and vetting activities;
- g) the interrelation of concept systems with data held in relational databases, XML databases, knowledge bases, text, and possibly graph databases deriving from natural language text understanding systems;
- h) the provision of services for semantics computing Semantics Service Oriented Architecture, Semantics Grid, semantics based workflows, Semantic Web etc.
- i) support for addressing semantic web considerations such as AAA (anyone can say anything about anything) non-unique open world assumption;
- j) capture of semantics with more formal techniques (in addition to natural language) - First Order Logic (e.g. Common Logic), Description Logic (such as OWL-DL);
- k) support of Application Development and Maintenance;
- l) support of data migration, data mediation;
- m) support of portals, data marts and data warehouses;
- n) support of data grids and online transaction networks;
- o) ontological reasoning with metadata;
- p) ontology entry point for browsing and searching for metadata registries;
- q) capture of associations between published identifiers used in ontology(s) and the concepts registered in the registry;
- r) support for Ontology-driven Data Translation;
- s) support for data integration and data interoperation.

For the data element, due to its importance, two mandatory definition and identification attributes are elaborated in separate documents: **ISO / IEC 11179-4**, [22] *Formulation of data definitions* and **ISO / IEC 11179-5**, [23] *Naming and identification principles*. When constructing a data element definition, ISO / IEC 11179-4 must be respected. The identification of the data element must take into account the set of principles contained in ISO / IEC 11179-5.

**ISO / IEC 11179-6**, [24] *Registration*. This part describes the procedure by which *metadata items* required in various application could be assigned an internationally unique identifier and registered in a metadata registry maintained by one or more Registration Authorities.

**ISO / IEC DIS 11179-7**, [25], *Metadata for data set registration*. This part ISO/IEC 11179-7 provides a specification for an extension to a Metadata Registry (MDR), as specified in ISO/IEC 11179-3, in which metadata that describes data sets, collections of data available for access or download in one or more formats, can be registered. Since a set can contain a single element, this specification will also allow the recording of metadata about a single data value.

There are currently many sets of data that are generally available. They may be part of the government-initiated open data initiative or may be datasets that are used within and between organizations for commercial, scientific or academic purposes.

There is a requirement that metadata about these datasets be readily available to allow for the consistent and appropriate use of data and information and to avoid duplication of work. If you have a registered metadata registry where metadata describing data files are registered, it will make it easier to find the appropriate datasets.

Clause 5 of this part of ISO/IEC 11179 specifies the types of metadata objects that form an extension to that structure so that the whole structure provides facilities to keep information about data sets. A Metadata Registry will be populated with instances of these metadata objects (metadata items), which in turn define, for example, types of data in an application database, or, in the case of this part of ISO/IEC 11179 data sets that are held elsewhere. Such data sets could, for example, be made available over the internet or be included as a table within a word processed document.

Registered metadata provides information about a data set that includes the provenance and quality of the dataset.

The specification in ISO/IEC DIS 11179-7, together with the relevant clauses of the specification in ISO/IEC 11179-3, provides the ability to record the following data set metadata:

- One or more unique identifiers for the data set.
- The designation or title of the data set.
- A definition or description of the data set that provides sufficient detail to enable a user to quickly understand whether this data set is of interest.
- The date the data set was issued and, if appropriate, the date that subsequent versions of the data set were issued.
- The access level and rights associated with the data set.
- The provenance of the data set, ie, information about the place and time of the origin of the data set, its ownership and the method of the generation of the set.
- A set of keywords or tags that help to explain the data set.
- The language or languages used to describe the data set.
- The temporal and spatial coverages of the data set.

- The accrual periodicity of the data set, ie, the frequency at which new, revised or updated versions of the data set are made available.
- The details of the distributions of the data set, including the identifier, the title, a description, the media type or file format, the size, the issue date, languages, access level and rights and access and download URLs.
- Annotations drawn from a concept system, such as an ontology, to describe the theme or category of the data set or the collection of data sets.
- Details of any contexts, such as a programme, project or business area that use the data set.
- Details of any quality assessments made in respect of the data set.
- Any additional descriptions of the data set, including: Any data elements that are already registered that are included in the data set.
- Any information models that describe the structure of the information in the data set.
- Any documents which describe aspects of the data set, such as technical information about the data set and/or developer documentation such as a graphical representation of the data model of the data set.
- Details of any superset/subset hierarchies containing the data set.
- Details of any replacement data set if this data set is superseded.
- The details of any collection of data sets of which this data set is a part, including the identifiers, the designation or title, a definition or description, issue dates, languages, access level, rights, the spatial coverage, the provenance and any quality assessments of the collection.

### 3.5.1.3. ISO / IEC 11179 users

ISO/IEC 11179 is of interest to information developers, information managers, data administrators, standards developers, application developers, business modellers and others who are responsible for making data understandable and shareable.

For users and data administrators, ISO / IEC 11179 specifies the basic set of attributes of data element and associated metadata to be specified and registered as **metadata items** in a **metadata registry**. Specifically, it focuses on highlighting such features of data elements, such as identifiers, definitions, and classification categories. ISO / IEC 11179 describes the data element and helps users who share data to share the meaning of data elements, their display and identification. When a user receives data values, they can determine their exact meaning. If the user wishes, they can identify their data type by searching in database of data values.

For system analysts and data administrators, ISO / IEC 11179 provides a way to reuse the necessary data elements or to design new data elements if they do not yet exist. Also, before making data elements stored in the database accessible to users, data administrators and system analysts must be provided with a way of identifying

and logically describing data to inadvertently inconsistent data values. If system analysts are creating products that share data, they must first know whether the required characteristics of the data elements already exist or need to be created. If they exist, they should use them. If system analysts decide to reuse data elements, these data elements must display the same information in the same way. If a data element with the required characteristics does not yet exist, the data administrator must design the data element, make its description available to software developers. ISO / IEC 11179 assists in processing accurate descriptions of data elements. The creation of data elements based on the principles set out in this multipart international standard facilitates their interchange and retrieval regardless of the information processing system or the communication protocols used.

For software developers, ISO / IEC 11179 provides a means to ensure data coherence. The registry can help them by enabling consistent use of data throughout the Software Development Life Cycle (SDLC). The registry provides a mechanism of data element administration and ensures their detection between the individual SDLC phases.

ISO / IEC 11179 provides workers who are developing data directories, registers of data elements, CASE tools, and other software for data administration, the basis for designing the metamodel necessary for the collection, storage, administration and interchange of metadata elements.

ISO/IEC 11179 has broad applicability across subject area domains and information technologies.

### **3.6 ISO 7372 Trade data interchange - Trade Data Elements Directory (TDED)**

The purpose of the standard is to provide standardized data elements to facilitate open data interchange in international trade.

These standardized data elements can be used with any EDI (Electronic Data Interchange) method for data interchange on paper documents as well as other means data processing and communication. They can be selected for transmission one by one or used within a special system of interchange rules e.g. United Nations rules for Electronic Data Interchange for Administration, Commerce and Transport (UN EDIFACT) ISO 9735 [27].

International Standard ISO 7372 [26] is a joint ISO / UN / CEFACT product and adopted by Technical Committee ISO / TC 154, *Processes, data elements and documents in commerce, industry and administration* as the Trade Data Elements Directory (TDED); and is maintained by the Joint ISO / UNECE Maintenance Agency.

The Directory have been compiled by the TDED Maintenance Agency (see Section 2 below) on the basis of work with UN / CEFACT, as well as with other MA members, in particular the WCO and the IMO.

**Volume I** of the Directory constitutes International Standard **ISO 7372**. Annexes A, B, C and D to this International Standard are informative only.

**Volume II** includes the **User Code List**. The preparation and maintenance of Volume II is under the responsibility of the UN / CEFACT.

**Volume III** is a Compendium of **Trade Facilitations Recommendations**. The preparation and maintenance of Volume III is in the joint UN / ECE and UNCTAD, the Special Trade Program for Trade (SPTE).

The main **source** for the release of TDED is the of UN / EDIFACT directories D.02A:

- **Volume I** has been as a true **superset** of D.02A EDED, ie data elements,
- **Volume II** is a straight forward **subset** of D.02A UNCL, ie codes.

The Data Directory contains specifications of data elements used in paper documents as well as Electronic Data Interchange (EDI). In addition to data elements for business, it also includes data elements from a number of other areas: transport, customs, health, labor and social affairs, tax, finance, insurance, tourism and others, both at the corporate level and at the level of public administration.

The directory of data elements is:

- Support for the Basic Model of Business Documents of the United Nations (ISO 6422) by containing data elements that may be used in such documents,
- fully compatible with the UN / EDIFACT data directories supporting EDI, in particular EDIFACT Data Elements Directory (EDED) and UNCL - UN Codes List,
- multimodal (for all modes of transport); the requirements of each mode of transport are satisfied by the use of business terms or synonyms and not by specific records; multimodal requirements are met by generic records,
- applicable to all sectors of public administration (public administration, customs, health, education, etc.), business (trade, transport, enterprises, etc.),
- technologically and syntactically independent,
- in accordance with the Core Components specification of ebXML [59] by being a directory providing a glossary of a password name with 1) an object class, 2) a property, and 3) displaying and supporting a controlled glossary with a list of acceptable words,
- the data element names match the naming rules defined in ISO / IEC 11179 and the required Technical Specification for the ebXML Core Components.

