Collaborative Solution Architecture for Developing a National Interoperability Framework in Romania

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Interoperability framework is a set of standards and guidelines that describe how organizations have established or will establish to interact. The framework is not static, but one that adapts to the change of standards, administrative requirements and technology. It can be adapted to the socio - economic, political, cultural, linguistic, historical and geographical purposes and to a specific context or situation. The article aims to clarify the essential concepts necessary for outlining Romanian national interoperability framework and to propose collaborative solution architecture for its development, updating and maintaining.
Keywords: *Interoperability Framework, National Interoperability Framework, European Interoperability Strategy, Collaborative Solution Architecture*

1 Introduction

The issues that had a strong influence on interoperability frameworks relate [1]: the *promotion of ITC, including paradigm change* that radically influenced mode of interaction between the administration, business and citizens; *European integration* stressed the need of providing cross-border e-government services , *globalization* has led to the creation of integrated and competitive environment for European business and labor, as well as to an increasing economic pressure due to changes in EU government policies (the Lisbon Agenda, etc.); public administration is under *political pressure to simplify and make streamline activities more efficient, to modernize infrastructure and integrate activities to provide better services, faster and cheaper for citizens and businesses*.

All this led to a growing importance of interoperability [4] [5] [7] [8] [10] [11] in all respects and the emergence of a European strategy in this area.

European interoperability strategy will establish the basic elements for defining the organizational, financial and operational framework necessary for supporting cross-border and sectors interoperability, but also for information exchange between European public administrations.

The objective of the strategy is to define and agree a set of actions at European level to identify effective and efficient means of providing cross border services for citizens and businesses, but also for improving cooperation between European governments to implement EU legislation. The strategy [9] [12] [16] will include a long-term planning for the prioritization and coordination of actions, but also the necessary finances. European interoperability strategy needs the support of active policy makers in transforming government at national or at EU level.

2 National Interoperability Framework in Romania vs. European Interoperability Framework

European Interoperability Framework is [2], on the one hand, a set of recommendations and guidelines for e-government services so that government, businesses and citizens can interact across borders, in the pan-European context, and one the other hand a comprehensive set of tools for implementation of e-government services across borders. It addresses the informational content, technical issues and proposes specifications that help connect the European government systems.

European Interoperability Framework objectives are:

1. to support the European Union's strategy to provide electronic services focused on user services and systems by promoting

interoperability of government and between government and citizens or companies across frontiers;
2. to supplement national interoperability frameworks in areas with a weak national approach;
3. to support in order to achieve interoperability between different policy areas, especially in the context of the IDABC Programme, other relevant community programmes and initiative.

European institutions and public administration should use the European Interoperability Framework for interactions with citizens and businesses in member states. Member state administrations and EU institutions should use the guidance provided by the European framework to introduce cross-border dimension in their interoperability frameworks.

The actors involved in the development and maintenance of the European Interoperability Framework are: the Member States, the interested parties (stakeholders) and the management of the IDABC unit. Political momentum is achieved through the eEurope initiative[6] and the IDABC Programme. The tools supplied to European institutions and Member States administrations are semantic interoperability rules, rules on cross-border services and infrastructure architectures.

