

LIS Software Development Methodology

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ABSTRACT

This paper deals with the issue of implementing an information system in BiH public administration. IS implementation is a complex process that implies solving problems such as: examining the theoretical aspects of IS development, analysing the current situation, choosing the most appropriate method of IS development, IS implementation, post-implementation support, as well as measuring the practical benefits of IS implementation.

Keywords: Systems, IS process, implementation.

Introduction

Several methodologies are present in the software development and engineering theory and practice. Today, development and engineering are realised by forming mixed teams consisted of: users (real system analysts), systems analysts, computer scientists and software engineers.

The project team, using contemporary tools for software development and engineering (CASE - Computer Aided Software Engineering), develops a software by stages depending on the selected methodology.

Today, the answer to the question how should software actually be developed and engineered within information systems related to the automation of certain functions at municipal levels, i.e. departments is very popular. However, due to the immense complexity and informality of certain functions and processes in the systems, for which a software should be developed, it is necessary to invest a lot to find the methodology that will meet the software development needs best.

Researching new methods is especially stimulated by failures in developing and engineering more complex information and software systems, as well as low productivity of project teams.

Concept Proposal for LIS Development

By using past experience in working on IS development, applying some of the existing methodologies and using the acquired knowledge on applying the MIRIS methodology (Information Systems Development Methodology), we are providing a concept for LIS development. Only a combination of multiple available methodologies would, perhaps, completely suit IS development for the local administration present in BiH today.

If we opt for top-down IS development, it is necessary to:

- at least, form a Government Information Centre for Computer Science (Bos. ICVI: Informacioni centar vlade za informatiku) at the level of entities,
- define the role government plays in development

The primary task of ICVI would be to create a satisfying public administration informatisation. The Government Information Centre for Computer Science would, among other things, be in charge of:

- developing application software,
- consulting the authorities on planning and introducing information technology,

- professional monitoring during the development and introduction of application software,
- quality assurance for information technology services and products, and
- methodological and technological coordination during project development.

The listed tasks are closely related to the chosen information system development methodology. Apart from the stated tasks, ICVI would have to keep track of the process of designing the methodology that would deal with public administration IS development. State authorities would take part in the public administration informatisation as service users and, in certain segments, as contracting authorities. The Government Information Centre for Computer Science would function as a professional coordinator and contractor, doing most contracting tasks. In such a situation there is often a case where, during individual developments, very different approaches are used resulting in diverse products (this is primarily related to the stages of analysis and planning). Such diversity hinders, if it does not disable, the effective professional monitoring and quality assurance, which is the responsibility of the Government Information Centre for Computer Science. Moreover, the repeated applicability of the development product and a comparison between different development projects is hindered.

In order to create a quality IS, it is necessary to include the government at the entity levels for several reasons:

- the software for municipalities would be cheaper,
- the software quality would certainly be infinitely greater due to the suggestions given by several municipalities during the application development,

- we would have a universal system applicable in BiH as a whole,
- people would have certain standard procedures for solving their problems wherever they may be,
- the government would have better control over the operations of certain municipalities,
- the Electoral Commission would receive unique data,
- the bureaus of statistics and various monitoring departments for municipality development would also have the necessary data,
- simply put, everyone would get something; the state, the municipalities and service users.

The primary purpose of the suggested information systems development concept for the Government Information Centre for Computer Science and, of course, other state authorities is to offer:

- assistance in preparing, establishing, coordinating, managing and supervising information systems development projects implemented for the needs of the Government Information Centre for Computer Science (joint projects) and other state authorities,
- a gradual approach in developing and implementing the state authorities' information systems,
- methodological support for monitoring the quality of project implementation conducted by hired contractors, and
- providing additional guidelines for the hired contractors' operations.

An Overview of LIS Development Methodology

Table 1: The contents of information systems development methodology [46]

Information systems development methodology							
Information systems development structural methodology			Information systems development object methodology			Workflow applications development methodology	
The rules and usage of diagramming techniques	Development procedure	CASE tools	The rules and usage of diagramming techniques	Development procedure	CASE tools	WfMc model	An overview of BPR and WF tools

STRUCTURAL METHODOLOGY

Diagramming techniques for data and functional modelling without which it is not possible to imagine a good approach in developing information systems, the information systems development procedures and examples of diagrams with CASE tools that offer a solid support for teams developing IS and those maintaining them are presented in the structural methodology. The information systems development structural methodology is based upon the information engineering methodology, Oracle CDM methodology and SSADM methodology.

