CONTEXTUAL MODELING OF ICT PROJECTS FOR E-GOVERNMENT: THE CASE STUDY OF REPUBLIC OF SRPSKA

Milan Latinović*, Zora Konjović**
* Agency for Information Society of Republic of Srpska, Banja Luka, Republic of Srpska, Bosnia and Herzegovina
** University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Republic of Serbia
milan.latinovic@live.com, konjovic.zora@gmail.com

ABSTRACT - Public administration institutions continuously implement information technology in their business processes through individual ICT projects. To ensure the coordination of such projects, they should be described as to enable their comparisson and determination of their effects within the context of the broader goals of electronic public government. This paper proposes the metadata model and the conceptual model of evaluation aimed at evaluation of the projects' effects within the broader context of the development of electronic government by taking into account the project itself, participants in its realization, and the direct beneficiaries of its results.

Keywords: *ICT project, electronic government, methodology, semantics, context*

I. INTRODUCTION

Semantics (Greek sēmantikós) is the branch of linguistics and logic concerned with a meaning, while a *concept* is an idea or thought that corresponds to some distinct entity or class of entities, or to its essential features, or determines the application of a term, and thus plays a part in the use of reason or language [1]. Accordingly, the semantic concept of an entity represents a meaning of this entity, both for itself and for its environment.

Modelling semantic concept means definition of a clear purport of entities to which this concept applies and definition the interaction between these entities.

When considering the concept of the project, a number of papers define it in different ways. According to the PMBOK Guide [2], a project is defined as follows:

The project represents a temporary activity which is undertaken in order to create a unique product, service or result.

"Temporary activity" means that each project has a clearly defined beginning and the end.

"The unique product, service or result" may refer to:

- concrete product that has been created, which can be quantified and may represent the final product of the project or a partial component;
- the ability to perform a service, for example, business process that supports the production or distribution;
- delivery such as a document or outcome, (for example new knowledge that can define new processes or even formal documents such as rules or standards).

The definition of electronic government (e-government) used in the paper uses is the one given in [3]:

E-government is defined as *the use of information and communication technologies in public administrations combined with organisational change and new skills in order to improve public services and democratic processes and strengthen support to public policies.*

Modelling the context of ICT projects in e-government environment involves creation of metadata describing ICT projects in such a way to enable their monitoring, individually and collectively, with the aim of systematic improvement of e-government.

II. ENTITIES OF E-GOVERNMENT

Semantics modelling requires basic concepts to be defined together with relations among them.

From the perspective of this paper, basic concepts of e-government are the following entities: *Institution, ICT project, Service and Citizen.*

A. Institution

The main carrier of an ICT project is an institution, which is described by following metadata:

- institution name;
- unique identifier;
- institution authorities.

Within the context of achieving the broader goals of e-government, it is necessary to pay attention to the following:

- The institution can be independent, it might have a parent institution, and it may be superior to another institution.
- The institution can (temporarily or permanently) transfer jurisdiction to another institution in order to successfully implement project or some activity under that project.
- In case when more than one institution is working on same project(s) or implementing same process it is necessary to clearly define owner structure for

all aspects of project (processes, results, entry data and databases etc.).

B. ICT project

Based on the document [4], in the proposed ICT project model the following aspects of electronic administration development are defined as necessary aspects of projects monitoring:

- strategic aspects;
- project management aspects;
- technical and technological aspects.

Strategic aspects refer to the references to strategic documents which can influence project directly or indirectly. Also, strategic aspects may refer to the documents which will appear as a result of observed project, and will be used as direct or indirect reference for observed or any other project.

Project-management aspects are based on identifying stakeholders, identifying the applied methodology, risk assessment, defining the legal basis for the implementation of the project and the definition of business processes within the project.

Technical and technological aspects refer to the content of the technical documentation which should appear as a result of the project such as the hardware and software aspects, descriptions of databases, defining communication channels, aspects of interoperability, standards, and the like.

