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## Model for interoperability evaluation in e-government services

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The recent publication of the European and Spanish interoperability frameworks implies that public organizations should start a change management process in order to adapt their technologies and procedures to the new standard as a way to guarantee information interoperability across e-government services. The main justification for this research is to disseminate the interoperability standards among Spanish public organizations and to provide methodological and technical guidelines to facilitate the adaptation process, and to foster the usage of new techniques and procedures for information integration and management. The aim of the research consists of identifying the essential aspects to take into consideration to guarantee the information and knowledge interoperability in e-government services. In this context good practices in information interoperability are taken into account and three basic approaches are identified: (1) Information and knowledge management: mark-up languages, open software and formats, and electronic document processing; (2) Metadata for knowledge representation in electronic resources; and (3) Web accessibility to improve access for all.

**Keywords** interoperability; e-government services; information management; knowledge management; metadata; accessibility

### 1. Introduction

Information interoperability is the capacity of different information systems, applications and services to communicate, share and interchange data, information and knowledge in an effective and precise way, as well as to integrate with other systems, applications and services in order to deliver new electronic products and services.

This research is based on the pillars of the recently adopted European Interoperability Framework (2005) [1] and its Spanish equivalent (2004) [2], and it is oriented to configurate an evaluation method of key factors related to information and knowledge interoperability. Having into account the good practices in the field of information interoperability in public government, a model to evaluate the web resources of public organisations will be developed and the conversion tasks from non-interoperable technologies to interoperable technologies will be defined.

A model to evaluate objective indicators for the formerly mentioned information interoperability related technologies has been developed. The interoperability indicators have been selected by a consultation process in which some relevant Spanish experts have sent their proposals. Then, the indicators have been contrasted and accepted or non-accepted by the rest of the consultation panel.

### 2. Political-Technical framework and Scientific context

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The eEurope2005 Initiative, in its action for e-government proposes that “before the end of 2003, the Commission will publish an interoperability framework to make easier the European e-government services delivery to citizens and business” [3]. The technologies for information and knowledge interoperability were established in the workshop of 18th March, 2003, celebrated in Brussels. In the final report of the workshop, the future research topics in this field are identified as: semantic web, web services, metadata and knowledge management techniques. The most relevant document in this field is the working paper published by the European Commission on June 3<sup>rd</sup>, 2003, called *Linking up Europe: the importance of interoperability for eGovernment services* [4]. The knowledge basis in the field of information interoperability in e-government services has been mainly developed in the last two years, in the framework of the eEurope 2005 Initiative and the recently started i2010 Programme [5].

In the Spanish interoperability framework the following technical aspects for information interoperability are identified: data presentation and interchange, metadata, web accessibility, open software and open formats. In the Spanish level, it is worthy to enhance the activity of The Public Administration Ministry that has elaborated “The standardization criteria for public electronic services”<sup>[6]</sup> in order to develop good practices in this field. In the former document, “Linking up Europe”, (in its annex II, containing the activities related to interoperability carried out by Member States) a reference to the Spanish document “The standardization criteria for public electronic services” is included, and it is considered as the Spanish interoperability framework.

Nowadays, most of the Member States and the candidate countries have developed or are planning a national interoperability framework [7]. Therefore, in the European context there is a need to create technical common interoperability specifications to be used in the different Member States, so that the European Interoperability Framework and the national Interoperability Framework be compatible.

The existing bibliography on interoperability developments in the Member States is very recent and scarce. According to the level of development, two groups of countries can be identified. On the one side, those with an official interoperability framework. On the other, those that are planning an interoperability framework or a set of technical specifications.

The co-ordination of European programmes related to e-government interoperability actions is considered essential and there are several community activities oriented to solve interoperability problems as well as to provide interoperable pan-european services. The above mentioned activities are located under the European programmes IDA, IDABC, IST, eContent and eTen, which include some kind of actions related to interoperability and they have the compromise of co-ordination and complementation [8].

In the context of accessibility there is a gap related to actions to improve accessibility of e-government services[9]. Nevertheless, the new i2010 Programme includes an action dedicated to e-Inclusion with some connections with public information.

### **3. Material and Method**

The method used to carry out the research consists of three main phases: the analysis of information interoperability related technologies, the design of a model to evaluate information interoperability in public web sites, and the empirical analysis of key factors affecting information interoperability.

Firstly, technologies related to information and knowledge management in public web sites are analysed to detect the existing connections with information interoperability. The analysis is carried out through a revision of law, standards and guidelines included in different interoperability frameworks. The analysis results in the identification of some relevant information interoperability related technologies, namely: mark-up languages, open software and open formats, electronic records and documents management, web accessibility guidelines, classification systems, metadata, and information retrieval systems. Secondly, a model to evaluate objective indicators for the formerly mentioned information interoperability related technologies has been developed. The interoperability indicators have been selected by a consultation process in which some relevant Spanish experts have sent their proposals. Then, the indicators have been contrasted and accepted or non-accepted by the rest of the consultation panel. Thirdly, the

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selected interoperability indicators are analysed in a representative sample of a web site resources. Finally the results are processed, and a report with the main detected errors and some conversion proposals or good practices is generated .