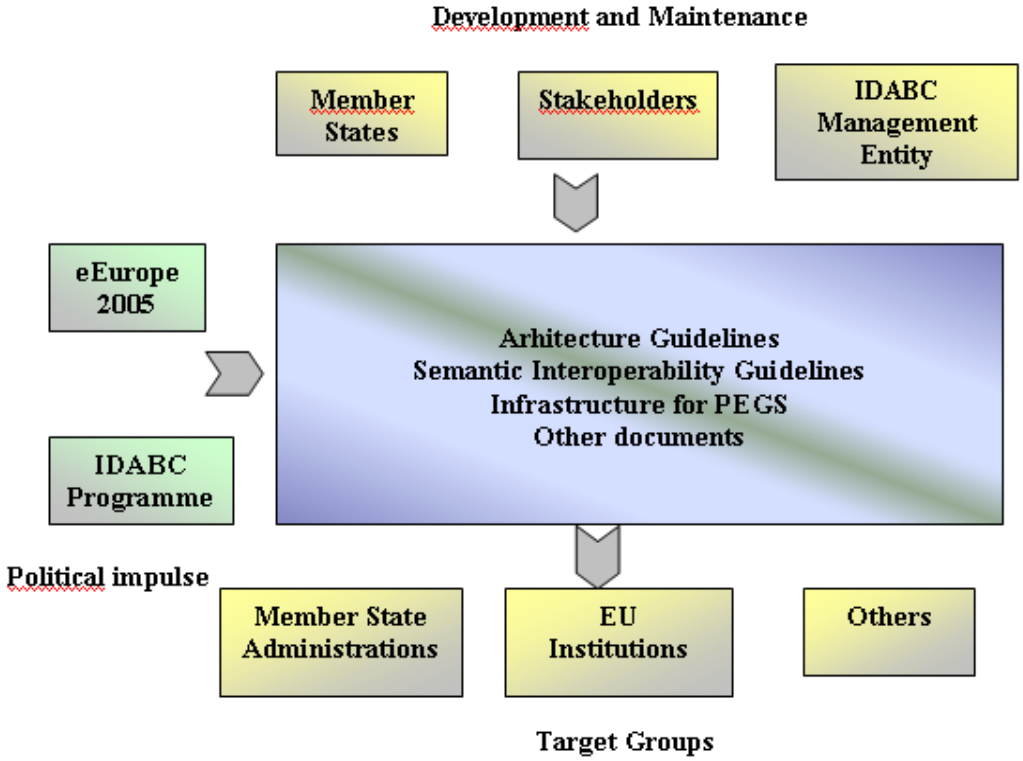

Fig. 1. Context and actors of the European Interoperability Framework, version 1.0.

European Interoperability Framework proposes a number of steps to achieve cross-border services (Figure 2).

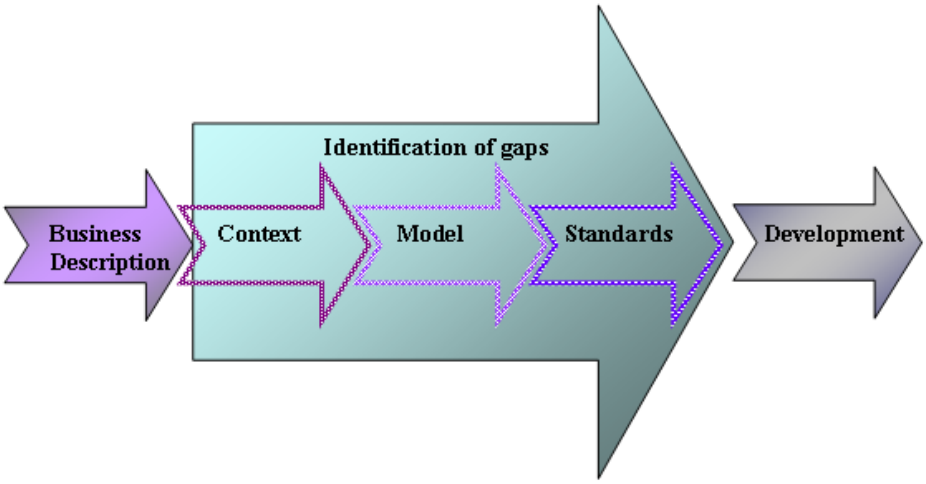

Fig. 2. Steps needed to achieve cross-border services proposed in the draft of European Interoperability Framework, version 2.0.