The rules and usage of diagramming techniques Clearly understandable and structural diagramming techniques defined in detail are of vital importance when developing information systems. When developing information systems, a close participation of those who develop IS (developers, analysts) and IS users, where everyone have their own role from the very beginning of IS development to its implementation and even in IS maintenance is necessary. Diagramming techniques are priceless for exchanging ideas and in the final stage, with their clarity, they guarantee that the developers will, properly and down to the smallest details, understand the operations and significance of the system organisation itself. Due to the operations automation, for analysts who use CASE tools, clearly defined diagramming techniques are even more important because they enable syntax translation, automatic transitions between different diagramming techniques and automatic translations of diagrams

at a logical level into diagrams at a physical level. There are a lot more reasons why the information systems development and maintenance cannot possibly be imagined without the usage of structural diagramming techniques.

Several diagramming techniques recommended by the structural part of information systems development methodology for different stages in information systems development are presented hereafter. Diagramming techniques, used in the analysis stage, serve for presenting performance and information needs of an organisation system (state authority) or performance of an area within an organisation system at a logical level, and the following physical operations of the information system are not conditioned. Diagramming techniques, used in the planning stage, already reflect the structure, that is, the application systems draft to be developed in the performance stage.

An overview of diagramming techniques used in various stages of information systems development can be seen in the (following) table.

The leftmost column states diagramming and other formal techniques with their usage recommended in the information systems development methodology; the first row states information system development stages. At the intersection of a stage and diagramming technique a product is stated showing the exact diagramming techniques which is used in that stage. If the intersection is empty, the diagramming technique is not used in that stage.

Table 2: An overview of diagramming techniques by information system development stages

Diagramming technique development stages	Strategic planning	Work area analysis	Application systems planning
Decomposition diagrams	Organisation scheme, Functional, Decomposition, Strategic elements (goals, problems, critical success factors)	Detailed functional decomposition	Application system structure plan
Data flow diagrams	Data flow analysis	Detailed functional model	
Entity diagram	Global entity model	Detailed data model	
Connection matrices	Connection matrices Functions - entities	Connection matrices Processes - entities	
Action diagram		Detailed functional model	Process plan
Structural diagram			Application system structure plan,
Structured language			Process plan
Decision tables and tree			Process plan
Transit diagram			Process plan
Relation schema			Data structure plan

DEVELOPMENT PROCEDURES

The image shows IS development described in the structural part of the information systems development methodology. The time axis contains stages, in succession, and the vertical axis contains activities within which it is necessary to perform one or several activities. An individual activity (determining demands for example) can be performed only within one stage; most activities are performed in several stages. A product (output), which will be based on one or more outputs presenting an input in one of the activities, should be created as a result of each activity. Considering the dependence among activities, it is possible that some of them are simultaneous or have a degree of overlapping, and some follow one another.

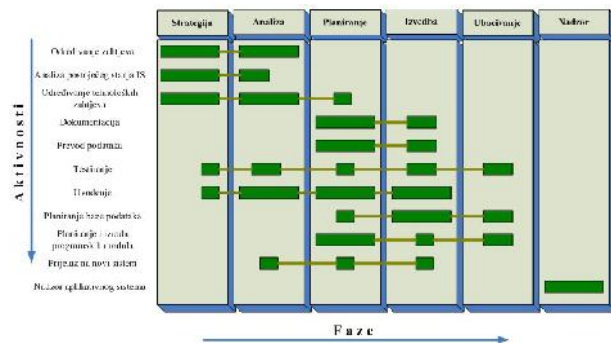


Image 1: Development according to structural methodology

Development tools - Contemporary CASE tools are essential for information systems development. In the structural part of the information systems development methodology, when making diagrams, it is necessary to include tools such as Oracle Designer/2000, or others, in the PowerDesigner. Development diagrams should clearly indicate which diagramming techniques support the tools and the type of the graphic notation that should be described.

WORKFLOW APPLICATIONS DEVELOPMENT METHODOLOGY

Basic concepts

The tools used to support workflow can roughly be divided into:

- workflow analysis and planning tools (Business Process Reengineering Tools - BPR Tools) and
- workflow management tools (WorkFlow Management Systems - WFMS).

