Software Methodology for Dynamising Database Structure in Municipalities

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Summary:

This paper focuses on the structure of municipal documents. These documents are official applications which provide specific facts and information in a particular type of law. In this sense, each local administration has its own document structure, described in the existing municipal regulations. Under the structure of municipal documents we understand the list of attributes of the document and their meanings in relation to this document. Typically, this structure does not change during the calendar year, but in many cases the structure is different for any of the following or even for each subsequent calendar year. Therefore, the paper examines some methodological issues of dynamising database structure in municipalities. For this purpose, five software methods are discussed – software method for defining documents, software method for presenting documents as metadata, software method for saving documents presented as metadata, software method for storing documents as metadata, software method for retrieving documents saved as metadata. The paper ends with conclusions about the advantages of using a software methodology for dynamising database structure in municipalities.

Key words: Methodology, database, software method.

JEL: C8, L86, H7.

1. Introduction

In terms of development of concept of e-municipality in Bulgaria, continuous investments in new business applications are required. It is an important task to uncover the opportunities for providing software tools for improvement of the performance of information systems, including information systems at municipalities, as a starting point for the improvement of management and decision making. Therefore we define the research problem of the article as the need of development of a methodology for dynamising database structure of modern business applications in the context of changes in the subject area. The object of the article is databases in municipalities. The goal of the article is a development of a methodology for dynamising database structure in municipalities.

For the purpose of establishing a software methodology for dynamising database structure in municipalities we have chosen a system of software methods that are subordinate to each other i.e. system of consistently associated methods. In this sense, by “software methodology” we will

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refer to the set of software methods and rules of their interaction:

1. Set of software methods. In terms of achieving the dynamic structure of municipal documents we offer software methodology consisting of five software methods, namely: software method for defining documents, software method for presenting documents as metadata, software method for saving documents presented as metadata, software method for storing documents as metadata, software method for retrieving documents saved as metadata;
2. Rules of interaction. The basic rule in the present study is the relationship between software methods that are part of the proposed methodology for dynamising database structure in municipalities – the result of the application of any method

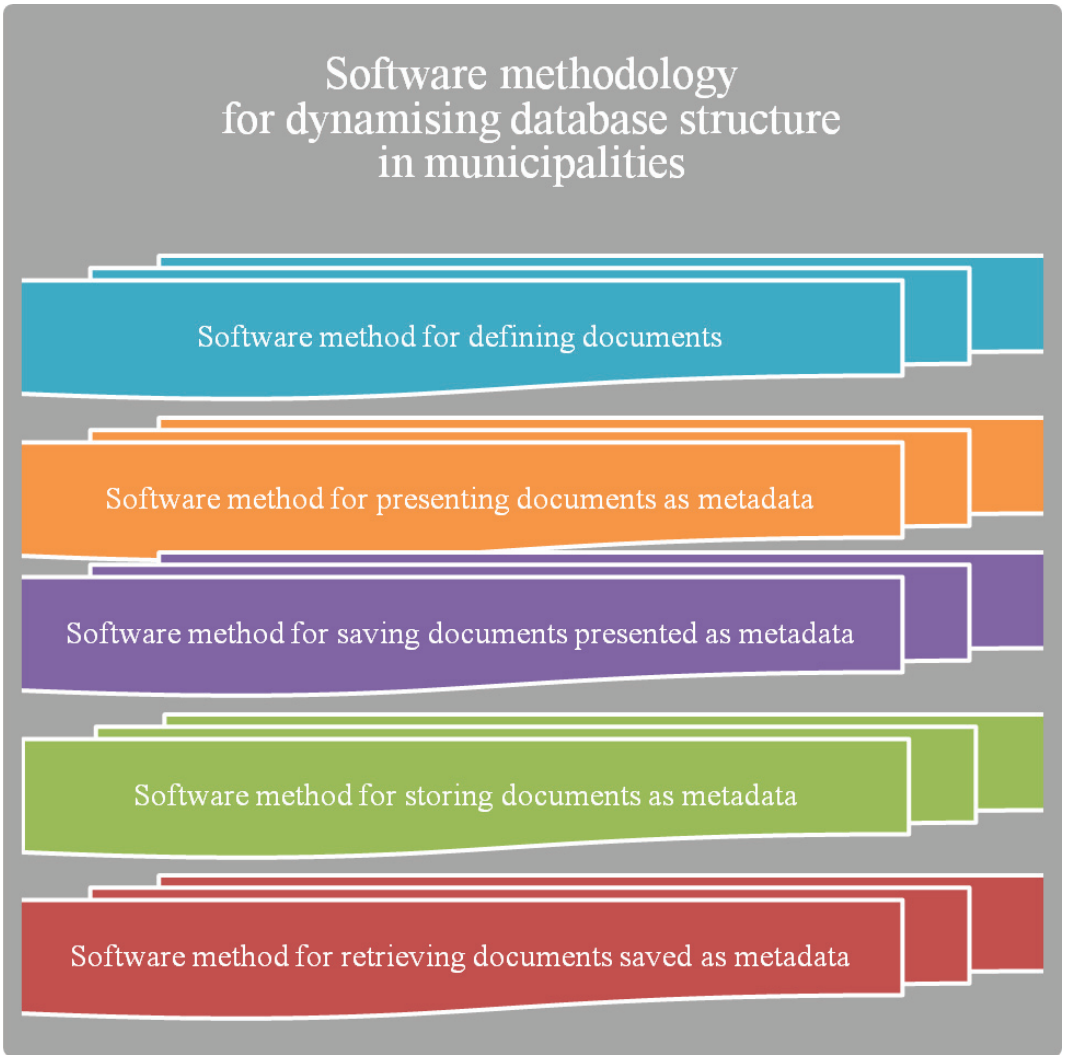

Fig. 1. Structure of the software methodology

within the methodology is a gateway to the next method in the methodology (the result of the implementation of the last method within the methodology is relevant in relation to the functionality of the first method) and the existence of any method makes sense only in the formation of the comprehensive software methodology.