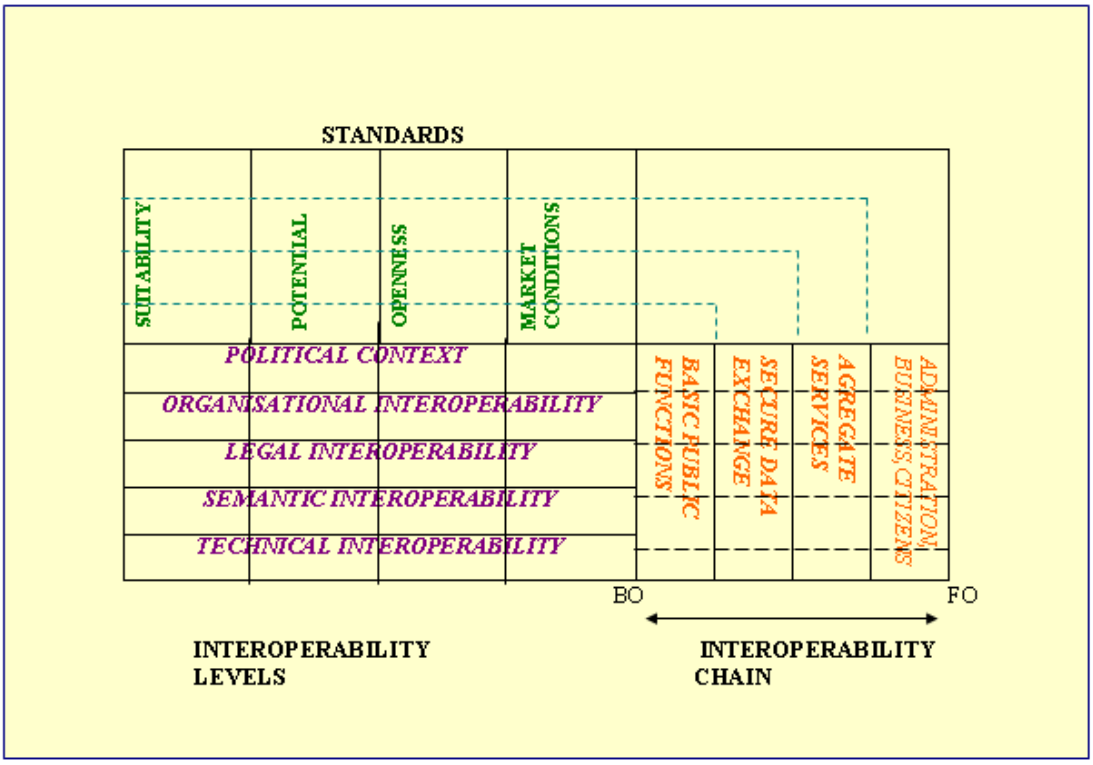

Fig. 3. Interoperability dimensions proposed in the working draft of European Interoperability Framework, version 2.0

According to the study [1], three dimensions should be considered to deal with all aspects necessary to achieve interoperability in cross-border context (Figure 3):

1. The first dimension is represented by the *levels of interoperability* that are classified according to who or what is involved.
2. The second dimension is the *interoperability chain* that handles the phenomenon as something built gradually over time through the construction and assembling "building blocks". The interoperability chain contains the elements of infrastructure (such as Internet, sTESTA network),

to basic services (such as IDM and eDOC) to collaborative structures.

3. The third dimension is the *interoperability standards* and specifications governing decisions of how interoperability is implemented. Evaluation and selection standards facilitate information sharing and integration.

Political context. Political support for achieving interoperability is an absolute necessity. For cooperation to be effective action in terms of common objectives, it is necessary that the partners have common vision, concentrated efforts and resources in the same direction, using the same timeframe and synchronize amendments to the established agreement.

In the European context, political support for interoperability can be reflected through specific policy instruments such as European directives, ministerial declarations and pan-European programs. These instruments expressed vision and priorities of political European decision. The level of funding, budget issues, measures and deadlines imposed can provide more details about political priorities and to understand the political context.

A major challenge in the context of political change is the management of EU cross-border services. More specifically, the challenges are: to avoid and / or prevention of diverging views on interoperability and insufficient support in the Member States. The best way to ensure continuous support is ongoing activities through the various coordination and consultation bodies, especially any permanent structures that deal specifically with interoperability issues.

Legal Interoperability. Legal interoperability requires Member States to cooperate so that the electronic data of any Member State are consistent with legal and recognized everywhere should be used in any other Member State.