EbXML describes and specifies basic components as a methodology for creating a common set of semantic building blocks that represent general types of trade data, creating new business dictionaries, and restructuring existing trade dictionaries. ISO 15000-5 can be used wherever trade information is shared or interchanged between

enterprises, government agencies and / or other organizations in an open and global environment. This interoperability includes both interactive and batch interchange of trade data between applications via the Internet and web interchange as well as traditional EDI systems.

### **3.7 ISO 9735 Electronic data interchange for administration, commerce and transport (EDIFACT)**

The purpose of the set of 10-part ISO 9735 with the common name Electronic Data Interchange for Administration, Commerce and Transport (EDIFACT) [27], [28], [29], [30], [31], [32], [33], [34], [35], [36] is to set rules at the application level for structuring data when interchanging electronic messages in an open environment. These rules are endorsed by the United Nations Economic Commission for Europe (UN / ECE) as EDIFACT syntax rules and are part of UNTDID Directory), which also contains manuals for designing batch [30], as well as interactive [29] EDI messages. In addition to the syntax rules, ISO 9735 also sets rules for security of EDI messaging [31], [32], [33], [34], [35].

The UN / EDIFACT standard is the two main components: Trade Data Elements Directory (TDED) - ISO 7372), which is a kind of "dictionary" and syntax rules (UN / EDIFACT - ISO 9735) a set of rules by which reports are produced.

ISO 9735 can be used in any EDI application, including public administration applications, but messages using these rules may be referred to as EDIFACT messages only if they correspond to other UNTDID manuals, rules, and protocols. UN / EDIFACT messages must conform to the reporting rules. These rules are updated in UNTDID.

There are several basic sets of EDI standards. The only international standard is the UN / EDIFACT (in fact, the UN recommendation), the use of which is prevalent in all countries except North America.

### **3.8 Use of the Register of Data Elements and Value Domains to Record and Analyze Data Elements of Individual Systems**

The register, as already mentioned above, is intended for the following basic purposes:

- Records of physical data elements that have already been used in the data structures of operating or upgraded information systems or databases.

- Creating, managing and publishing conceptual data elements. These data elements serve as a template for developers to create physical data elements of real data structures of updated or upcoming information systems and databases.
- Creating, managing, and publishing the value domains.

Creation and management of data dictionaries based on conceptual elements. It is also advantageous to add the registry to other features such as:

- Record of data models of information systems and databases.
- Record of data interfaces between individual information systems.
- Record data sets and data collections.
- Automated dissemination of updated code lists into information systems and databases.
- Interconnection with ETL and ESB for easier identification of data structures.
- Interconnection with electronic forms creation tools.



## **4. The analysis of data structures, data elements and their dependencies**

The team obtained for analysis purpose data models of limited group of information systems, or rather state primary registres and administration registers.

Obtained materials of data structures contained names of data elements, their data type and maximum length. Material consisted also used value domains. Due to detailed description team was able to identify common data elements and value domains, which are used through analysed registers.

### **4.1 The description of data structures of selected registers and eGov information systems**

#### **The Population Register (Registrul Populației)**

List of provided tables:

- PhysicalPersonData
- DocumentData
- AddressData
- PhysicalPersonShortData

List of provided value domains metadata descriptions:

- RelativeData
- PhysicalPersonCivilState
- GenderData
- LocalityData
- DocumentStatusData
- CitizenStatusData
- BloodGroupData
- CountryData

#### **The Register of Legal Persons (Registrul Unităților de Drept)**

List of provided tables:

- PhysicalPersonData
- DocumentData
- AddressData
- PhysicalPersonShortData

- JuridicalPersonShortData
- ProcessData
- ConductorData
- FounderData
- ActivityData
- ReorgParticipantData
- ReorganizationData
- AccountData
- BranchData

List of provided value domains metadata descriptions:

- PersonStateData
- LegalFormData
- LegalStatusData
- FinancingSourceData
- OwnershipFormData
- CurrencyData
- LiquidationCauseData
- DocumentTypeData
- DocumentStatusData
- CountryData
- LocalityData
- ReorgTypeData
- GenderData

### **The Address Register (Registrul adreselor)**

List of provided tables:

- DocumentData
- AddressData
- StreetData
- StreetSegmData
- BuildingData
- RoomData

List of provided value domains metadata descriptions:

- DocumentStatusData
- StreetCategoryData

- PrepareMethodData
- BuildingDestinationData

### **The Cadastre (Registrul bunurilor imobile)**

List of provided tables:

- RealEstateData
- ServitudeData
- OwnershipRightData
- RightEncumbranceData
- EncumbranceNotesData
- AddressData

List of provided value domains metadata descriptions:

- DocumentData
- UseModeData
- OwnerData
- OwnershipCategory
- BorderTypeData
- BorderTypeData
- RegistryTypeData
- CountryData
- LocalityData

### **The Tax Register (Registrul Fiscal)**

List of provided tables:

- TaxpayerGeneralData
- PhysicalPersonShortData
- DocumentData
- FounderData
- ReorganizationData
- BranchData
- AccountData
- PatentHolderData

List of provided value domains metadata descriptions:

- JuridicalPersonShortData
- DocumentTypeData
- DocumentStatusData
- GenderData
- LegalFormData
- OwnershipFormData
- ActivityData
- CurrencyData
- TaxPayerTypeData
- PhantomTaxpayerData
- LocalityData

### **The Vehicle Register (Registrul Unităților de Transport)**

List of provided tables:

- VehicleData
- HolderAddressData

List of provided value domains metadata descriptions:

- VehicleTypeData
- VehicleMarkData
- VehicleModelData
- VehicleBodyTypeData
- FuelTypeData
- VehicleEuroCategoryData
- OwnershipCategoryData
- LocalityData
- CountryData

### **The Register of Immigrants (Registrul Imigranți)**

List of provided tables:

- ImmigrantsData
- HostessTinData

- DocumentData
- AddressData
- PhysicalPersonShortData

List of provided value domains metadata descriptions:

- DocumentTypeData
- GenderData
- LocalityData
- DocumentStatusData
- CountryData
- JuridicalPersonShortData

## **4.2 The procedure of the analysis**

Due to the extent of the available data, the team puts the data elements lists into the database and based on the semantics of these data elements, it has created sets of compatible data elements and a set of incompatible data elements.

The sets of compatible elements have been compared and created recommendations for their harmonization and creation of data dictionaries.

## **4.3 Result of the analysis**

### **4.3.1 Data Element Dependencies**

On the basis of background information, the team has identified dependencies between individual data elements.

### **4.3.2 Sets of compatible Data Elements**

From a semantic point of view, the team set out the groups of data elements that are repeated in the registers analyzed in the following areas:

- data describing an individual person,
- data describing a legal entity,
- data describing a document,
- data describing address data.

Shared value domains among registers:

DE name	VD name	registers names				
ORDERNUMBER	<b>ActivityData</b>	Reg. of leg. pers.	Tax reg.			
ACTIVITYCODE	<b>ActivityData</b>	Reg. of leg. pers.	Tax reg.			
ACTIVITYNAME	<b>ActivityData</b>	Reg. of leg. pers.	Tax reg.			
LEGALFORMCODE	<b>LegalFormData</b>	Reg. of leg. pers.	Tax reg.			
LEGALFORMNAME	<b>LegalFormData</b>	Reg. of leg. pers.	Tax reg.			
OWNERSHIPFORMCODE	<b>OwnershipFormData</b>	Reg. of leg. pers.	Cadastre	Vehicle reg.	Tax reg.	
OWNERSHIPFORMNAME	<b>OwnershipFormData</b>	Reg. of leg. pers.	Cadastre	Vehicle reg.	Tax reg.	
CURRENCYCODE	<b>CurrencyData</b>	Reg. of leg. pers.	Tax reg.			
CURRENCYNAME	<b>CurrencyData</b>	Reg. of leg. pers.	Tax reg.			
DOCUMENTTYPECODE	<b>DocumentTypeData</b>	Reg. of leg. pers.	Cadastre	Tax reg.	Immigrants reg.	
DOCUMENTTYPENAME	<b>DocumentTypeData</b>	Reg. of leg. pers.	Cadastre	Tax reg.	Immigrants reg.	
DOCUMENTSTATUSCODE	<b>DocumentStatusData</b>	Reg. of leg. pers.	Population reg.	Reg. adres	Tax reg.	Reg. imigrantu
DOCUMENTSTATUSNAME	<b>DocumentStatusData</b>	Reg. of leg. pers.	Population reg.	Reg. adres	Tax reg.	Immigrants reg.
COUNTRYCODE	<b>CountryData</b>	Reg. of leg. pers.	Population reg.	Katastr	Vehicle reg.	Immigrants reg.
COUNTRYNAME	<b>CountryData</b>	Reg. of leg. pers.	Population reg.	Cadastre	Vehicle reg.	Immigrants reg.
REORGTTYPECODE	<b>ReorgTypeData</b>	Reg. of leg. pers.	Cadastre			
REORGTYPENAME	<b>ReorgTypeData</b>	Reg. of leg. pers.	Cadastre			
GENDERCODE	<b>GenderData</b>	Reg. of leg. pers.	Population reg.	Tax reg.	Immigrants reg.	