2. Structure of software methodology for dynamising database structure in municipalities

In terms of research and in terms of the proposed methodology for dynamising database structure in municipalities, we interpret the documents as forms that provide specific

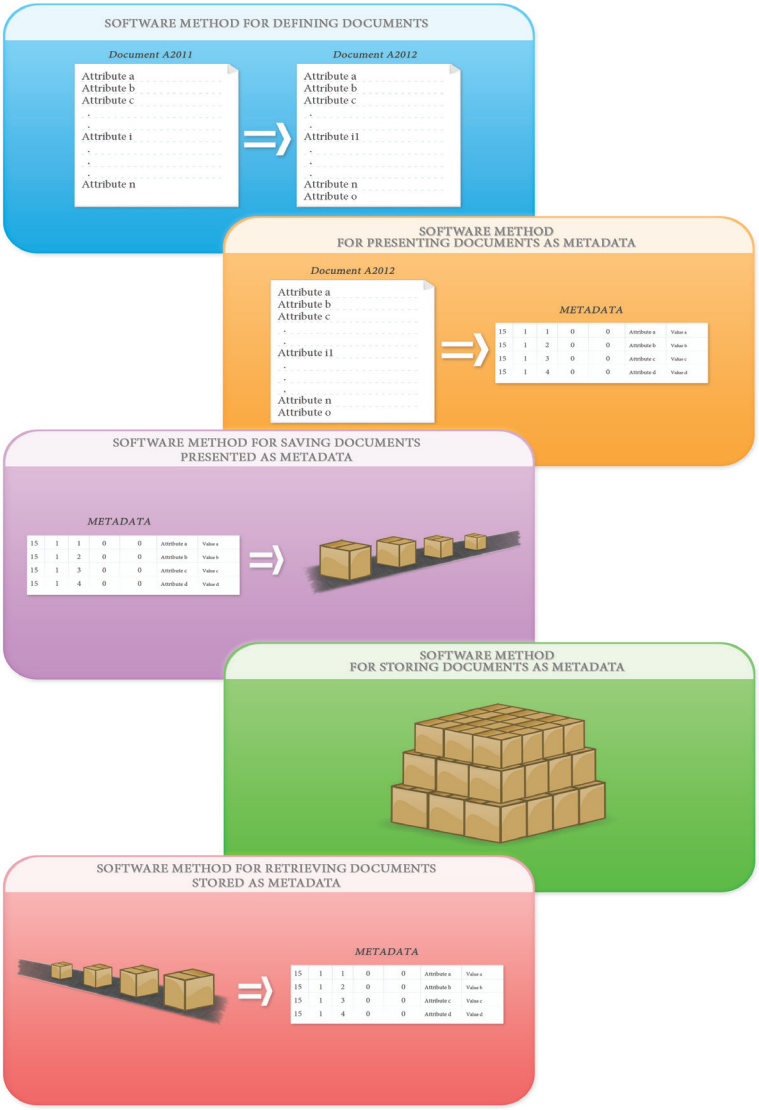

Fig. 2. Graphic description of the set of software methods within the software methodology

facts and evidence in a particular order. In this sense, each document has its own structure. Under the structure of the documents we mean the list of attributes for each document and their meaning in relation to this document.

The structure of the software methodology is shown in figure 1.

From the point of view of a software solution, this set of five software methods that form the software methodology for dynamising database structure in municipalities represents a software environment that provides opportunities for initial definition of documents and subsequent use of the instances of these documents. This environment includes means of saving, storing and retrieving documents. Under "software environment" thus formulated, we understand the software framework that will enable the set of the software methods to achieve their functional targets.

The graphic description of the set of software methods within the software methodology is shown in figure 2.

3. Software method for defining documents

The first method within the set of software methods that build up the software methodology for dynamising database structure in municipalities is a **software method for defining documents**. This