Legal interoperability is required for: mutual recognition of electronic data from other EU Member States and mutual assistance processes integration and border processes through authorized institutions in Member States.

Solving legal problems or electronic data protection is achieved through the implementation of pilot schemes in several Member States, after which their example is followed by other countries. Through these pilot schemes we reduce barriers to market entry, removing conflict resolution and other issues that may arise in respect of 27 sets of constraints.

Data protection in pan-European context is one of the key legal issues. The question that arises here is whether there is sufficient support to cover legal and operational entities and mechanisms responsible for data protection. The answer to question may be provided by a data protection strategy, which should include elements such as establishing one or more data protection authorities and planning for the establishment of collaborative structures and mechanisms associated.

Commission and Member States should assess the impact of ICT on legislative proposals, and interoperability should be included as a standard criterion for procurement process, preferring to choose open standards and specifications.

Organizational interoperability allows defining business goals, modeling business processes and collaboration administrations wishing to exchange information and internal structures and different business processes. Organizational interoperability addressing the needs of users through the implementation of basic electronic services, making them easily identifiable and user-centered. For a better relation between the government and citizens or companies, Member States use the important events in the lives of citizens (birth, marriage, death, etc..) and business events (setting up a company, liquidation, etc.). In this way citizens and businesses remain focused on their needs and should not focus their efforts on understanding the functional organization of specific public sector.

Each of the life events and business milestones are associated with the relevant actions and interactions with and among public institutions. Electronic services can involve one or more business processes to be performed

in a time sequence between different administrations.

Pan European services should be determined jointly by the participating administrations via a demand-driven approach, but responsibility must be decentralized. Decentralized responsibility involves the ability of each partner to organize business processes in a manner best suited to its national practices. It is unrealistic to believe that the administrations of different Member States will be able to harmonize their business processes due to cross-border requirements. Stages and internal processes of a Member State may remain unchanged provided that "entry points" and "exit" from these processes are made transparent and interoperable to other Member States concerned.

Reengineering business processes is an interim solution for achieving interoperability of services necessary to provide organizational borders. In order to accomplish pan European is necessary a effort to review the business processes for common understanding of the processes involved, identifying common elements and process decomposition into processes that enable pan-European interconnection.

Establish service level agreements allow the formalization of specific aspects of mutual assistance, joint activities, business processes "coupled" in order to provide cross border services. One means is the Memorandum of Understanding between government sites/portals, detailing bilateral agreements on joint actions and cooperation. We consider the establishment of service level agreements as a cross-border activity standards.

Common Assessment Framework evaluations should be made at the sectoral level, to identify the real weaknesses of business processes. Identify weaknesses improves and align business processes.

Member States must establish a change management strategy at national level and to integrate action plans for achieving cross-border services to make change management.

Member States shall strengthen cooperation through:

- cross-border exchange of information on business processes;
- pan-European consultations on taxonomy of business processes and its components;
- cross-border coordination of change management activities;
- functional and cross sectoral coordination;
- cross-border coordination of change management activities;
- assessment of cross sectoral deficiencies that would affect the functions of electronic services;
- border consultation on mechanisms and architecture for business process orchestration.

Semantic interoperability enables to understand the data exchanged by any other application and lets the system combines information and resources to process them in a meaningful manner. In practice this will involve establishing common sets of data structures, data and protocols. For the data exchanged to be interoperable, we need government:

- to publish information on national data involved;
- to agree on data and data dictionaries required at pan-European level;
- to agree on multilateral mailing lists of various border and national data.

Essential requirement for exchange of information is the existence of a single language that allows describing the basic meaning and structure of data involved. Developing an XML-based common semantics to be done in a coordinated and should be given to cooperation with existing standards bodies. European definitions and diagrams should be made available to interested parties (stakeholders) through a common infrastructure. Portal Semic.eu aims to establish bases of semantic interoperability necessary for cross-border services in all sectors and at all levels, both conceptually and as implementation.

European Commission and Member States should identify and support community development sector whose role is to facilitate semantic interoperability. Sector communities are entities that are closest to the reference model, the services they use or provide, and problems faced. Knowledge and exper-

tise of the community sector should focus on standardization efforts.