Register of ICT projects in public administration of Republic of Srpska (RegIKT) is the information system which supports metrics for defining level of development, identification of needs and coordination of activities related to e-government development. Information system RegIKT has been developed by using methodology described in [5]. According to this methodology, ICT project is defined by the following metadata:

- project name;
- level of government institution which is implementing this project;
- indication of whether the project is international;
- name of the institutions involved in the implementation of the public government (PG);
- contact information (internet site of the project, contact person);
- external partners;
- segments and complexity of the project;
- status of the project;
- start date of implementation;
- the duration of the project;
- value of the project and funding sources;
- contractor / executor / supplier;
- comment on the project; and
- additional information

Also, the methodology defines the conditions, such as:

- Multiple public administration authorities may be involved in the implementation of the project, but only one body can be responsible for the project (the main responsible institution for the project).
- The project value can be defined by the specific financial amount or described trough usage value.
- One project can be displayed as a number of smaller projects, separated by segments, as long as the total financial value of these projects is equal to the financial value of the parent project.

C. Service

Service actually represents a mechanism which enables certain institution to provide end users with its service. **Electronic service** is a service that is implemented by using ICT and, in most cases, it's realized through reengineering of one or more existing services.

Process represents a clearly defined algorithm/workflow that solves a particular problem.

Using the approach described in methodology used for ICT projects we are able to describe metadata for service as an entity.

Unique identifier of the service represents a primary key which is used to index services.

A list of previous versions of the service represents a set of unique identifiers that point to previous versions of service.

Service name is a descriptive name for the service.

Development environment of the service is the connection with the project / projects from whom / which this service is created or updated.

Related services are those services that are required for the operation of this service.

Owner of the service defines the institution that owns the service.

The service user identifies users who have the right to use the service. Each specific user is defined by the set of permissions for usage of the service (for example, right of access to databases, updates or reading data, etc.).

Interactivity of service describes the nature of the interaction that user achieves via service: access to content; electronic forms download; two-way communication without authentication; two-way communication with authentication; complete transaction service (authentication with transactions that have a financial impact).

Technical specification of service provides access to all documentation that represents technical specification for the service (i.e. database schemas, use cases, activity diagrams, network schemes, etc.).

Legislation of service provides access to all legislative documents, which affects the service and to which this service must comply.

Additional information provides access to information which is not covered in this metadata but is relevant for the given service.

D. Citizen

In the context of this paper, the entity Citizen does not represent a physical entity, but an abstraction that should provide information about the benefits that a citizen, as an individual, is achieving by implementation of specific ICT project. This information is provided by connecting *Citizen* entity with *ICT project* entity, where *Citizen* entity is

described with specific metadata, with semantics given in further text.

Citizen's profile represents the target group which includes all individual citizens who should enjoy the benefits from ICT project.

The intended benefit is a benefit that has been planned for the target group *Citizen's profile* trough implementation of ICT project.

The accomplished benefit is a benefit that has been achieved for the target group *Citizen's profile* trough implementation of ICT project.

If the entities *ICT project* and *Citizen* connect via metadata from *Services of the public administration* entity and *ICT project* entity, it is possible to provide such information for each service that is the subject of any ICT project.

III. CONTEXT OF ICT PROJECT

In order to define semantic model of ICT project, we contemplate the project through a series of identification and metadata shown in Figure 3.1.