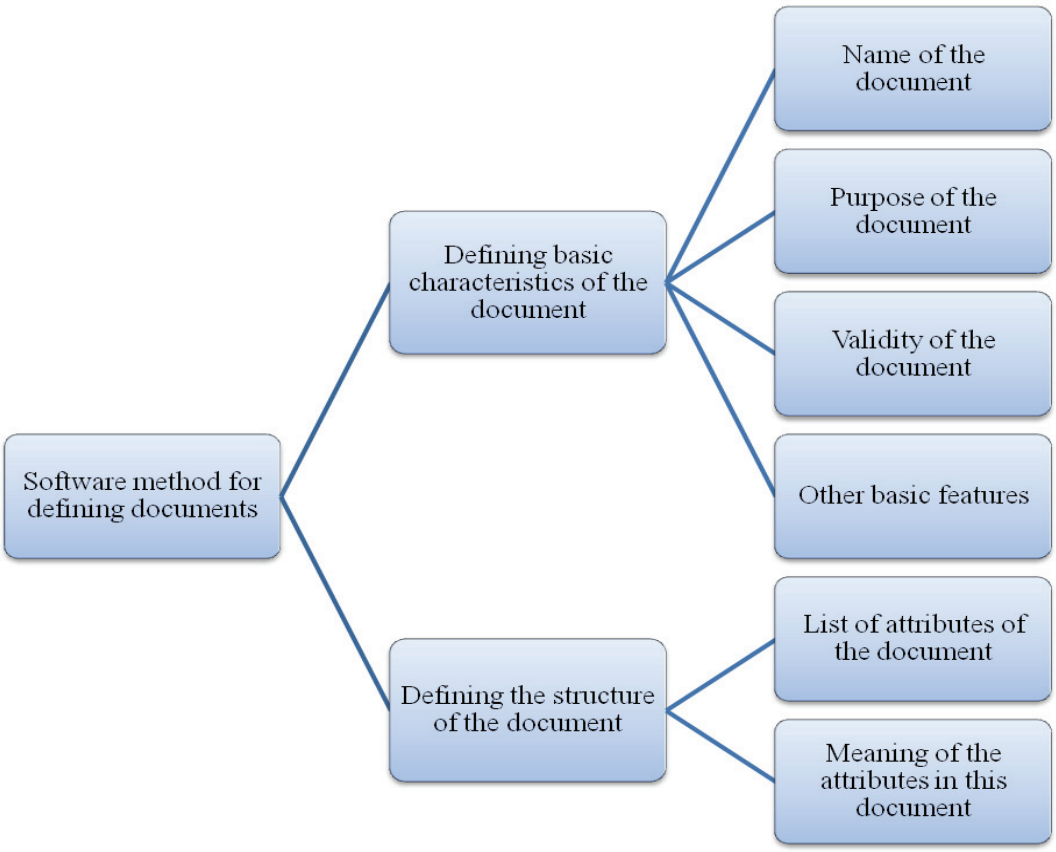

Fig. 3. Software method for defining documents

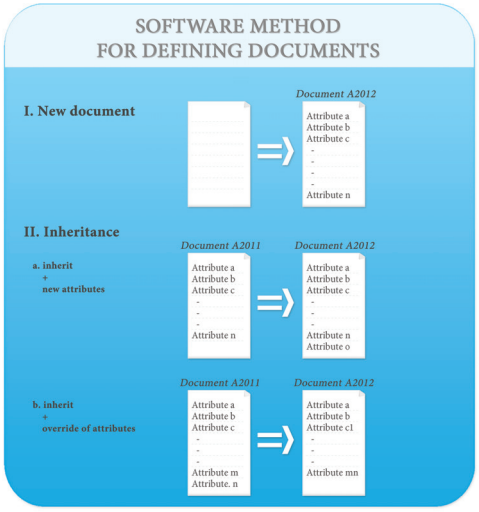

Fig. 4. Graphic description of software method for defining documents

method provides an opportunity to define municipal documents, as shown in figure 3:

1. Defining the basic characteristics of the document, which include the name, purpose, validity and other basic features;
2. Defining the structure of the document that includes a list of attributes of the document and their meaning in this document.

The software method for defining the document aims to create a universal algorithm for defining documents with different structures, in which similar documents or different versions of a document can be created using inheritance based on an already defined document.

Graphic description of the method for defining documents is shown in figure 4.

The mode of operation of the software method for defining documents can be described in the following steps and features (fig. 5):

1. The definition of documents can be realized with already described inheritance of documents and therefore we can use

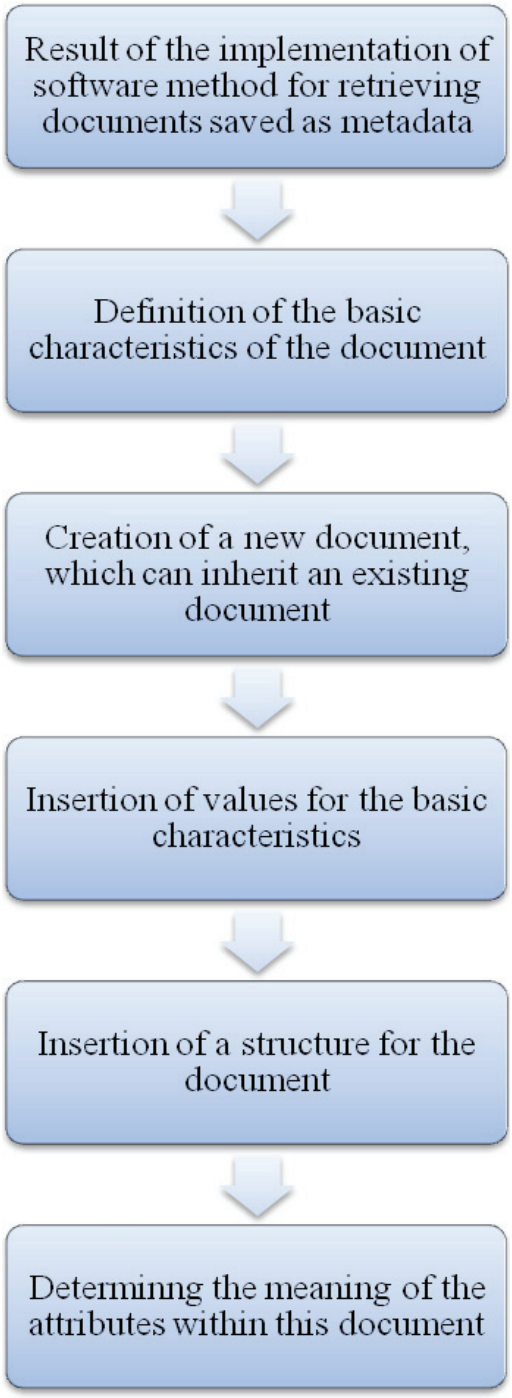

Fig. 5. Mode of operation of the software method for defining documents

the result of the implementation of the latest software method within the software methodology (software method for retrieving documents saved as metadata);

2. We define the list of the so-called basic characteristics that will be used to describe the documents to be defined;
3. We create a definition of the document with a choice of the already defined document to be inherited;
4. We insert the desired values of basic characteristics that describe the document;
5. We insert a document structure;
6. We determine the meaning of the attributes, which represent this structure within the document.

The result of the implementation of the software method for defining documents represents a model of definition of document that includes basic features and a list of attributes (new and/or inherited).