<i>GENDERNAME</i>	<b><i>GenderData</i></b>	Reg. of leg. pers.	Population reg.	Tax reg.	Immigrants reg.	
<i>LOCALITYCODE</i>	<b><i>LocalityData</i></b>	Cadastre	Vehicle reg.	Tax reg.	Immigrants reg.	
<i>LOCALITYNAME</i>	<b><i>LocalityData</i></b>	Cadastre	Vehicle reg.	Tax reg.	Immigrants reg.	
<i>REGIONCODE</i>	<b><i>LocalityData</i></b>	Cadastre	Vehicle reg.	Tax reg.	Immigrants reg.	
<i>REGIONNAME</i>	<b><i>LocalityData</i></b>	Cadastre	Vehicle reg.	Tax reg.	Immigrants reg.	

In addition to the above value domains, the registers also use relatively the same structures of these tables:

- DocumentData (small differences for individual data elements)
- AddressData (the data element in case of Vehicle Registres is named as HolderAddressData)
- PhysicalPersonShortData

#### **4.3.3 Incompatibility of Data Elements**

As part of the analysis, the team also identified minor differences in data models such as the data element LASTNAME, when in case of The Population Register, The Register of Legal Persons a the Tax register, have maximum length 52 characters, but in case of The Register of Immigrants have maximum length 60 characters. In this case, the team recommends standardizing the maximum length of the data element for all registers and information systems to the same maximum length.

#### **4.4. Prepared Semantic Catalogue**

This year's pilot project of the Semantic Catalog is under way. This tool should become the cornerstone of e-Government interoperability platforms. In addition to authentication and authentication services, the semantic catalog in the pilot phase should also include the following parts:

1. Metadata register
2. Semantic services catalogue
3. Ontology.

The above mentioned parts considers the team to be inadequate, therefore recommends extending the semantic catalog to other parts listed in chap. 5.2.

At the same time, the team considers the proposed semantic services processes to be complicated and not entirely appropriate for environments where data from registers and e-Government information systems built on different technologies within last twenty years.



## 5. Suggestions for Interoperability solutions

The team, in its analysis, found that the Moldovan side has already built foundations for solving of interoperability in the form of information infrastructure and existing information systems development teams. At the same time, they are developing new e-Government information systems and registers, as well as the integrating platform and specific electronic services such as Mpass, MSign, MPay, MCloud, MConnect. Some of these services are already in operational mode while others are still under construction. Thanks to these conditions, the team proposes to **address interoperability through data integration / harmonization**. This method does not require high investment in hardware or software because it is based mainly on organizational-methodological tools, standardization and harmonization of data structures of information systems of state administration and local administration. It is part of the lifecycle of e-Government information systems. Its advantage is that it is in the hands of development teams of information systems and is mainly happening at the time of development or upgrading of information systems. Exceptions are the updates of the value domains, which are performed by an independent expert in the given subject area and their dissemination into the database information system is ensured by support staff / management of information systems.

The above-mentioned method takes place in e-Government continuously and over the long term, or rather throughout the life cycle of information systems. Its difficulty lies mainly in arrangement of individual activities.

The team considers using the proposed solution architecture (see picture number 1) which consists of:

1. Existing or components of the MServices platform which are in development and the upcoming Semantic Catalogue.
2. The Semantic Catalogue itself (hereinafter referred to as the Catalogues) proposes to add additional components (see Chapter 5.2). This catalogue should be part of Master Data Management.
3. Master Data Management tool should use integration services such as the deployment of value domains into information systems and applications, controlled data and document shredding, or data sharing.
4. Integration services should be used by individual e-Government information systems and applications, by MServices services or by core registers directly, or in the form of aggregated data store in the shared database (data warehouse or repository of regularly shared data).

- The proposal counts on the use of a user portal that would cover both MServices and other services provided by e-Government information systems or registers.

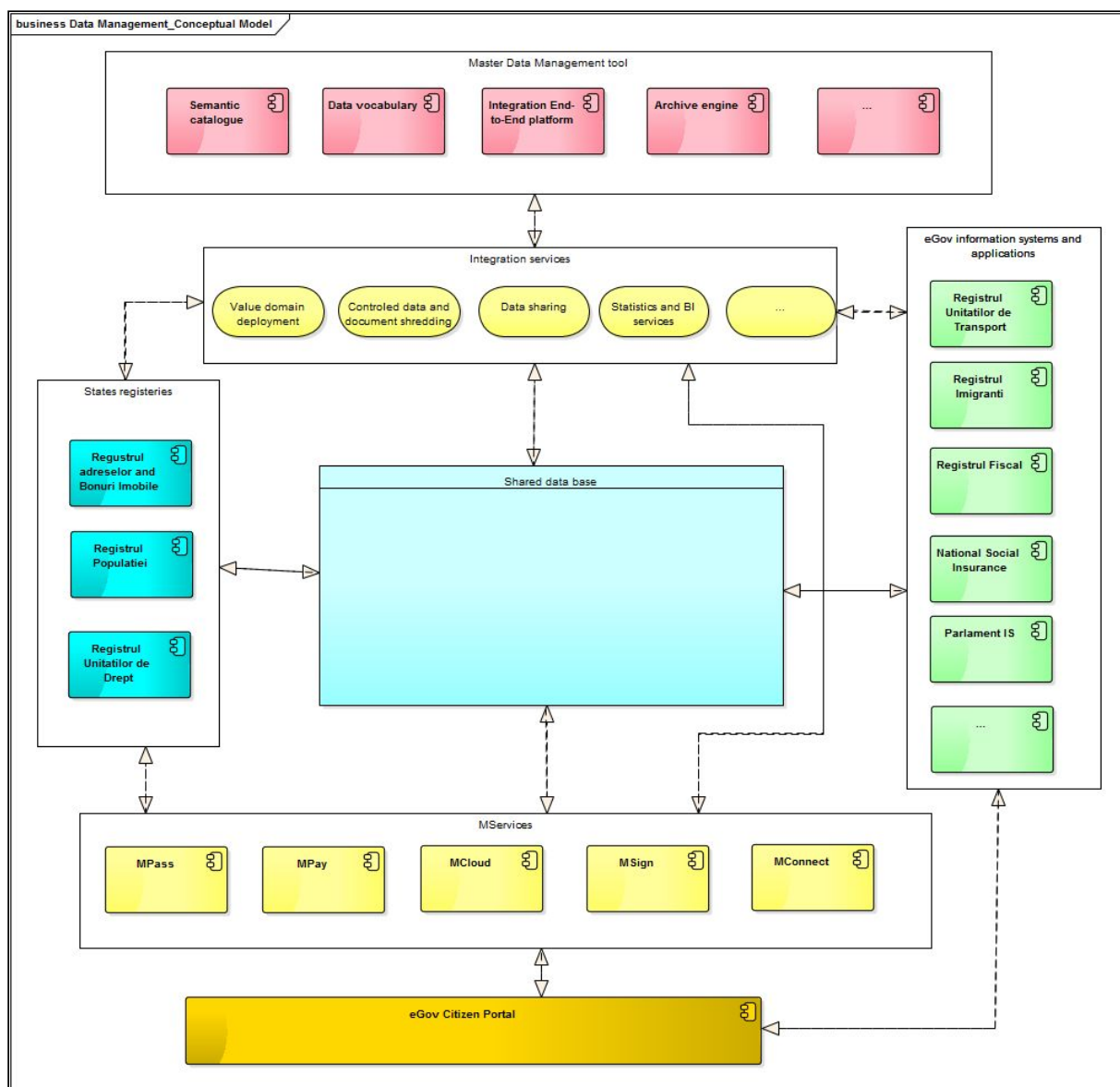
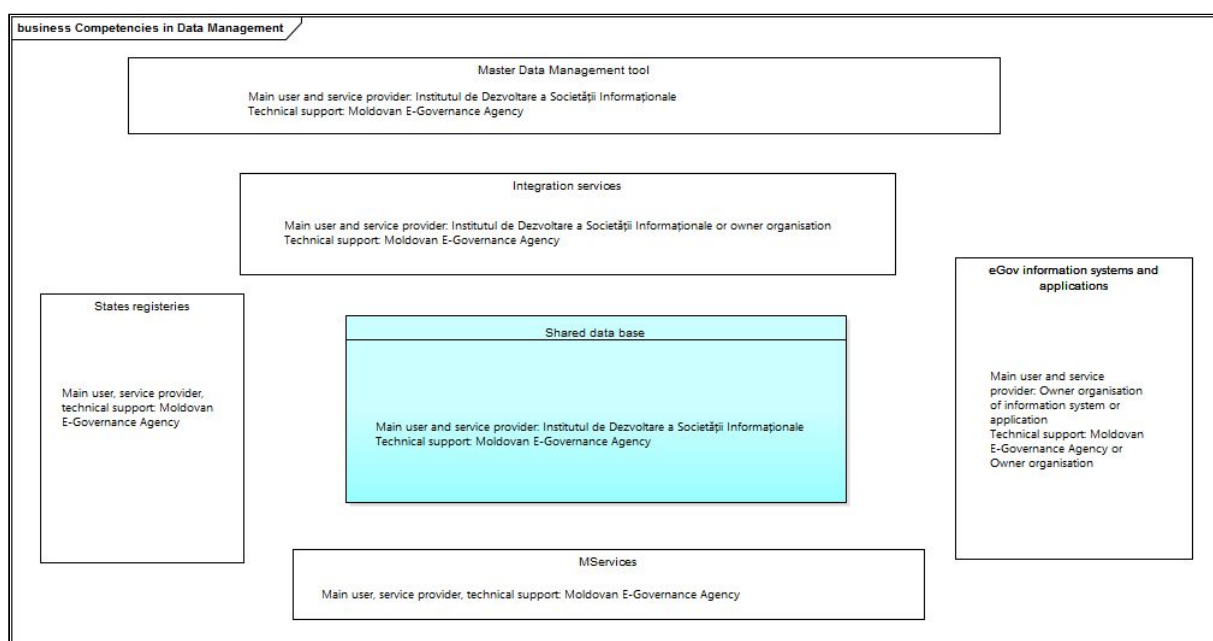