<table>
<tr><td colspan="3">UNIQUE IDENTIFIER OF ICT PROJECT</td></tr>
<tr><td colspan="3">PROJECT NAME</td></tr>
<tr><td>LEVEL OF IMPLEMENTATION</td><td colspan="2">INTERNATIONAL PROJECT</td></tr>
<tr><td colspan="3">PROJECT LEADER</td></tr>
<tr><td>LIST OF PARTICIPANTS IN THE PROJECT</td><td colspan="2">LIST OF EXTERNAL PARTNERS</td></tr>
<tr><td colspan="3">PUBLIC ADMINISTRATION SERVICES</td></tr>
<tr><td colspan="3">DEGREE OF PUBLIC ADMINISTRATION SERVICES</td></tr>
<tr><td colspan="3">PROJECT PHASES / LOTS
LOT 1
LOT 2
-
LOT N</td></tr>
<tr><td colspan="3">STATUS OF THE PROJECT</td></tr>
<tr><td>START DATE</td><td>PLANNED COMPLETION DATE</td><td>ACTUAL COMPLETION DATE</td></tr>
<tr><td colspan="3">SOURCES OF FUNDING</td></tr>
<tr><td>TOTAL AMOUNT OF FINANCING PLANNED</td><td colspan="2">TOTAL AMOUNT OF FINANCING EXECUTED</td></tr>
<tr><td colspan="3">SUBMITTED DOCUMENTATION</td></tr>
<tr><td colspan="3">NOTES</td></tr>
</table>

Figure 3.1. – Context of ICT project

The semantics of metadata is described in sequel.

Unique identifier of the ICT project represents a unique value that identifies the given project. In database terminology, this is a primary key of this model. The practical implementation of this identifier can vary, depending on the environment that implements this model.

Project name represents the formal name of the ICT project.

Level of implementation represents level of public administration on which this project will apply. It defines if project will apply to the level of single town, region or whole country.

International project defines whether it is a project of international significance (i.e., project which includes partners from other countries). In the case of the acceding EU, this field may represent (or can be replaced by) a tag which indicates if the project is related to EU integration.

Project leader is a unique *Institution*, which is fully responsible for initialization, monitoring, project implementation and reporting.

List of participants in the project is a list of *Institution*(s) which participate in this project together with project leader.

List of external partners is a list of institutions participating in the project, but by their nature are not parts of the observed eGovernment system (i.e. Non-Government Organizations, private sector partners, external auditors and validators and the like).

Public Administration Services (one of the most important indicators of ICT project) represents the field of legal framework and practice for acceding EU. It can be defined according to the fields of the legal framework and practice of the EU [6]:

1. Free movement of goods;
2. Freedom of movement for workers;
3. Right of establishment and freedom to provide services;
4. Free movement of capital;
5. Public procurement;
6. Company law;
7. Intellectual property law;
8. Competition policy;
9. Financial services;
10. Information society and media;
11. Agriculture and rural development;
12. Food safety, veterinary and phytosanitary policy;
13. Fisheries;
14. Transport policy;
15. Energy;
16. Taxation;
17. Economic and monetary policy;
18. Statistics;
19. Social policy and employment;
20. Enterprise and industrial policy;
21. Trans-European networks;
22. Regional policy and coordination of structural instruments;
23. Judiciary and fundamental rights;
24. Justice, freedom and security;
25. Science and research;
26. Education and culture;
27. Environment;
28. Consumer and health protection;

29. Customs union;
30. External relations;
31. Foreign, security and defence policy;
32. Financial control;
33. Financial and budgetary provisions;
34. Institutions; and
35. Other issues

Degree of public administration services defines the degree of electronic services that will be achieved by implementing this project. This field represents a direct indicator of the progress of e-government, after the implementation of this project. This field is classified according to the classification defined in the paper "Strategic framework for the development of eGovernment and eServices in the world" [7], as follows:

1. presentation content;
2. access to web forms;
3. fulfilling the general forms;
4. transactions; and
5. Connection "full integration".

Presentation content – *Citizen* receives basic information about *Institution*, where *Institution* has no information about *Citizen*. This concept includes G2C and G2B concepts.

Access to web forms - *Citizen* receives access to *Institution* official forms, whereby *Institution* still has no information about *Citizen*. This concept includes G2C and G2B concepts.

Fulfilling the general patterns – non-authenticated two-way communication (forum, FAQ, polls, etc.). This concept includes G2C, G2B, B2G and C2G.