4. Software method for presenting documents as metadata

The second method within the set of software methods that build the software methodology for dynamising database structure in municipalities is a **software method for presenting documents as metadata**. Under the term "metadata" within the formulation of the method as a software method for presenting documents as metadata, we understand the description of the details of the documents in the form of data with a higher level of abstraction. By "higher level of abstraction" we describe the possible use of the metadata stored in different ways (database, index, file structures) through a unified approach for saving, storing and retrieving data. In this sense, the second method within the software methodology provides a unified scheme for presenting the attributes and values of the defined documents as metadata with the necessary level of abstraction, as shown in figure 6:

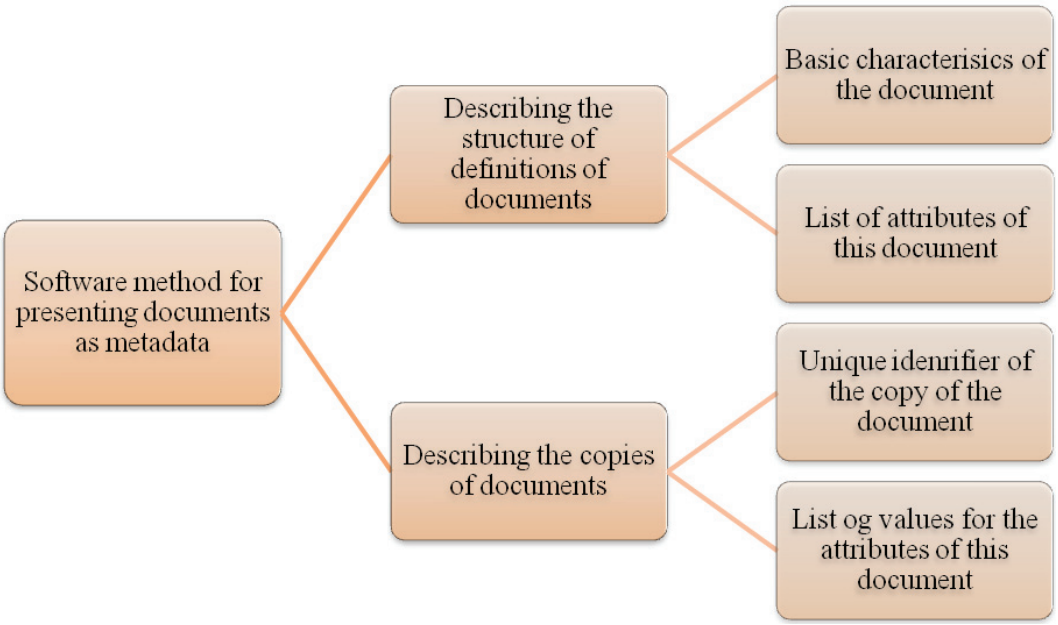

Fig. 6. Software method for presenting documents as metadata

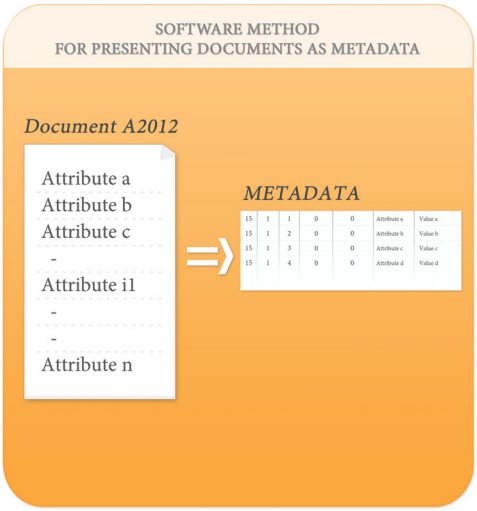

Fig. 7. Graphic description of software method for presenting documents as metadata

1. Describing the structure of definitions of documents in the form of metadata that includes the document's basic characteristics and a list of its attributes;
2. Describing the copies of the documents in the form of metadata that includes a unique identifier of the document's copy and a list of values for its attributes.

The software method for presenting documents as metadata aims to establish a universal scheme for describing documents with different structures, where on the one hand we describe the definitions of documents, and on the other - their copies of the principle attribute – value.

The graphic description of the method for presenting documents as metadata is shown in figure 7.

The mode of operation of the software method for presenting documents as metadata can be described in the following steps and features (fig. 8):

1. For presenting documents as metadata we use the result of the implementation of the first software method within the software methodology, namely the result of the implementation of the software method for defining documents;
2. Documents defined and their copies are described using the appropriate data model within the software method for presenting the document as metadata;
3. We use a model of presenting documents as metadata where describing relations between different documents is possible;

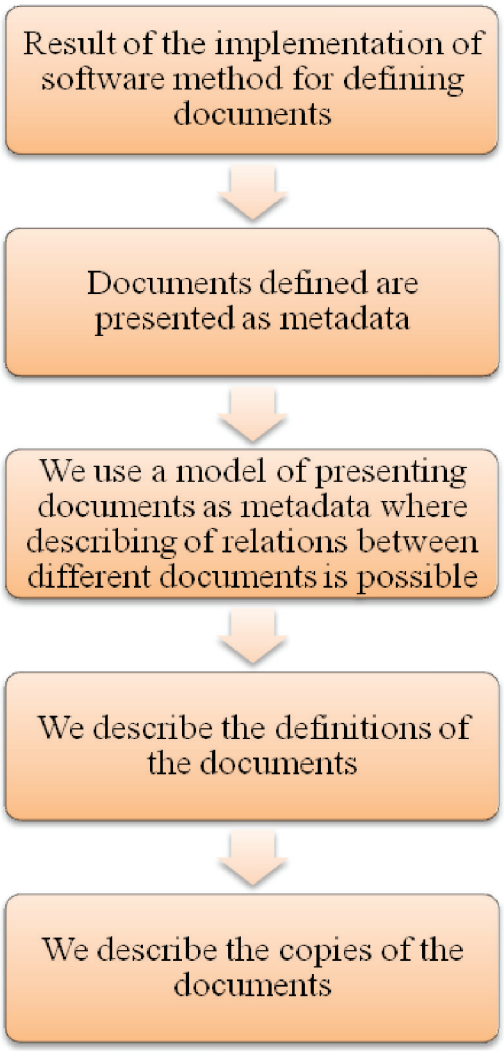

Fig. 8. Mode of operation of the software method for presenting documents as metadata

4. We describe the definitions of the documents;
5. We describe the copies of the documents.

The result of the implementation of the software method for defining documents represents a model of presentation of documents in the form of metadata, which includes the definitions of documents and their copies.