Fig. 1: Data management architecture

In the case of the full implementation of ISO / IEC 11179 recommends, three-level procedures (national, sectoral and at the level of the information system) are used within e-Government. Due to the current state of Moldovan e-Government, the team recommends the introduction of this standard with some modifications. This means **using only two-step management** (nationwide and at the level of the information system) and **limiting the number of roles** in the data management system.

The team recommends **creation of central data and value domains management center** (preferably within the IDSI organizational structure) on a nationwide basis to provide support and services to individual development teams and IT support / management teams. At the same time, it recommends creation of the role of a data manager and data element manager in the individual development teams (this role can be linked to the size of the information system or its life cycle stage). Information management roles should be set up within the information management / support teams. Central Data Management Body (CDMB) technical support could be provided by the Moldovan E-Governance Agency.

The proposal for the division of competencies is presented in picture number 2. It is worth mentioning that, for example, in the case of State Registers, MServices and some information systems and applications, is owned by the Moldovan E-Governance Agency.



**Fig. 2: Proposal of Data management competence/authority**

The basis of data integration / harmonization, in addition to the process of harmonizing data elements and their value domains, is **data management**. Which is a system of data management activities at the central level of e-Government. It should be gradually implemented in the individual information systems and fully supported by CDMB, both on the methodological side and in the form of creation and management of the Catalogues.

Based on personal consultations in selected organizations, the team found that data management processes are being used in creation of information systems. However, these processes are mostly applied only to system development. And because they are not formalized, there is a risk of errors in updating data elements and value domains and their disseminations within informations systems and registers.

## **5.1 Organizational-methodical tools**

### **5.1.1 Data Management**

The scope of data management is determined by the accountability and responsibilities of individual roles and role groups in the process of data management. Data management operates across the whole range of processes that take place within the framework of the construction or operation of information systems, in particular:

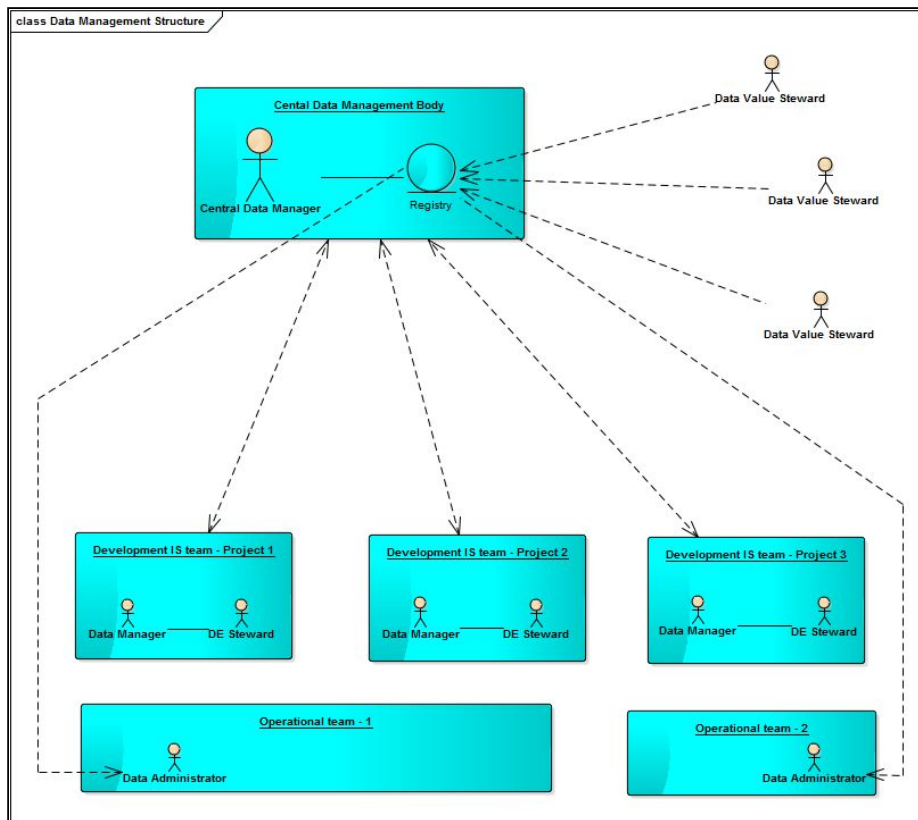
- the development and construction of new information systems in relation to existing information systems,
- methodical management of individual information systems in the field of processes falling within the scope of data management, data elements and value domains,
- obtaining an overview of the implementation of e-Government information needs by individual information systems,
- operational provision of the current, functional state of data management, data elements and value domains in integrated parts of information systems.

#### **Organizational solutions:**

- Use the ability to share data elements and value domains as much as possible (with the EU, on national level, within a department or organization).
- A Subject Matter Expert in a given field is responsible for the contents of particular value domain.
- Unified metadata storage (catalogue of data elements and value domains) which is accessible to all users and supports data management processes.

#### **5.1.1.1 Organizational Structure**

Due to the scope and complexity of data management, individual activities should be handled at the level of individual information system projects. These activities should then receive support in the form of central services.



**Fig. 3: Data management structure**

At the individual information system level, data management is ensured throughout the lifecycle of the given information system through data managers, data element administrators, and data administrators.

At the central level, the services are provided by the Central Data Management Body (CDMB) by the methodical support of the data management process using harmonization of data elements and value domains, management of the Central Catalogue of Data Elements and Value Domains (also Catalog or Registry), administration and publication of conceptual data elements and value domains in the Catalogue.

#### 5.1.1.2 The Roles

##### Data manager

An employee designated by the information system owner or by the project manager is responsible for:

- implementation of valid standards in data management during the construction and operation of the information system (including data interfaces),
- communication with CDMB,

- synergy with data element and value domains stewards during project implementation,
- the structure and content of the data elements and value domains used (taking standardized and harmonized data elements and value domains and creating new ones in accordance with valid standards),
- setting up the system for data and value domains management for individual information systems,
- synergy with the implementation plan processing (data elements and value domains area).

Has competences to:

- negotiations with designated personnel of their organization, Moldovan E-Governance Agency (AIS) and supplier in the issues in question,
- requiring lists of used data elements and value domains within a project,
- comparing delivered data models with data standards and harmonized data elements and value domains.