#### 4. Evaluation proposal

As such in the introduction present, the model to evaluate information interoperability in public web sites contents three main phases [10]:

- a. Information and knowledge management: mark-up languages, open software and formats, and electronic document processing.
- b. Metadata for knowledge representation in electronic resources.
- c. Web accessibility to improve access for all.

In order to evaluate **mark-up languages**, there are some relevant indicators most of them included in the W3C Technical Reports and that can be summarized in the following ones [11]:

- The existence of a doctype declaration at the beginning of an HTML document, that is generally expressed as follows: `<!doctype HTML public "-//W3C//DTD HTML 4.0//EN" "http://www.w3.org/TR/REC-html40/strict.dtd">`.
- The usage of the most recent version of mark-up language (HTML, XML o XHTML) so they only include valid elements and ommit deprecated ones. For example, the last version for HTML is 4.01 and for XHTML is 1.1.
- Closely linked to the former indicator is the usage of deprecated elements, that are supported by most browsers, therefore the quality and interoperability of a website is enhanced when only valid elements are used. A list of deprecated elements can be found in `<http://www.w3.org/TR/html4/index/elements.html>`.
- Another evaluation indicator for the mark-up languages section can be identified as the correct usage of CSS, separating structure (in HTML) and presentation (in CSS).

The evaluation of **open software and open formats** can be difficult. Some objective indicators that are included in the model are [12]:

- The usage of open software for database connection, for example php, (but not asp which is a proprietary method).
- The publication of non HTML documents in open formats, such as: OpenOffice.org (OOo) or OpenDocument Format, (ODF).
- The conversion to standarized and widely accepted formats, taking into account the guidelines included in the interoperability framework that applies in our field of work or organizational level.

For the correct management and publication of **electronic records and documents** the following evaluation indicators are considered relevant [13] [14]:

- Text format documents should be in any of the following extensions, considered interoperable in the Spanish interoperability framework: txt, rtf, sxw, odf, o pdf.
- Graphic documents should be published in any fo the following formats: jpeg, tiff, png o fax.
- Vectorial formats should be CGM or VML.
- Multimedia formats could be exported to SMIL.

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For **classification and navigation systems**, some relevant indicators included in the model are [15]:

- The website contains a structured web map.
- The website includes one or several navigation bars and they are consistent across the website.
- The navigation bars have been codified using OL or UL elements and CSS.
- The classification systems used are correct and they do not mix different classification methods.

**Metadata** are a way to represent knowledge in web resources [16] and some examples of objective indicators of metadata application in the context of the proposed interoperability evaluation model are:

- The metadata are included in the head of a HTML document and they are grammatically correct.
- The metadata set contains a representative title of the web resource.
- The main metadata elements for semantic information are included, namely: title, keywords and description [17].
- The main metadata element for resource discovery are included.

The information retrieval system of a website is oriented to make easier the localization of information that potential users will seek and it is a complementary device that reinforces the contextual aids provided by the navigation systems of the website [18]. Some relevant evaluation criteria for a information retrieval system in the context of an e-government website are:

- The existence of an internal search engine accessible from all pages which indexes all internal resource of the website.
- The search engine interface should include different search options, for example: simple and advanced search, search refinement, etc.
- The search engine should have a series of help documents, FAQs or other tools to assist the user in the search process.

In order to evaluate the accessibility of web resources, the principles and recommendations included in the Web Content Accessibility Guidelines 1.0 (WCAG) have been taken into consideration. The WCAG are structured in 14 main guidelines and 3 priorities of importance. Moreover, there is a list of checkpoints classified by priority. Each checkpoint has been considered as one or several evaluation indicators for our interoperability evaluation method [19].

## 5. Conclusion

As the European and Spanish interoperability frameworks have been recently approved, this research has a competitive advantage, as it will develop the first tool available in the market to evaluate information interoperability in e-government services and to elaborate an action plan for conversion, modifications and migrations.

This research can potentially benefit to all public government organizations of different administrative level (national, regional, local, etc.). Moreover, it offers added value as it includes a set of guidelines related to specific conditions of web contents for disabled users. The research implies an important advance in the field of information interoperability of e-government services, and it will benefit to different level public organizations and departments, as they can use a model and a tutorial as a useful tool to plan or evaluate the interoperability of a web service or product.

The main results are a model to evaluate information interoperability according to the guidelines included in the European and Spanish interoperability frameworks, and a tutorial for public managers that will help them to acquire a knowledge base on interoperability technologies. Therefore, this new knowl-

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edge base will improve the adaptation of e-government services and products to the new technological requirements, new standards and new formats [20].

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