5. Software method for saving documents presented as metadata

The third method within the set of software methods that comprise the software methodology for dynamising database structure in municipalities is a **software method for saving documents presented as metadata**. This method provides an opportunity for saving documents as metadata, as shown in figure 9:

1. Metadata that represent definitions of documents, includes the ability for saving in the form of SQL scripts, index data and data array;
2. Metadata that represent copies of the documents, this includes the ability for saving in the form of SQL scripts, index data and data array.

The software method for saving documents presented as metadata aims to convert the metadata by the described definitions of

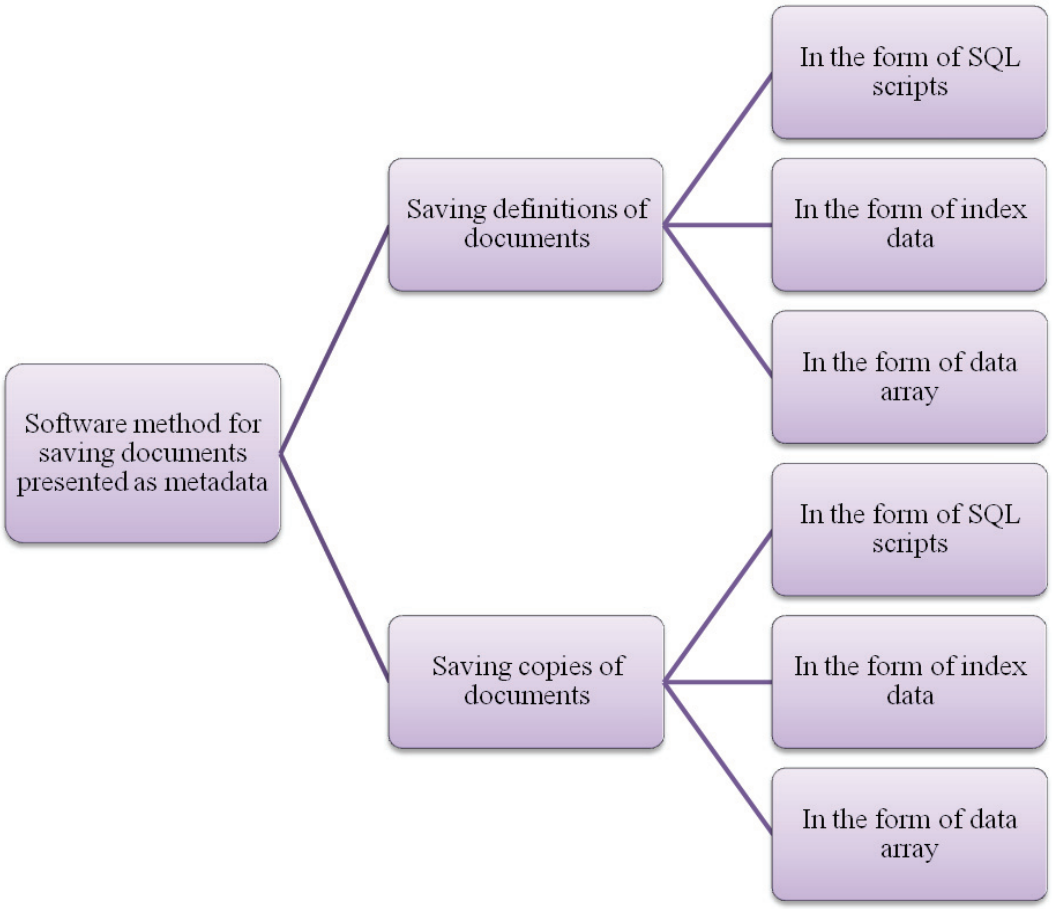

Fig. 9. Software method for saving documents presented as metadata

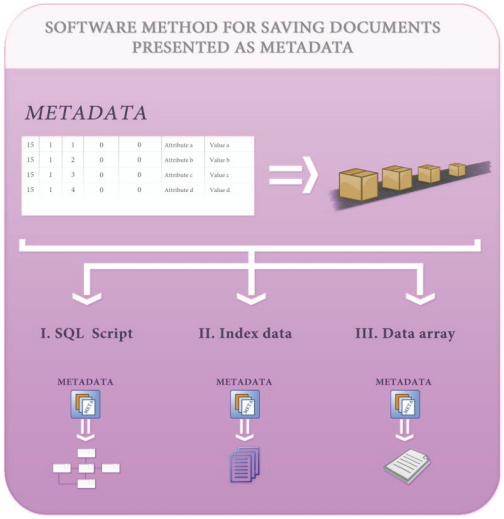

Fig. 10. Graphic description of software method for saving documents presented as metadata

documents and their copies into an appropriate form for saving the metadata in some way.

The graphic description of the software method for saving documents presented as metadata is shown in figure 10.