National interoperability frameworks should take into account the pan-European nature of semantic interoperability when developing data dictionaries.

Technical interoperability includes key issues to connect systems and services, open interfaces, data networking, exchange and presentation of data, accessibility and safety services. Technical interoperability should be applied at front-office and back office system level.

Issues to be considered front-office level to achieve technical interoperability are:

- exchange and presentation of data;
- accessibility - interface design principles;
- multichannel access; character sets;
- file types and format documents;
- compression for files.

Issues to be considered back-office level to achieve technical interoperability with business applications from back-office are:

- data integration;
- XML-based standards;
- EDI-based standards;
- Web services;
- distributed application architecture;
- interconnection services;
- protocols for transferring messages and files;
- Message transport and security;
- Message storage services;
- access to the box;
- type directory services and domain name;
- network services.

European Interoperability Framework and the National Interoperability Framework complement each other. The EU refers to cross-border services, and national level refers to electronic services offered both nationally and across-borders.

EU and Member State governments must have a clear and precise picture of the technologies, technical expertise and capacity of their staff and documentation of business processes ([11], [13], [15]). The administration should also undertake the audit, compliance and benchmarking to identify closed systems and other technical barriers to achieving interoperability.

Analyzing the information provided by the national interoperability frameworks observatory [3], I made a list of mature interoperability frameworks that include the following countries: Bulgaria, Denmark, Estonia, Germany, Greece, Hungary, Italy, Poland, United Kingdom and Switzerland. From this list, making a web analysis we removed the frameworks that do not have the content in English, French and at least the second version of the framework. The new list includes Bulgaria, Estonia, Germany and United Kingdom. National interoperability frameworks of Bulgaria and Estonia offer general directions of development and their implementation, without a presentation in detail, while Germany and United Kingdom made a detailed presentation of the general directions of development and implementation, proposing solutions that can be integrated in other national interoperability frameworks. I believe that in creating national interoperability framework of Romania, collaboration with Germany and United Kingdom could help us in the transfer of know-how and good practices.

After analyzing the European Interoperability Framework, version 2 and the national interoperability frameworks of United Kingdom and Germany, I believe that any national interoperability framework should include at least the following elements (Figure 4)

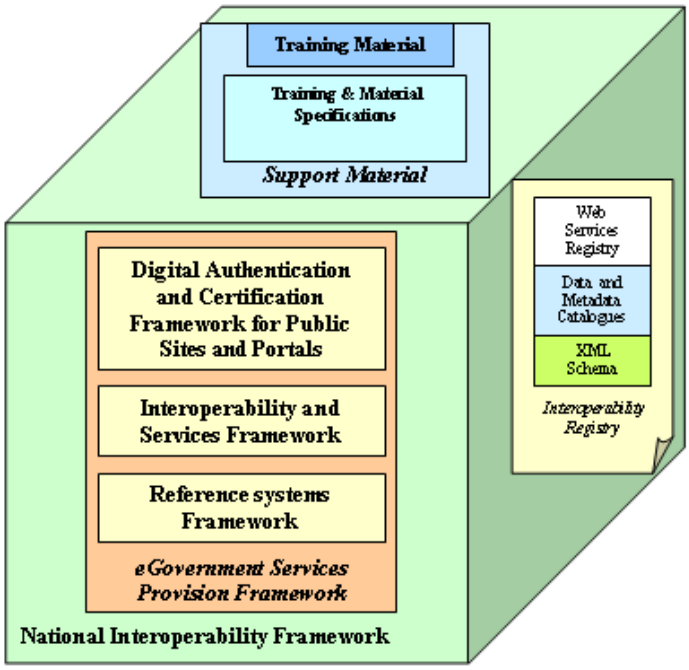

Fig. 4. Minimum elements of any national interoperability framework

I noticed from the analysis of national interoperability frameworks that any collaborative architecture needs: a national knowledge base on interoperability, a good working environment for working groups and a collaborative platform for communities from administration, industry and academia.