Workflow analysis and planning tools are intended for creating images of the existing processes, their future modelling and detailed analysis. The process models created with such a tool serve for its evaluation, considering costs, time (performance, waiting and total time) and amounts (the number of performances in a time unit). Within the basis of process evaluation results, renewed process models for which it is possible (if the tool provides) to verify feasibility and compatibility at the same time are made with the same tool. Workflow management tools enable workflow performance. Before it is possible to perform the processes, they have to be modelled in the way recognised by the individual tool. In order to avoid repetition, for different tools, it is necessary to design instruction manuals that enable data transfer in the model from the process analysis and planning tools, as well as workflow management tools. Workflow management tools enable information monitoring and workflow directing from one activity to the other, i.e. from one contractor to the other. When directing processes, it is necessary to inform the users that they have to perform a task guaranteeing them with the appropriate toolkit which will be able to perform the desired task, to guarantee appropriate data the tool needs and enable the users to see where their demands belong in the process as a whole, which can contribute to a gradual process improvement.

Development procedure - The workflow application development procedure differs from a classical approach. Since the work area of such an application can present an overall performance of the organisation system, it is really important to have a developed approach to the description of the organisation system. Key elements of such a description are organisation scheme and workflow description. The main reason there are differences between a classical approach and an approach during workflow management application development is in the emphasis on contents, not on performance.

Integrating other Methodologies and Projects

One of the approaches in the beginning of creating an information systems development methodology should be that the methodology has to be harmonised with the existing ones already in usage, those ICVI uses and those that could be used for state authorities' informatisation. Introducing a new methodology, that would not be harmonised with the existing and methodologies already in use, would actually create a lot of questions and dilemmas which would be exactly opposite to the objective of the new methodology.

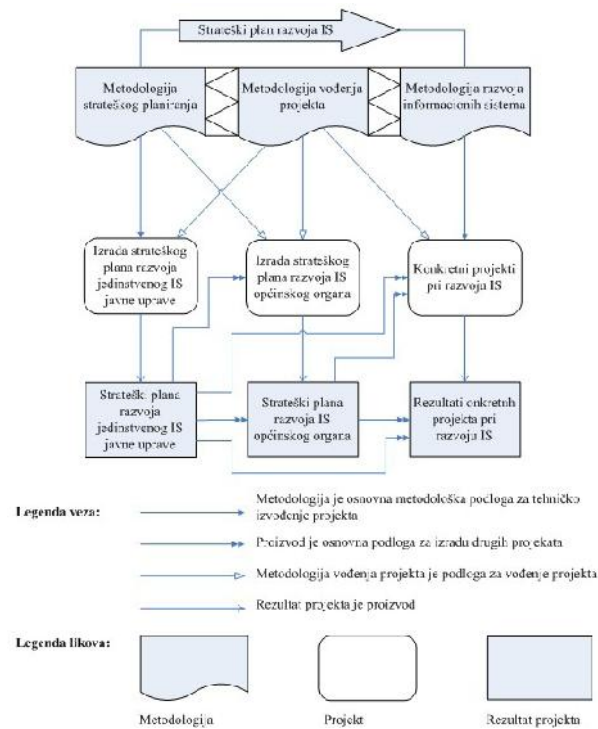


Image 2: A meta-model of relations between methodologies, projects and products

The image shows that the information systems development methodology is connected to the strategic planning methodology and other methodologies used in introducing information technologies in public administration, such as project management methodologies.

Thus, for example, the strategic planning methodology can be made on the basis of the information engineering methodology, within which strategic planning is the first stage. Strategic planning methodology has to describe procedures, products in development and final products of strategic planning for information systems development, which would serve as a fundamental methodological background for implementing projects related to creating information systems development strategic plans. It will be shown that strategic plans for developing a unique public administration information system and strategic plans for information system development of certain state authorities are input "products" in specific information system development projects and with that one of the foundations for their products. The products, created upon the strategic planning methodology and those the methodology accepts as results, should be accepted as input data in the information systems development methodology.