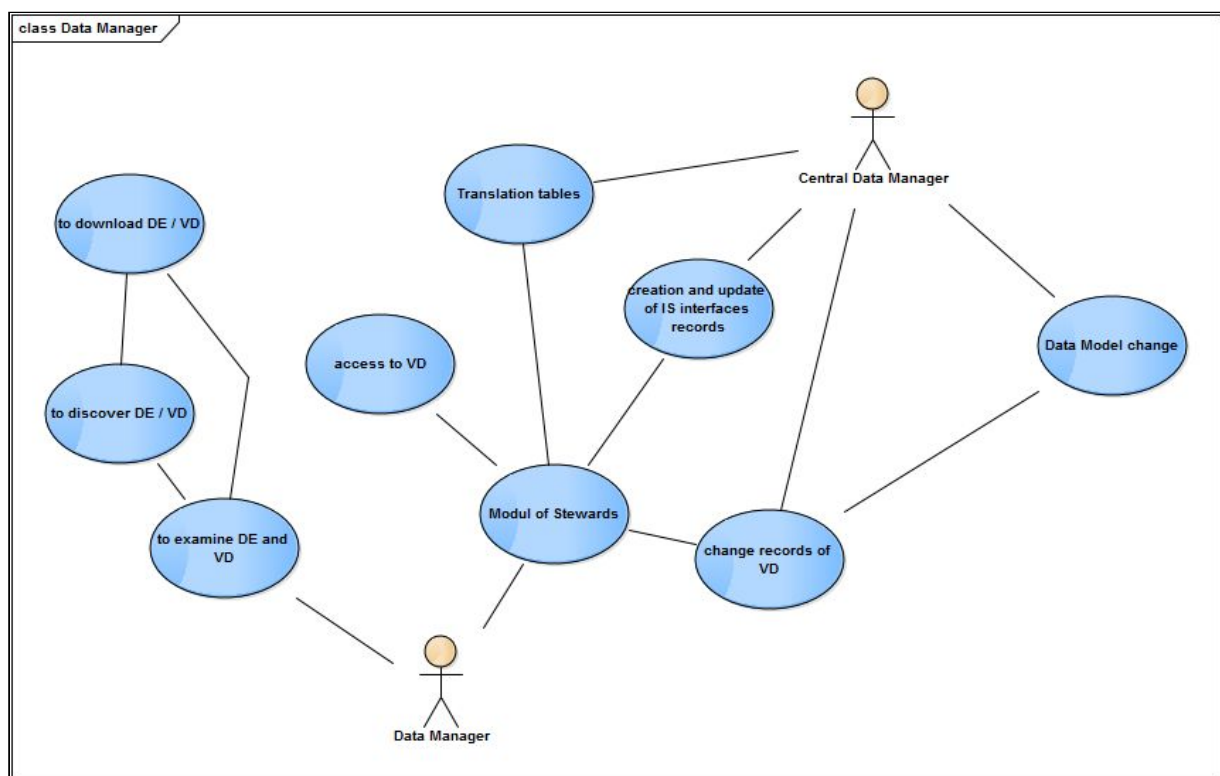


Fig. 4: Data manager - Functions of Data Elements and Value Domains Catalogue

## Data Element Steward

In practice, this role can be associated with the role of Data Manager in the project. Data element steward is the person who is responsible for the definition of the data element who creates and modifies it in the Catalogue of conceptual data elements

and value domains. It is intended by the information system owner, project manager or CDMB (for a harmonized data element).

Is responsible for:

- data element definition,
- updating or retiring of his data element in the Catalogue of conceptual data elements and value domains,
- in the case of ongoing harmonization of the given data element for its upgrading in the data model of the given information system.

Has competences to:

- negotiations with designated personnel of their organization or department and supplier in the relevant issues of their competence,
- to negotiate with CDMB staff.

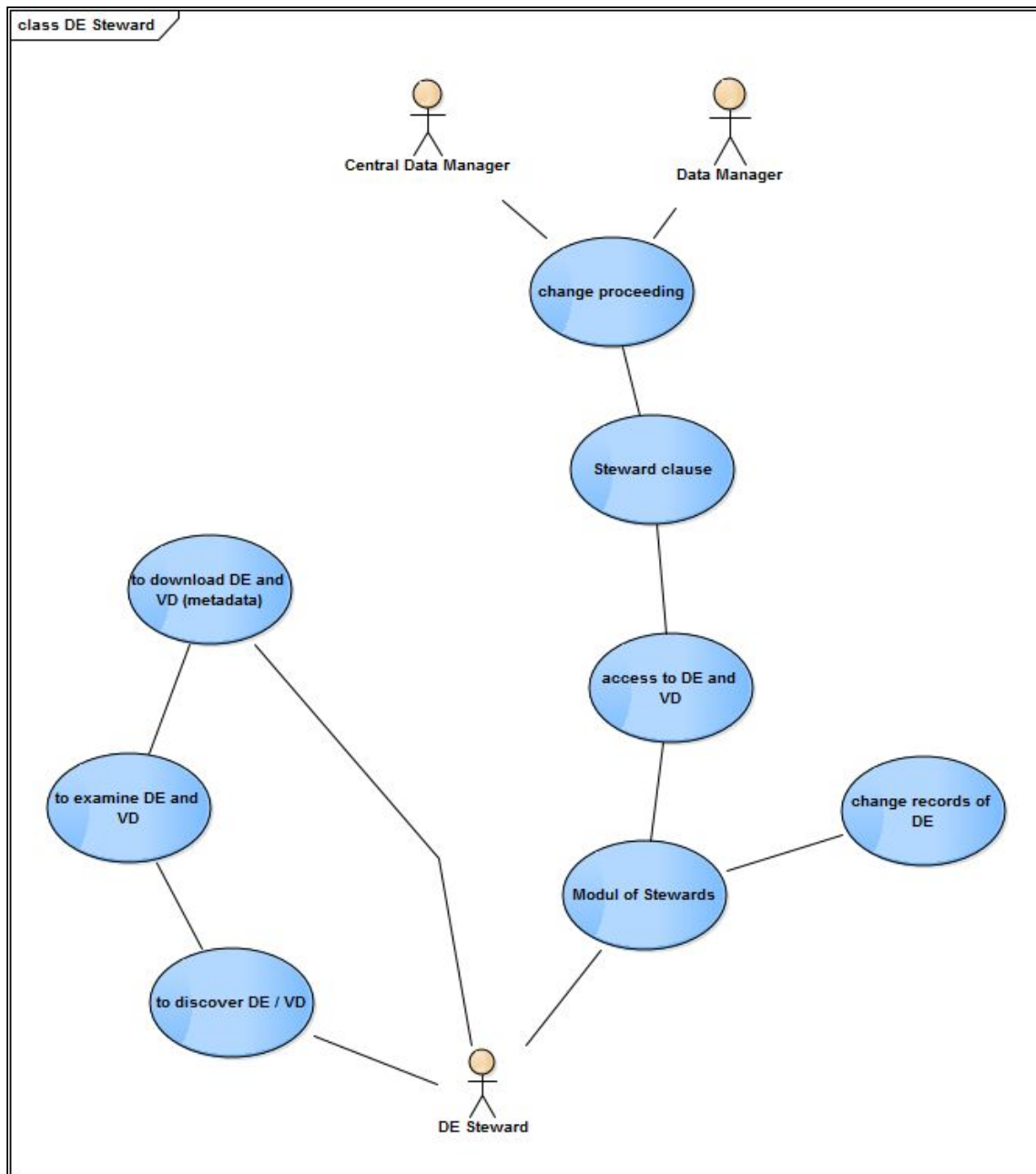


Fig. 5: Data element steward - Functions of Data Elements and Value Domains Catalogue

### Value domain steward

The value domain steward is a person (Subject Matter Expert) who is responsible for the content of the value domain, so he creates and updates it in the Catalogue of conceptual data elements and value domains. It is determined by the owner of the information system or CDMB.

IS responsible for:

- definition of the contents of the value domain,
- setting update rules, including date of validity,



- update or retirement of value domain in the Catalogue of conceptual data elements and value domains.

Has competences to:

- negotiations with designated personnel of their organization or department and supplier in the relevant issues of their competence,
- to negotiate with CDMB staff.

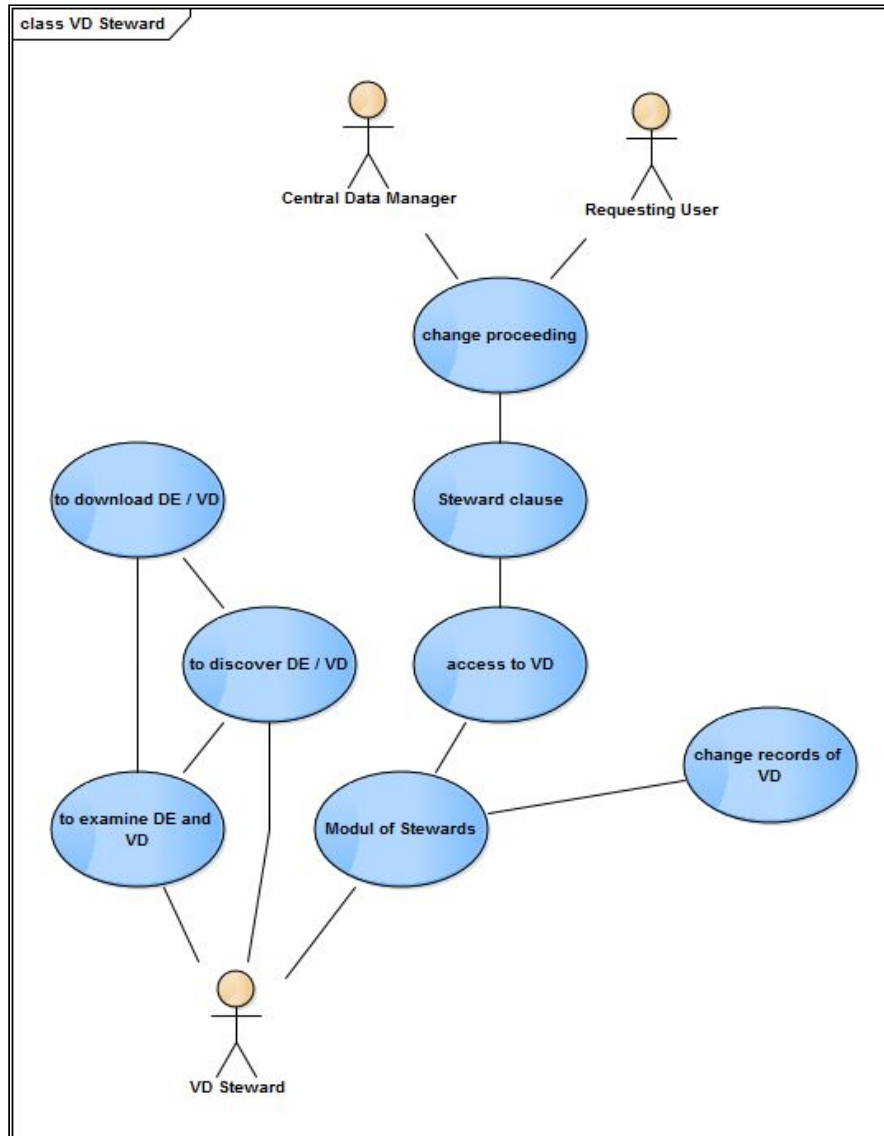


Fig. 6: Value domain steward - Functions of Data Elements and Value Domains Catalogue