The mode of operation of the software method for saving documents presented as metadata can be described in the following steps and features (fig. 11):

1. For saving documents presented as metadata we use the result of the implementation of the second software method within the software methodology, namely the result of the implementation of the software method for presenting documents as metadata;
2. We convert the metadata content with the described definitions of documents and their copies into an appropriate form for saving the metadata in the form of SQL script, index data or data array;
3. We create a SQL script for saving the metadata into relational database;
4. We create index data for saving the metadata into index;

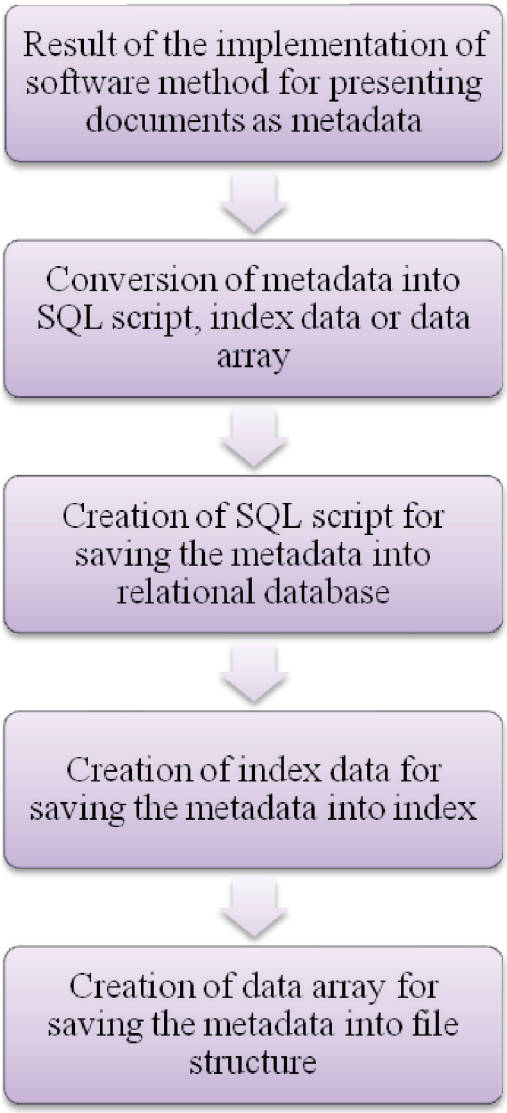

Fig. 11. Mode of operation of the software method for saving documents presented as metadata

5. We create data array for saving the metadata into file structure.

The result of the implementation of the software method for saving documents presented as metadata represents SQL script, index data or data array, which include the content of the metadata.

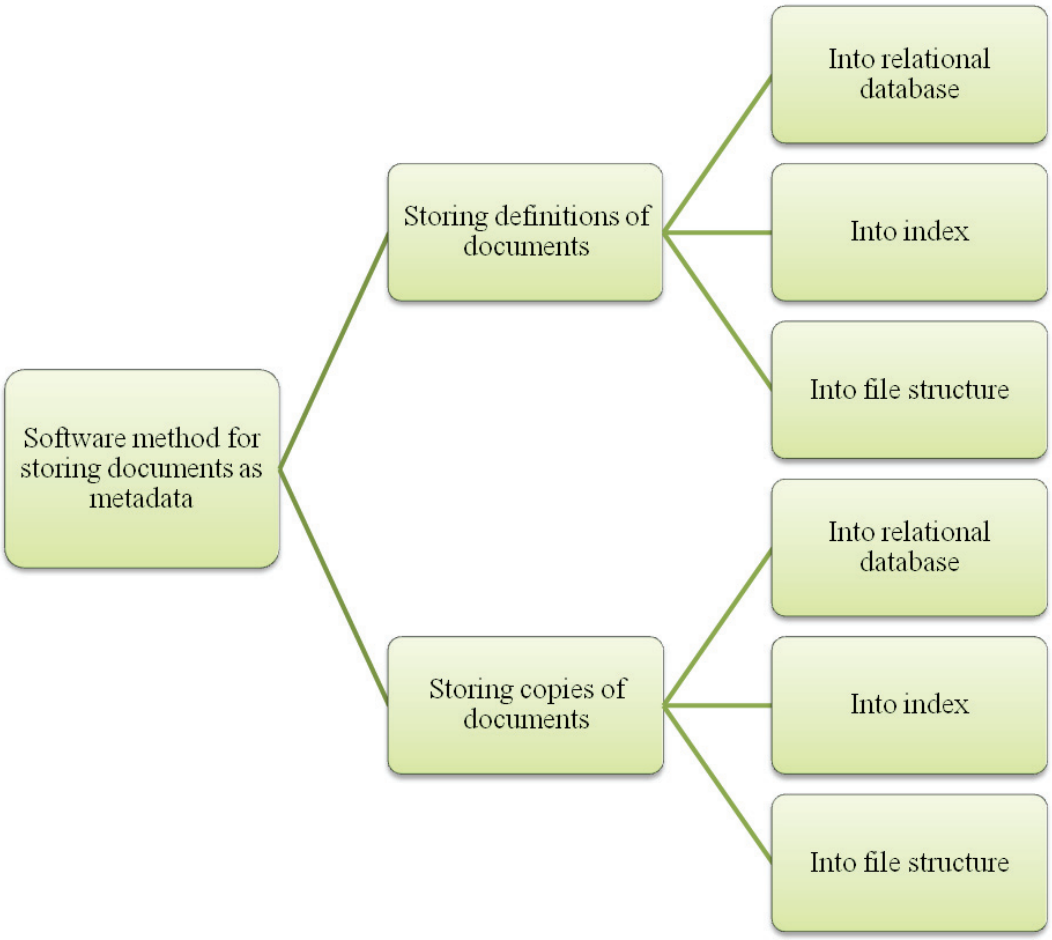

Fig. 12. Software method for storing documents as metadata

6. Software method for storing documents as metadata

The fourth method within the set of software methods that build the software methodology for dynamising database structure in municipalities, is a **software method for storing documents as metadata.** This method provides the option for storing metadata, namely (fig. 12):

1. Metadata that represent definitions of documents, which includes the ability for storing in a relational database, index and file structure;
2. Metadata that represent copies of documents, including the ability for storing in a relational database, index and file structure.