Project management methodology in public administration can be created on some other foundation. Project management methodology in public administration should be a described project organisation, management procedures. Such methodology can be used in all projects in the area of information technology for project management and quality assurance. The relations shown in the meta-model suggest that, in information systems development projects, several methodologies can be used:

- information systems development methodology according to which technical activities are performed and technical products prepared, and
- project management methodology according to which the project management and quality assurance are implemented

This means that project management methodology in public administration / information technology determines that the project is divided into stages, and the new methodology determines which ones. Furthermore, the methodology should determine which content and technical activities will be performed and what will their sequence be like, and the project management methodology in public administration / information technology determines which management and quality assurance activities

will be performed and when will they be performed in relation to the content and technical activities. The used methodologies should overlap and that is why it is sometimes really difficult to determine which boundaries are defined by the first, and which by the second methodology.

Methodology Application Projection

Considering the purpose of information systems development methodology, which is at the very beginning of a proposal for developing a methodology for the municipality's IS development, a projection of its application can also be made if we take into consideration the fact that one of the users is the information system development project manager, who will use MIRIS to help define appropriate engineering activities and select surveillance points, as well as tools that will be created in the development process. The project manager will select the appropriate approach (structural, object,...) according to which the project will be developed. In the part of the methodology which presents the IS development procedure, an output, that will be used later and that will determine the flow of the following stages constituting the project, will appear as a result. Of course, the project manager will be able to retain the actual condition and, based upon his or her experience, keep the recommended stages or even break them into multiple ones. The presented division into stages in the methodology cannot be taken as absolute, but as a mere example corresponding to most, but not all of the actual development projects. The fact that the suggested division into stages is not absolute was already stated in the structural part of the methodology proposal, where, based upon the first presentation of a complete approach, a contracted one would be also presented.

In the contracted approach, certain stages have to be joined having in mind that the activities within the stages are actually truncated. Furthermore, the project manager will, in the part describing the development process, find a proposal of activities and their sequence within the stages. The activities and their sequence are determined based upon experience in working on several projects and that is why it is recommended that the project manager uses them as much as possible, with the possibility to join or change individual activities according to his or her own judgement.

The second part of this chapter mentions in passing that the methodology is intended for managers and team members developing IS. In order to reach a satisfying quality, the team leader finds interesting the part where the development procedure is presented, because, among other things, there is a proposal showing to best way to separate certain stages in the development project and which outputs would be used as inputs in one of the stages. Analysis and planning products are of key importance for IS development; the biggest traps and the most frequent shortcomings appearing later in the IS development stage are hidden there.

Conclusion

As an addition to the conclusion, it could be added that this is a Bosnian E-management model with foundations build on tradition and professional systems influencing municipal administration for the last couple of decades. The term transformation should also be understood as elimination, rotation and introduction of new methods in administration related to the citizens, without having to eliminate too much of the old one. So, the road shown for BiH municipalities' development is not extreme, neither in relation to economic efficiency nor in relation to introducing bureaucratic ideals. It is placed in a grey area, between black and white, where all justifications are satisfying, but there is no collective ideal model for who, what and how it is accomplished. The pressure put on municipalities by the environment and the ICT development speed can take part in improving tendencies, that can be seen in relation to the competition, orientation towards the citizens, responsibility, goal orientation and auctioneering and, in the future, they can take part in the apoliticism of terms like profit and result orientation .

Just like other methodological materials, neither the information systems development methodology, created for the needs of state administration, nor the written document (Document: UNDP BH ICT4D – ICT FOR DEVELOPMENT) will remain unchanged forever. It has to be properly renewed and supplemented. That is why, in the following years, the necessary materials will be further supplemented based upon practical experience, new needs in the area of public administration information system development and new technological trends. The information systems development methodology adds another piece in the mosaic that is the methodological order of public authorities' informatisation.

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Metodologija razvoja programskih sistema za LIS

SAŽETAK

U ovom radu je obrađena problematika implementacije informacionog sistema u javnoj upravi BiH. Implementacija IS-a je kompleksan proces koji podrazumjeva rješavanje problema kao što su: razmatranje teorijskih aspekata izgradnje IS-a, analizu postojećeg stanja, izbor najpogodnije metode izgradnje IS-a, implementaciju IS-a, post implementacijsku podršku, kao i mjerenje praktičnih koristi implementacije IS-a.

Ključne riječi: Sistemi, IS proces, implementacija.

Received: November 31, 2017 / Accepted: December 12, 2017

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