### Data administrator

An Information System Administrator responsible for implementing changes in its data structures.

Is responsible for:

- update and /or dissemination of value domain in his information system

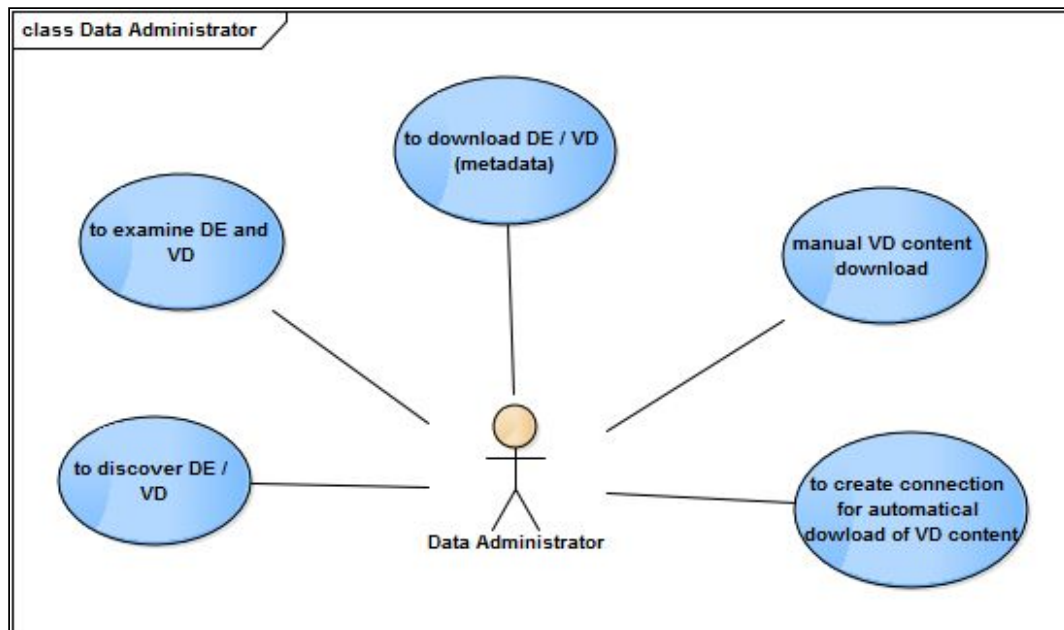


Fig. 7: Data administrator - Functions of Data Elements and Value Domains Catalogue

### Centra Data Management Body (CDMB)

Organization set up at the central level of e-Government. The CDMB workplace provides professional management of the entire data management process and guides the Catalog of data elements and value domains used by individual information systems - their development teams, vendors, and support / management teams.

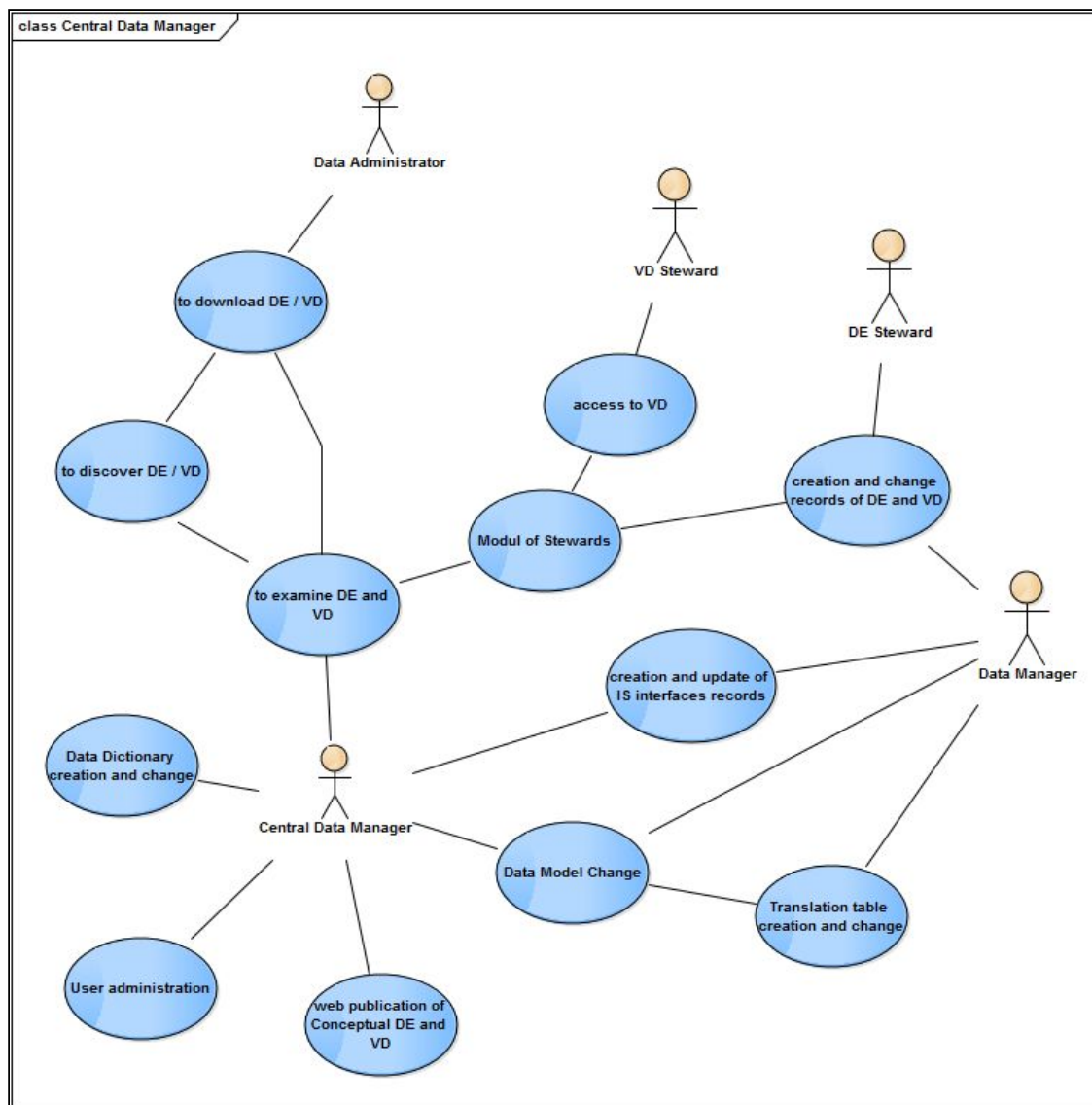
Is responsible for:

- coordination of activities related to data integration of information systems of state administration and self-government,
- coordination of use of data and value domains in individual information systems of state administration and self-government,
- professional management of data managers and steward in data management and data integration / harmonization of information systems of state administration and self-government,
- elaboration of expert methodologies in the field of data management and data integration / harmonization of e-Government information systems,
- keeping records of data elements and value domains used in information systems of state administration and self-government in the environment of Catalogue of data elements and value domains,
- use of standard data elements and value domains (ISO, EU, nationally harmonized) in development of individual information systems of state administration and self-government,

- the management of data managers' records, data element and value domain stewards and data administrators of individual information systems of state administration and self-government,
- coordination of activities within the process of harmonization of data elements and their value domains,
- publication of standardized, harmonized and conceptual data elements and their value domains.

Has competences to:

- monitoring the development and operation of individual information systems of state administration and self-government in terms of data management, creation and use of value domains,
- requiring lists of used data elements and value domains within a project,
- negotiation with dedicated staff of information systems development teams and suppliers in the scope of ist authority,
- monitoring developments in legislation and standardization in data management within the EU or ISO and informing relevant staff of individual information systems of state administration and self-government,
- negotiations with representatives of state administration and self-government, professional organizations and EU or ISO bodies in the issues of the scope of ist authority.