Software method for storing documents as metadata aims to maintain the stored definitions of documents and their copies in the appropriate manner for subsequent retrieval.

The graphic description of the software method for storing documents as metadata is shown in figure 13.

The mode of operation of the software method for storing documents as metadata

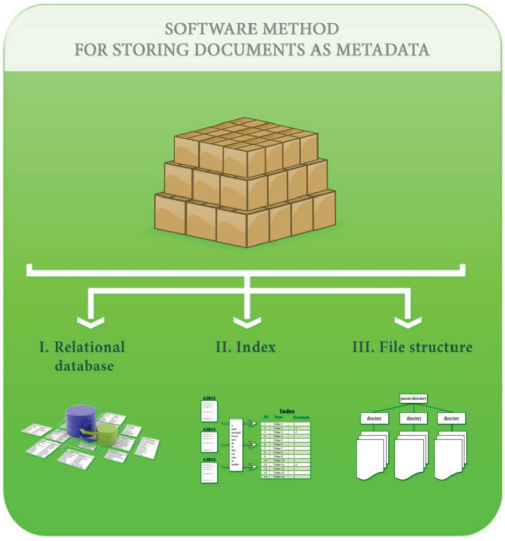

Fig. 13. Graphic description of software method for storing documents as metadata

can be described in the following steps and features (fig. 14):

1. For storing documents as metadata we use the result of the implementation of the third software method within the software methodology, namely the result of the implementation of the software method for saving documents presented as metadata;
2. Saved metadata in the form of SQL scripts, index data or data array is going to be stored respectively into tables in a relational database, index or file structure;
3. Storing SQL scripts into relational database;

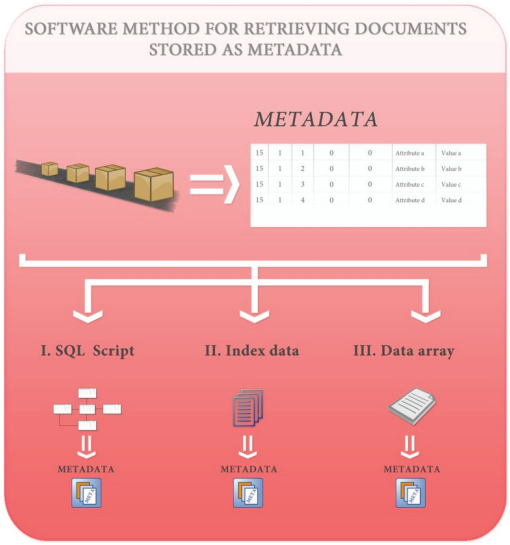

Fig. 16 Graphic description of software method for retrieving documents stored as metadata

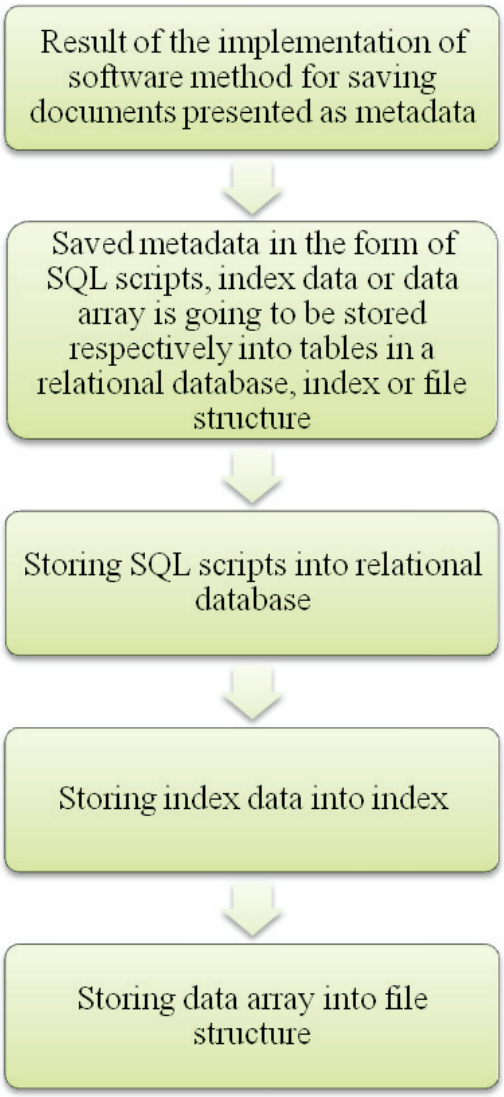

Fig. 14. Mode of operation of the software method for storing documents as metadata