Transaction - *Institution* is aware of the identity of the *Citizen*, authentication is enabled as well as electronic transactions. This concept includes G2C, G2B, G2G, C2G and B2G.

Connection – *Institution*(s) are integrated into fully connected entities which are able to respond to the needs of *Citizen* by using interconnectedness of specific *Institution*(s), interoperable information infrastructure and connectivity of *Institution* with the private sector and academic institutions. This concept includes G2C, G2B, G2G, C2G and B2G, and indirectly to the B2B, C2C, C2B and B2C concepts.

Project phases / lots represent separate parts of the project, where each lot can be regarded as a project within a project, i.e. can be defined by any set of data from the parent project. The basic rule is that the data inside phases must always be a subset of the data of the main project.

Status of the project represents the status of the project during the reporting period, and is defined as *planned, in progress*, *completed* or *postponed.*

Start date represents the start date of the project.

The planned completion date of the project is defined as the expected end of the project.

The actual completion date is the date when the project is declared as completed. The difference between the actual and planned completion of the project is one of the indicators of the success of the project.

Sources of funding are defined by *Institution*(s), funds and partners who provide funding for the project and the clear indication of the share of these funds in the overall project.

The total amount of financing planned and **total amount of financing executed** are representing the difference between budgeted costs and actual costs and are also an indicator of the success of the project.

The submitted documentation represents all the documentation that came with the *ICT Project*, as evidence that all entries are correct.

Notes represent an optional field for the parameters of the project that cannot be displayed existing fields.

IV. CONCEPTUAL MODEL OF INFLUENCE OF PROJECTS

In order to enable determination of influence of projects in context of achieving the broader goals of electronic public administration, in addition to model of *ICT Project,* it is necessary to define model for evaluating the influence of specific *ICT Project* on electronic governance. This section describes proposed conceptual model – **Electronic Administration and Level of Information System (EALIS) matrix.**

EALIS matrix has three dimensions.

Dimension X represents the service(s) of public administration that are subject of the specific project.

The variable X takes the value from the set corresponding to a field *Public Administration Services* (a collection of 35 entries corresponding to legal framework and practice for acceding EU).

Dimension Y represents the level of service of public administration achieved through implementation of specific project and takes value from the set corresponding to a field *Degree of public administration services* (a collection of 5 entries corresponding to degrees of services).

Dimension Z is the time dimension, as the basis for monitoring the continuous development of electronic government.

One way to implement proposed conceptual model is to quantify dimensions X and Y adequately, and then to represent a single project as a function $f(x, y, z, a)$, where a is an input parameter that specifies the context of evaluation, and the value of the function is a "success" indicator, i.e. value of the impact of the project on the entire system.

Improvement of the entire system is measured by the sum of the results of all projects by time

$$Q = \sum_{z=t_1}^{t_2} f(x, y, z, a).$$

By changing the input parameter a it is possible to get a large number of indicators of the entire system.

With the proposed model it is possible to calculate the following indicators:

1. the overall level of development of electronic government for a certain period of time;
2. level of development of specific aspects of electronic governance indicators through time;

3. level of development of specific aspects of electronic government through specific project or projects.