Obrázek 8: Data manager(member of CDMB) - Functions of Data Elements and Value Domains Catalogue

### 5.1.1.3 Processes

Data management processes are implemented in the following areas:

- information systems development,
- operation of information systems,
- provision of central services.

In the areas of development and operation of information systems, processes are provisioned by data managers, data element stewards, value domain stewards and data administrators. The processes of central services are within the competence of the CDMB.

The team created a separate diagram that illustrates the processes and individual roles in the process for each of them. These diagrams can be found in Appendix number 1.

**The basic processes** of data management include the following:

- New - creation of new data element and value domain in organisation.
- New - takeover already existing and used data element (and value domain) from organisation source.
- New - takeover of new data element (and value domain) from external organisation.
- Update - change of value domain in case of change of data element (organisation ownership).
- Update - change of value domain due to change of the law or internal regulation.
- Update - change of organisation data element and/or value domain on the basis of internal request.
- Update - change of organisation data element and/or value domain on the basis of external organisation request.
- Update - change of external organisation data element and/or value domain on the basis of internal request.
- Retirement – of data element in one information system.
- Retirement – of data element in all information systems of all organisations.

### **5.1.2 Integration / harmonization**

Data integration or harmonization is the process in which consensus is reached among stakeholders on the format and content (syntax and semantics) of a harmonized data element (or entire data structures composed of sets of data elements). If the data element has a value domain, it is also necessary to harmonize the content of the value domains (used by all information systems for which the harmonization takes place) and then to create a translation table that allows the values used in the information system database to be converted to new values so that it's possible to read the data, whether they are new or historical.

#### **Roles:**

- CDMB,
- Data element steward,
- Value domain steward.

Consequently, when implementing a harmonized data element into the information system, the Data Manager and the Data Administrator also play a part.

**Processes:**

- identification of data sets that are supposed to be harmonized,
- identification of the information systems that will be involved in the harmonization (the team recommends that it should include all the information systems that already have that data element included in its data model),
- the establishment of The Integration / Harmonization Commission in which all the above-mentioned roles will be represented,
- collection of the materials needed for harmonization (all data sets relating to the harmonized object, including the entire value domains),
- data sets analysis,
- the arbitration procedure in which the harmonized data element and its steward are determined,
- development of translation table for harmonized data element,
- development of translation table of its harmonized value domain,
- inclusion of a harmonized data element and its value domain into a harmonized data set and creation of a data dictionary for a given object,
- announcement of a harmonized data set by resolution of the Integration / Harmonization Commission and signed by CDMB Chief Representative,
- publication of a data dictionary and harmonized data elements in the form of conceptual data elements,
- publication of harmonized value domains and translation tables of data elements and value domains.

## **5.2 Set of catalogues**

Data management cannot be performed without knowledge of the environment, so individual roles need to have access to information about their respective data structures. For this reason, it is advisable to conduct at least a catalog of conceptual data elements and codebooks and physical data elements. These lists may be in different forms, but it is now common to use the so-called Metadata registries (the "Catalog") based on ISO / IEC 11179 Information Technology (MDR). In addition to basic registration services, it also provides support for cataloging, record management and other optional services.

The catalogs listed below are recommended as part of a semantic catalog, which is discussed in chap. No 4.4.

### **5.2.1 Catalogue of conceptual data elements and value domains**

It is a set of metadata descriptions of the data elements and their value domains. A conceptual data element could be described as a context-independent data element that has fixed attributes such as data type values, minimum and maximum lengths or

form of presentation. This concept is then used to create real-time data models as a template.

In ISO / IEC 11179, the concept of a conceptual value domain is defined. Since it is advisable to reduce the administrative burden associated with data management as much as possible, the team recommends unified inventory and management of the codebook without splitting into conceptual and physical. That is why we are talking only about the codebook.

The Catalog of value domains serves not only to record the value domains in the form of attributes, but also to record their contents in the form of codes and item names. Each value domain is linked to at least one conceptual or physical data element because it is actually a quantification of the possible content of the given data element. Such a value domain can also define a data element with the presentation code as well as a text presentation (for example, in the code of a country followed by the name of the country).

For modern tools, there is a service that enables value domain updates and the subsequent automated dissemination of these value domains into the information systems so that data consistency across these systems is guaranteed within a reasonable time.

Suggestions for metadata descriptions of conceptual data elements and the value domain can be found in Appendix number 2.

### **5.2.2 Catalogue of data structures (physical data elements)**

The catalog of physical data elements is used to record the data elements of the data models of existing or developed information systems. As mentioned above, these data elements are based on conceptual data elements. They are, however, placed in context. Like conceptual data elements, these are also linked by reference to related value domains.

### **5.2.3 Data model catalogue and Data interface catalogue**

Some of the catalogues also offer additional services, such as the recording of data models of individual information systems or a catalogue of data interfaces among individual information systems. These catalogues, in addition to the basic registry attributes, allow links to specific data elements and value domains that are used in a given model or interface.

The above mentioned catalogues are often incorporated into a unified system that allows access to individual information and services based on their role and relevance to the information system. It also serves as support for ETL or ESB tools.

### 5.3 Technological provision

As already mentioned, the Moldovan side is relatively well technologically secured. Therefore, the team recommends creation of **catalogue of data elements and value domains** for easier support of data management processes and automation of dissemination of updated value domains. After the implementation of the data management process and at least partial harmonization of data structures, it will be easier for the Moldovan side to use the already existing **MConnect**, which will help remove the large set of interfaces among individual government systems, self-government, organizations or transnational organizations).



## 6 System security

Information security is an important part of modern information systems which decides how successful is their implementation and operation. In this respect, it is necessary to place great emphasis on the systematic management of information security and on the management of security and information risks.

An important starting point for the development of information security management are administrative instructions No.01 / 2010 On the safety and access to databases and no. 02/2010 About information security management. These guidelines should first be brought into line with the international standard ISO / IEC 20000-1: 2011 Service management systems requirements [39].

Another fundamental starting point for safety management is the family of international standards ISO/IEC 27000 [40] aimed at managing information security in organizations. ISO 27000 is only an umbrella standard, and organizations must always choose specific standards to address their specific needs.

Key and most commonly used standard is ISO / IEC 27001 [41]. This standard applies the well-known PDCA (Plan, Do, Check, Act) model to information security management and requires the implementation of tasks which are necessary for the proper systematic management of information security. Currently, there are several practical experiences with implementing the requirements of this standard and its mastery has positive effects on enhancing information security and reducing resource consumption required to ensure the necessary level of safety

Safety rules should be based on a single common security policy which will be binding for all information systems, including information and agenda systems included in Public Administration of the Republic of Moldova. The specific requirements of individual information systems that go beyond the general security policy need to be specified in the form of system security policy created by individual IT systems administrators.

Information security management in the Republic of Moldova should be based on effective risk management. Here, a central risk register will work to allow for centralized and systematic collection, evaluation, processing and recording of security risk-related activities and requirements. This environment should include the basic risk management rules (e.g. risk assessment methodology) and the database where all information related to the identified risks and management of these risks will be stored.

The second standard is ISO / IEC 27002 [42], which includes so-called Best Practice for Information Security Management and Recommendations.

The Information Security Management Organization is based on a centralized model that ensures uniform methods, procedures and interpretations of security rules called security management (security architect and security inspectors). The enforcement of the security rules is ensured in each information system separately via defined IS entities (e.g. IS Provider, IS Administrator, IS Security Administrator, Operators, etc.).

Asset management is based on a centrally defined scheme for assessing individual security aspects of assets (confidentiality, integrity, availability). When making a proposal, each information system must create individual records and asset valuations. All information assets must be listed in the risk register. Human resources security is primarily implemented on the central level through a department responsible for human resource development. To achieve this, we need to use the standards [44], [45], [46], [47] and others.

We do not know how the physical security is currently handled. Documents and information have not been handed over from the Moldovan side.

Management of communications and operations management, in terms of security is implemented centrally. Individual information systems define their requirements for the use of infrastructure services (e.g. backup requirements, communication network transmission parameters, performance or disk capacity, etc.).

To provide an efficient control of access, all users are registered centrally and there is a basic common infrastructure such as role definition, identity management, PKI, etc. Within the framework of centralized role and identity management, individual information systems define their own access rules, including procedures for their enforcement, verification and tracking.

For the acquisition, development and maintenance of information systems, the rules for encryption and for security during development are centrally defined.

Security incident management is implemented centrally. Within the defined rules, the necessary interfaces will be defined for each individual information system.

Compliance with requirements will be centrally implemented to allow audits and to ensure technical compliance. It is the individual responsibility of each information system to monitor compliance with existing legislation, including monitoring the development of relevant legislative documents [58].

## 6.1 Privacy policy

Currently applicable data protection rules in Moldova republic are divergent and inconsistent with the EU's. The result is a fragmented legal environment with legal uncertainty and unequal protection for individuals in Moldova republic and individuals in EU.