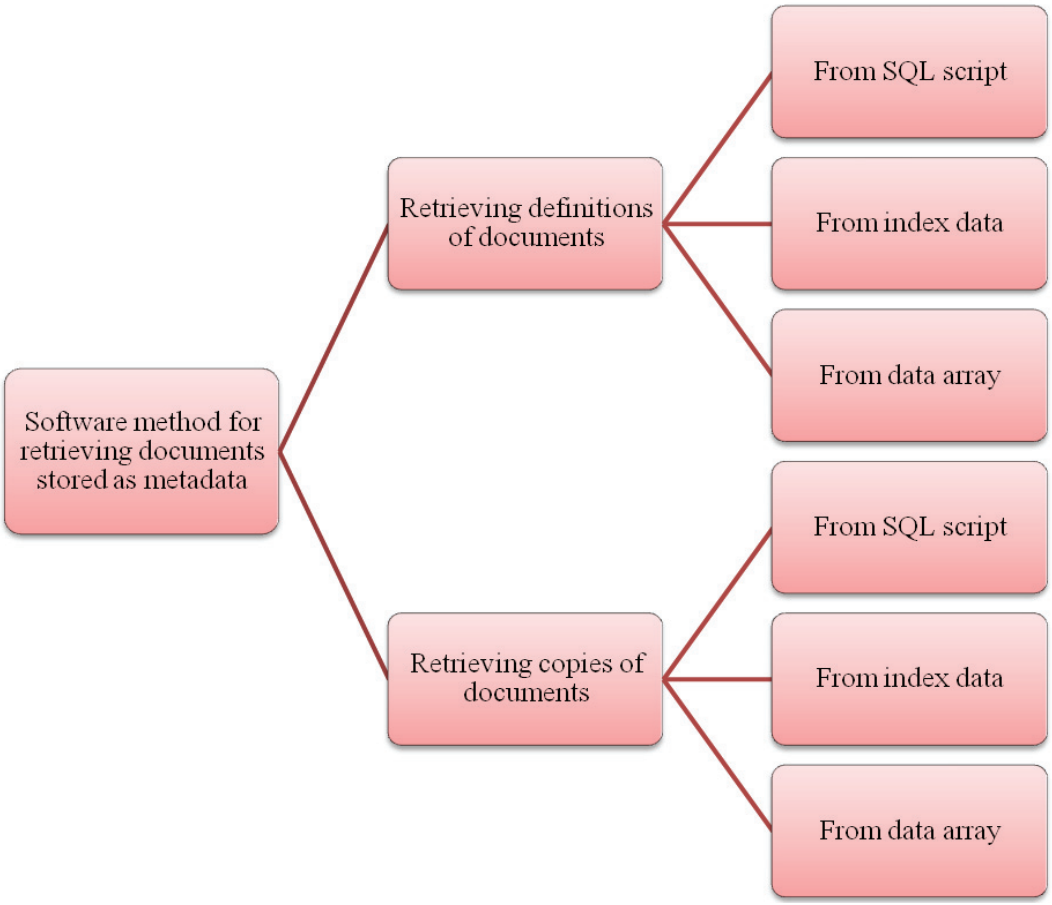

Fig. 15. Software method for retrieving documents stored as metadata

4. Storing index data into index;
5. Storing data array into file structure.

The result of the implementation of the software method for storing documents as metadata represents metadata stored in the form of tables in a relational database, indexed data in an index or data array in a file structure.

7. Software method for retrieving documents stored as metadata

The last method within the set of software methods that build the software methodology for dynamising database structure in municipalities is a **software method for retrieving documents stored as metadata.** This method provides an opportunity to extract metadata, namely (fig. 15):

1. Metadata, which represent definitions of documents, this includes the ability for retrieving metadata from SQL script, index and data array;
2. Metadata, which represent copies of the documents, this includes the ability for retrieving metadata from SQL script, index and data array.

Software method for retrieving documents stored as metadata aims to convert the responding SQL scripts, index data and data arrays, which represent definitions of documents and their copies, into the metadata

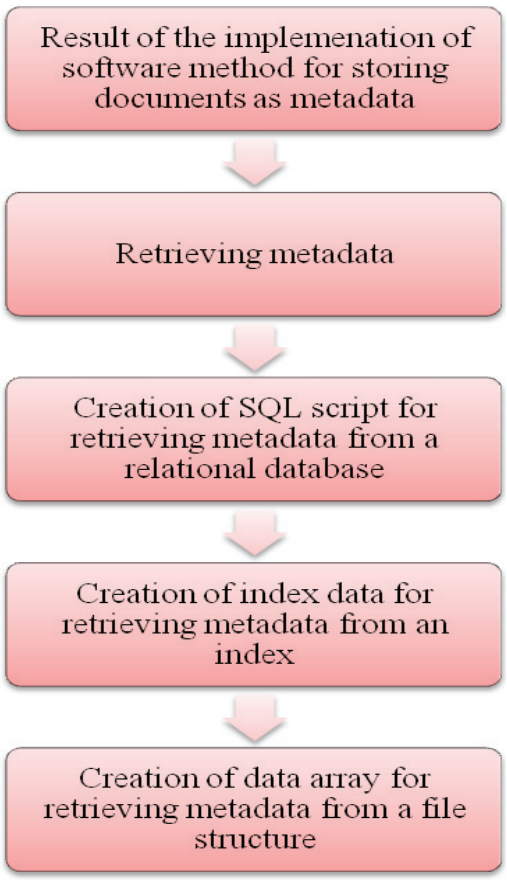

Fig. 17. Mode of operation of the software method for retrieving documents stored as metadata

model used by the second method within the software methodology.

The graphic description of the software method for retrieving documents stored as metadata is shown in figure16.

The mode of operation of the software method for retrieving documents stored as metadata can be described in the following steps and features (fig. 17):

1. For retrieving documents stored as metadata we use the result of the implementation of the fourth software method within the software methodology, namely the result of the implementation of the software method for storing documents as metadata;
2. Metadata is retrieved from SQL script, index data or data array, according to the specific data store used – respectively relational database, index or file structure;
3. We create SQL script for retrieving metadata from a relational database;
4. We create index data for retrieving metadata from an index;
5. We create data array for retrieving metadata from a file structure.

The result of the implementation of the software method for retrieving documents stored as metadata represents a model of presentation of documents in the form of metadata, which includes a description of definitions of documents and their copies, extracted from relevant metadata repository – a relational database, an index or a file structure.

8. Conclusions

The use of software methodology for dynamising database structure in municipalities can solve one of the major problems that the municipalities face in their work with legal documents, namely the problem of different documents in structural terms. It will thus be possible for both citizens and businesses to make queries for old and current periods using only one software solution. This solution is supposed to be using the implementation of the software methodology for dynamising database structure in municipalities in the form of a library of classes that implement the methods within the software methodology.

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