A possible architecture of the collaborative solution for the development, updating and maintaining national interoperability framework in Romania is shown in Figure 5:

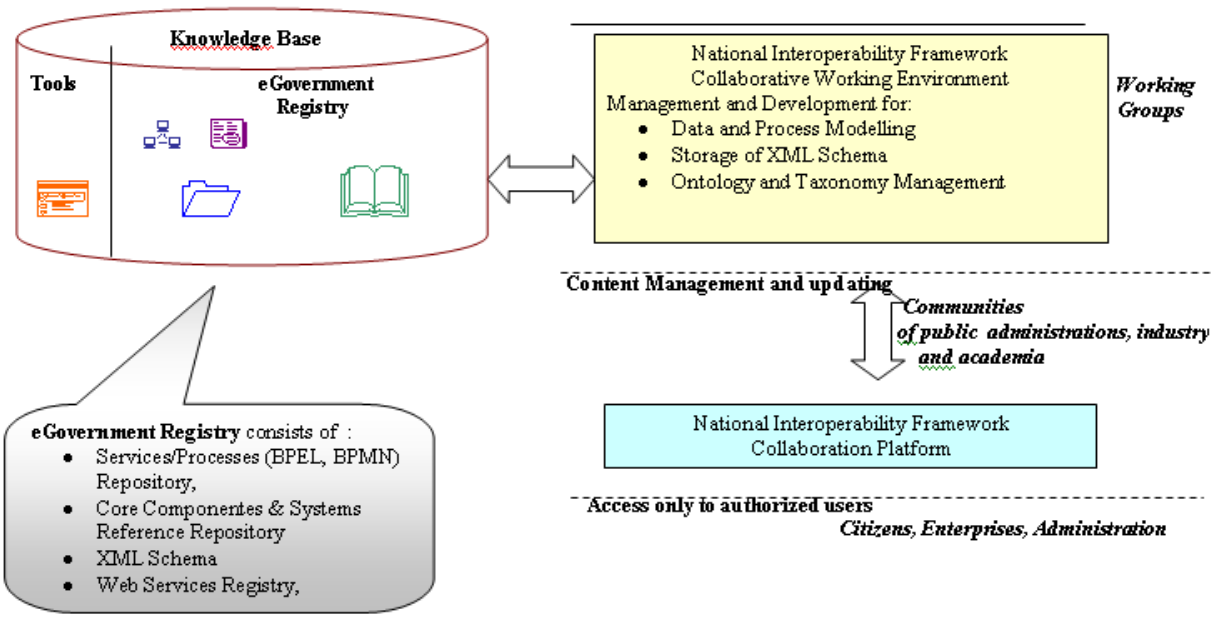

Fig. 5. Collaborative architecture for developing a national interoperability framework in Romania

Knowledge base will need to include a repository that allows the structuring of knowledge, a glossary of eGovernment specific terms, a list of bibliographic references, a list of links. Research carried out has found that e-government experts in the field need a standardized glossary of specific terms. Knowledge base is developed based on demonstrators that use different technologies to solve specific problems, electronic books, research, public administration studies, thesis, dissertations, surveys and products. Each of the elements plays an essential role in developing the knowledge base. The results obtained will improve the e-government registry by identifying and developing eGovernment services, processes, XML schemas, basic components and reference systems. Collaborative platform aims to develop a virtual community that includes representatives of public administration, industry and academia. This community will be divided into working groups that will deal with identifying and building data models, developing XML schemas, defining and improving ontologies and taxonomies.

Facilities of the virtual community allow members to see working group activities, publication of announcements in the community, experts and group can use blogs to communicate, share bookmarks, calendar events, complete experts surveys and groups, experts publications and experts ePortofolio. Management and development tools for data and processes, ontology and taxonomy are integrated into their working environment. e-Government community working environment is provided via VMware virtual appliance [17]. Virtual appliances are prebuilt software solutions, comprising one or more virtual machines and applications, which are packaged, updated, maintained, and managed as a unit. Unlike traditional hardware appliances, software appliances let customers easily acquire and deploy preintegrated solution stacks [17]. Virtual appliances are usually built on a standard operating system (OS) and run as a virtual machine (VM).