Since 25.5.2018 the protection of individuals and the processing of their personal information and free movement of these information (GDPR – General Data Protection Regulation) is in effect by the Order of the European parliament and council number 2016/679.

GDPR is an EU regulation which aims to significantly improve the security of personal information of its citizens. This creates a 'level playing field' on data processing within the EU. Having the same rights across the EU will also boost individuals' confidence that the protection they get for their data will be equally strong, wherever their data is processed.

GDPR includes clear rules defining when EU law is applicable to companies or organisations established outside whenever the organisation's activities are related to the offering of goods or services to EU individuals, or to the monitoring of their behaviour, EU rules will apply. The new streamlined procedure for so-called "adequacy decisions" that will allow the free flow of information between the Republic of Moldova and EU countries. An adequacy decision is an acknowledgement that a Republic of Moldova ensures an adequate level of data protection through its domestic law or international commitments. Such adequacy decisions will be taken at European level on the basis of explicit criteria which will also apply to police cooperation and criminal justice. The Regulation promotes effective international cooperation for data protection enforcement between the Commission, European data protection authorities and authorities of Republic of Moldova, through investigative assistance, information exchange and complaint referral.

When the Republic of Moldova cooperates with EU countries, the Regulation will make sure that citizens' data is within the EU. This will help to improve international trust in the protection of individuals' personal data, wherever the data is located. This will in turn promote growth opportunities for businesses in Republic of Moldova.

The new simpler, clearer and stronger rules of GDPR will make it easier for citizens of Republic of Moldova to protect their data online. They will also cut costs for business considerably, providing companies in Republic of Moldova with an advantage in European and global competition, as they will be able to offer their

customers assurances of strong data protection whilst operating in a simpler regulatory environment. This simplification of the regulatory environment will give companies in Republic of Moldova a more predictable business environment in data protection, with a set of rules encouraging more consumer confidence and a better functioning internal market. Companies in Republic of Moldova offering protection of privacy will be more attractive for the consumers and in turn make them more competitive.

Implementation of the GDPR will ensure that citizens of Republic of Moldova will receive clear and understandable information when their personal data is processed. The new rules will also strengthen individuals' right to be forgotten, which means that if you no longer want your personal data to be processed, and there is no legitimate reason for a company to keep it, the data shall be deleted. GDPR will also guarantee free and easy access to their personal data, making it easier for them to see what personal information is held about them by companies and public authorities, and make it easier for them to transfer their personal data between service providers – the so-called principle of 'data portability'.

Better data protection rules mean that citizens of Republic of Moldova can be more confident about how their personal data is treated, particularly online. These stronger data protection rules will help increase trust in online services, so that they are able to use new technologies in a more confident way and so fully reap the benefits of the internal and European market. New, clear and robust rules for the free movement of data will also help businesses grow within a data protection friendly environment boosting the demand for innovative services and products.

Implementation of GDPR introduces one, single, technologically neutral and future proof set of rules. This means that regardless of how technology and the digital environment develop in the future, the personal data of individuals in Moldova republic will be secure, and their fundamental right to data protection respected. This trust will enable consumers to engage with innovative technologies and purchase online in full confidence that their personal data will be protected. Increased demand for privacy friendly products and services will foster new investment and the creation of new jobs and release the market's potential to provide a greater choice of goods at lower prices. This increase in economic activity will also help businesses, especially small and medium-sized businesses (SMEs) grow to their full potential within the single market and the European market. The Data Protection Reform in Moldova republic will be an enabler for Big Data services by promoting the adoption of principles such as data protection by default and by design, enhancing transparency and fostering consumers' trust and boosting competition through the new right of data portability as well as the creation of a level playing field for all companies active in the single market.

Under GDPR, everyone's personal data must be processed lawfully, fairly, and only for a specific purpose, a purpose that is always linked to the fight against crime.

GDPR ensures that personal data processing in Republic of Moldova complies with the principles of legality, proportionality, and necessity, with appropriate safeguards for individuals. It also ensures completely independent supervision by national data protection authorities, and effective judicial remedies. Police and criminal justice authorities will apply the principles of data protection by design and data protection by default at the beginning of any process to do with personal data, for example when developing new databases. Those responsible for processing personal data will be held more accountable for their work.

GDPR improve law enforcement authorities' work. In order to effectively fight crime, law enforcement needs efficient and robust rules on personal data exchanges at national, European and international level. By implementing rules related to personal data protection in the field of criminal justice in Republic of Moldova will make cooperation easier for the police and criminal justice authorities between Republic of Moldova and the EU. Data processing will be less costly and time-consuming. Police and criminal justice authorities will no longer have to apply different sets of data protection rules according to the origin of the personal data. Cooperation between police and criminal justice authorities in Republic of Moldova and in the EU will also be strengthened since there will be clearer rules for international data transfers related to criminal offences. The new rules will ensure that transfers take place with an adequate level of data protection.

## 7. Economic benefits

A key condition for effective support for public administration agenda management processes is the quality of information provided by information systems to users. The quality of the information is based on the quality of the data. Therefore, the maximum attention to methods of data creation and administration should be paid. The quality of these processes creates the conditions for the following areas that create the conditions for enhancing the quality of IT support of particular processes in public administration and achieving direct and indirect economic benefits.

It involves these issues:

- By data elements unification and harmonization, their quality and their reporting capacity are improved, including their reduction.
- By introducing the standardization of the technology of their transfer into the cooperating IS, the error rate and the assumptions for their further utilization at another level of utilization are also reduced.

This is a much easier and cost-effective creation of data warehouses geared to the individual segments of the monitored issue and the managerial systems that provide them with basic information to create concepts and management strategies for a given segment of the managed issue. In particular, information obtained from statistical, trending and other areas such as tax and customs administrations where tax evasion and customs fraud can be more successfully detected. An analysis of the available data structures can reveal shortcomings in the construction of information systems and appropriately innovate relevant information systems to obtain other necessary information (for example, the effectiveness of subsidies provided). A number of economic analysis can be carried out according to selected indicators (for example, the cost of choosing individual types of taxes) and a number of other activities with significant economic benefits such as the efficiency of investment incentives, etc.

Further benefits of this study's recommendations can be seen in reducing the cost of modifying individual information systems and creating new information systems where the good management of data registers and communication standards substantially reduces development costs or costs transferred to collaborative information systems.

We see a further economic benefit in enhancing the quality of processes when creating procurement documentation for new information systems, where it is enough to appeal to relevant registers, technical standards and recommendations to ensure data compatibility of old and new information systems.

The use of international standards will allow faster development of information systems, easier communication with foreign information systems, and the cost of modifying existing information systems needed for flawless communication.

## 8. Conclusions

"Developing a feasibility study for communication between national registers" was carried out under the Aid for Trade Program - Republic of Moldova.

The long-term experience of the authors in solving similar tasks in the Czech Republic was used during this study.

During the elaboration of the study, the team concluded that the basic incompatibility of structured data is the main obstacle for effective communication between the public administration organizations of the Republic of Moldova and its surroundings. This incompatibility causes data incompatibility and the resulting difficulties for decision-making processes in public administration. Public administration must be able to react flexibly and cover the information needs of its own, business and citizens.

The way how to remove data incompatibility is to add a Semantic Catalog to a metadata registry with a subsequent harmonization of data elements that will create the conditions for:

- The creation of a system of basic registers (population register, register of legal entities and address register) will simplify the communication of the public administration. Rationalizing administrative procedures will reduce the administrative burden on citizens, entrepreneurs, eliminate duplication and multiply in public administration.
- The introduction of a paperless interchange of information is not possible without clear terminology, definitions and identifications.
- Involvement of individually created data bases into a nationwide integrated whole.
- Effective creation of application software and its rational use. This will only be possible with a built-in information system on a uniform basis, which will not hinder the satisfaction of individual information needs.
- Communication between the participants in the reproduction process both horizontally and vertically based on comparable information. There will be no differences between the center's information and other levels of control of the state of the reproduction process. A properly interconnected system of source databases of information standards will allow you to process the necessary analyzes. Stored data will not be dependent on changes in the interpretations of descriptors (indicators) and will allow for the creation of comparable time series over the long term.
- Interlinking to data resources that were created around the state. Without this interlinking, it will not be possible in the near future to engage in an effective



international division of labor, cooperation and trade to which the world economy is going.

- Efficient providing of electronic services to citizens.
- Semantic interoperability solution.
- Solutions to Open Data.

Based on knowledge and experience from the implementation of this solution in the Czech Republic is the cheapest way of ensuring the integrability and interoperability of information systems, not only in public administration.

Although the document deals with structured data, the processing team recommends that the Moldovan side also deal in a similar way with unstructured data (documents) - their creation, workflow and trustworthy long-term storage in accordance with international, European standards and recommendations [49], [50], [51], [52], [53], [54], [55], [56], [57]. An important task is legal and technical solution of conversion of documents from electronics form to paper and vice versa. This has crucial meaning for providing electronics services not only to citizens but general. Only when both forms of data are dealt with will it be possible to carry out their full exploitation over them.

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