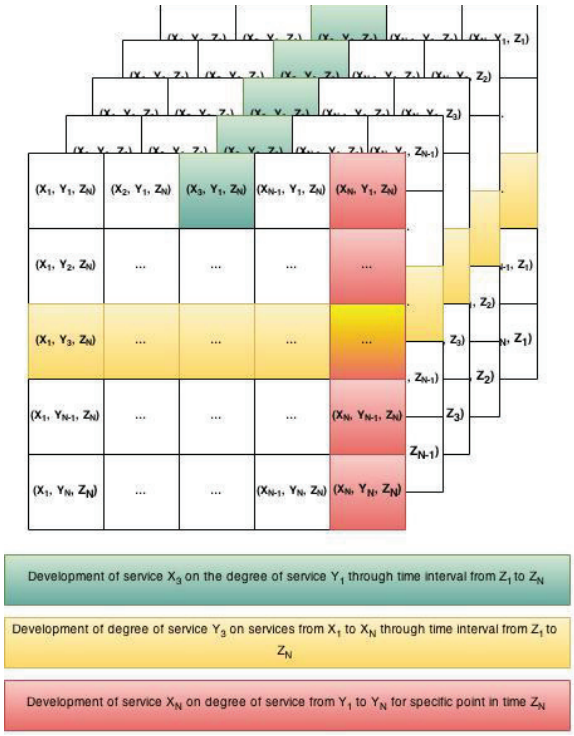

Figure 4.1 – Specific reports of EALIS matrix

Figure 4.1 represents an illustration of generating individual reports based on the EALIS matrix.

By applying mathematical operations on indicators of individual reports by some of the dimensions of the matrix aggregated reports can be obtained, and the diversity in reporting can be achieved by varying the input parameter a which can be used from corresponding metadata of *ICT Project* entity. One example of the input parameters a is the metadata of the project entity that can be quantified, and the form of functional dependencies is one of the central topics for further research.

In this way, it is possible to get EALIS matrix of successfully implemented projects or EALIS matrix of funding sources, etc. The main challenge of the proposed method of assessment is an adequate quantification of individual indicators and the definition of consistent metrics (for example, the metric for the degree of service).

V. CONCLUSION

Modelling of electronic government ICT projects proposed in this paper is aimed to provide indicators for assessing the impact of the project(s) on the broader goals of electronic public administration development. The practical aim is to provide indicators that could help to direct ICT projects planning and implementation towards achievements of the broad objectives of electronic government.

By combining current initiatives and methodologies for managing ICT projects, such as *„Database on ICT Projects in PA of Republic of Srpska – Methodology and Instructions for Forms Filling“* and *„Guidelines for providing expert opinion on ICT projects submitted to AISRS“*, this paper proposed methodology for contextual modelling of ICT projects and its application at the public administration of the Republic of Srpska.

Considering the context of ICT projects in public administration, the model identifies four entities. The *Institution* is an entity that is the main carrier of project activities, *ICT project* is the operating entity, while entities *Service* and *Citizen* represent base mechanism for evaluation of achievements in the development of electronic government. The semantics of ICT project within the context of achieving the broader goals of electronic governance is defined by semantics of metadata for the four identified entities. In addition, this paper proposes a new conceptual model of evaluation called EALIS matrix that includes the dimension of electronic service, degree of electronic service and time component for implementation.

It is planned that further research is going in two directions.

The first one will include further developing of model of metadata from the standpoint of the aspects of evaluation, as well as advancements of the evaluation model regarding allowed input data (imprecise, linguistic, etc.) and indicators calculation.

The second direction will include research related to machine-readable representation of the model, evaluation process automation, and presentation of the evaluation results.

REFERENCES

[1] Stevenson, A. „ *Oxford Dictionary of English* “, Oxford University Press, 2010.

[2] *„A Guide to the Project Management Body of Knowledge”,* 3rd Edition, Project Management Institute, Pennsylvania, USA, 2004.

[3] Alabau A. *“The European Union and its eGovernment development Policy”,* FUNDACION VODAFONE ESPAÑA, 2004.

[4] *„Guidelines for providing expert opinion on ICT projects submitted to AISRS “,* Agency for Information Society of Republic of Srpska, 2013. (in Serbian)

[5] *„Database on ICT Projects in PA of republic of Srpska – Methodology and Instructions for Forms Filling“,* Agency for Information Society of Republic od Srpska*, 2009.* (in Serbian)

[6] EU Acquis communautaire, http://ec.europa.eu/enlargement/policy/conditions-membership/chapters-of-the-acquis/index_en.htm, visite: 02.01.2015.

[7] Radinković M., Latinović M. „A Strategic Framework for eGovernment and eServices Development in the World“, Modern Government, Banja Luka, January 2010. (in Serbian)