The following items summarize the benefits of virtual appliances[17]:

- Accelerate time to market – Customers can quickly download and power on your virtual appliance.
- Reduce distribution overhead – The same virtual appliance runs on most VMware product platforms.
- Increase reliability – VMware Studio builds an optional update repository for automatic patching.
- Enhance security – Appliances are less vulnerable to security breaches than a general purpose OS.
- Lower support costs – Virtual appliances require little configuration and no maintenance.

Acknowledgments

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3 Conclusions

The proposed architecture helps to obtain a clear and precise image on technologies, technical expertise and to identify e-government processes and services, basic components and reusable reference systems. That can be useful for the process of developing intelligent systems for decision support.

References

[1] Echipa IDABC, “Draft for public comments – As Basis for EIF 2.0 – 15/07/2008” July 2008, Available: http://ec.europa.eu/idabc/en/document/7728

[2] Echipa IDABC, “European Interoperability Framework for Pan-European eGovernment Services” November 2004, Available: http://ec.europa.eu/idabc/en/document/3473/5585#finalEIF

[3] Echipa IDABC, “NIFO project” May 2009, Available: http://ec.europa.eu/idabc/en/document/7796

[4] M.I. Stemberger, J. Jaklic, “Towards E-government by business process change - A methodology for public sector,” *International Journal of Information Management*, nr. 27, pg. 221–232.

[5] P. Harmon, *Business process change: A manager's guide to improving, redesigning, and automating processes*, San Francisco, Morgan Kaufmann Publishers, 2003.

[6] Comisia Europeană, „Planul de acțiune eEurope 2005," May 2002, Available: http://ec.europa.eu/information_society/eeurope/2005/all_about/action_plan/index_en.htm

[7] Perri 6, "E-governance: Do digital aids make a difference in policy making? " in *Designing egovernment: On the crossroads of technological innovation and institutional change*, E. J. Prins, Ed., Hague: Kluwer Law International, 2001, pp. 7 – 27.

[8] M. Cook and M. LaVigne, "Making the local e-gov connection," May 2002, Available: http://www.urbanicity.org/FullDoc.asp?ID=36

[9] J. S. Hiller and F. Bélanger, "Privacy strategies for electronic government" in *E-government 2001*, M. A. Abramson şi G. E. Means ,Eds., Lanham : Rowman & Littlefield Publishers, 2001, pag. 162-198.

[10] M.J. Moon, "The evolution of e-government among municipalities: Rhetoric or reality?," *Public Administration Review*, nr. 62(4), July, pg. 424-433.

[11] S. H. Schelin, "E-government: An overview" in *Public information technology: Policy and management issues*, G. D. Garson, Ed., Hershey: Idea Group Publishing, 2003, pg. 120-137.

[12] D. Holmes, *E.gov: E-business strategies for government***,** London: Nicholas Brealey Publishing, 2001

[13] I. J. Martinez-Moyano and J. R. Gil-García, **"**Rules, norms, and individual preferences for action: An institutional framework to understand the dynamics of e-government evolution**"** in *Proceedings of 3rd International Conference on Electronic Government (EGOV 2004) - Electronic Government*, 2004, pg 194 – 199.

[14] N. Benamou, A. Busson and A. Keravel, "Impact of e-government interoperability in local governments**"** in *Proceedings of 3rd International Conference on Electronic Government (EGOV 2004) - Electronic Government*, 2004, pg 82-87.

[15] J. Makolm**,** "Best practice in e-government," in *Proceedings of the 1st International Conference on Electronic Government (EGOV 2002) - Electronic Government*, 2002, pg. 370-374.

[16] J. Millard, "E-government strategies: Best practice reports from the European front line," in *Proceedings of the 1st International Conference on Electronic Government (EGOV 2002) - Electronic Government*, 2002, pg. 298-306.

[17] VMware, "Developer's Guide to Building vApps and Virtual Appliances," Palo Alto: VMware, Inc, 2010.

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