Governance of Interoperability
in Intergovernmental Services
Towards an Empirical Taxonomy

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ABSTRACT

High quality and comfortable online delivery of governmental services often requires the seamless exchange of data between two or more government agencies. Smooth data exchange, in turn, requires interoperability of the databases and workflows in the agencies involved. Interoperability (IOP) is a complex issue covering purely technical aspects such as transmission protocols and data exchange formats, but also content-related semantic aspects such as identifiers and the meaning of codes as well as organizational, contractual or legal issues. Starting from IOP frameworks which provide classifications of what has to be standardized, this paper, based on an ongoing research project, adopts a political and managerial view and tries to clarify the governance of achieving IOP, i.e. where and by whom IOP-standards are developed and established and how they are put into operation. By analyzing 32 cases of successful implementation of IOP in E-Government services within the European Union empirical indicators for different aspects of governance are proposed and applied to develop an empirical taxonomy of different types of IOP governance which can be used for future comparative research regarding success factors, barriers etc.

Keywords: E-Government, E-Services, Centralization, Governance, Integration of Information System, Intergovernmental Cooperation, Intergovernmental Information Systems, Interoperability, Standardization.

1. INTRODUCTION

There is unanimous agreement that high quality and comfortable online delivery of governmental services often requires the seamless exchange of data between two or more government agencies. Smooth data exchange, in turn, requires interoperability of the databases and workflows in the agencies involved. Interoperability (IOP) is a complex issue covering purely technical aspects such as transmission protocols and data exchange formats, but also content-related semantic aspects such as identifiers and the meaning of codes as well as organizational, contractual or legal aspects and raises issues of privacy and cost-sharing among others.

Although everyone agrees that IOP is central and crucial, there is little debate on how to achieve it and how to maintain it within the E-Government context as Scholl and Klischewski (2007) conclude after having reviewed more than 80 research sources addressing IOP in E-Government based in information systems research, computer science, public management or organization science [30]. Most studies are conceptual, empirical research most frequently is based on one or few cases. A large part of the case studies deals with data integration and information sharing, only few with interorganizational transaction systems. There is almost no comparative empirical research trying to explain why certain forms of achieving or maintaining IOP have been chosen or emerged.

The technical literature refers to standards as the appropriate means to provide for IOP. The first step in this respect is to achieve agreement on reference systems or architectural models, which distinguish different classes of functions for which standards are needed.

These IOP frameworks distinguish, for example, between technical, syntactical, semantic and organizational IOP. While there is high agreement, which standards provide for technical and syntactical IOP, where they are negotiated, set and published, this is far less obvious for semantic and organizational IOP. In particular organizational IOP in the technical literature is treated as a residual category where all the non-technical issues are parked.

This paper looks at the different layers of IOP from a political and managerial point of view applying the concept of governance in order to find out how IOP is achieved and maintained for E-Government services. It starts with a review of different IOP frameworks in order to define what has to be made interoperable and then argues that for clarification of governance issues two different aspects should be distinguished: the governance of the negotiation and establishment of standards, rules and institutional arrangements on one side, and the organization and management of the provision and maintenance of interoperation on the other. For both dimensions empirical indicators are proposed and applied to cases of intergovernmental online services within the European Union in order to arrive at an empirically assessed taxonomy, on which future comparative empirical research could build on and investigate, which institutional arrangements

have been chosen for achieving IOP of different services or for similar services in different countries.

The cases which build the empirical basis of this research have been collected in a study on IOP for the European Commission within the MODINIS program [26]. In 2003, 2005 and 2007 the European Commission had called for submissions to the *e*Europe Awards for E-Government. An independent jury of E-Government practitioners and academics chose up to 60 cases in each wave as good practice, based on self descriptions by the case owners. In the MODINIS study these cases have been checked whether they had achieved some kind of IOP. Additional cases have been proposed by national E-Government representatives of member states of the European Union. For 72 cases a questionnaire has been sent to the case owners and a telephone interview was conducted in order to amend and validate the self description and to produce standardized case profiles. For 32 of them additional information has been collected, the cases have been presented on workshops by the case owners and the written case description has been checked by the case owners. The case profiles as well as the in depth descriptions can be accessed via http://www.egov-iop.ifib.de.

2. REVIEW OF SELECTED IOP FRAMEWORKS

As mentioned IOP frameworks define what has to be standardized and classify the available standards. Various expert bodies in Europe have developed such frameworks for IOP in E-Government adopting a multi-layer approach (Table 1):

- The European Interoperability Framework for Pan-European E-Government Services, which was developed within the EU program IDABC (Interoperable Delivery of European E-Government Services to Public Administrations, Businesses and Citizens) [15], distinguishes the three layers of technical, semantic and organizational interoperability.

- In a similar architectural model of the European Public Administration Network (EPAN), the layer of structured customer contact and support is introduced and, besides the four layers, the aspect of governance is highlighted [10].

- In a white paper with the title "Standards for Business", the European Standardization Institute ETSI introduces the layer of syntactic interoperability between the technical

and the semantic interoperability [11].

An overview over these and other classifications is given by Peristeras and Tarabanis [27]. Based on the analysis of twelve different IOP frameworks they suggest a concept of their own which they call "The Connection, Communication, Consolidation, Collaboration Interoperability Framework (C4IF)". The four terms characterize the functions or purposes, which the standards shall fulfill on the different layers of the mentioned framework concepts.

Such IOP frameworks shall support the practical planning of systems for several administrations by listing the topics, which have to be coordinated, as well as the available standards and methods, which are suitable and necessary to create IOP among several information systems. At the same time they allow for a distinction of different solutions for providing IOP, which can be used for comparative analysis or benchmarking of E-Government services. The informational value of benchmarks and rankings in E-Government so far is limited by the fact that very heterogeneous applications are compared and that there are no classifications allowing meaningful comparisons within homogeneous classes. Similarly, social science E-Government research cannot identify the success factors and barriers of the development of intergovernmental information systems, if the different types of IOP, which require different forms of cooperation, cannot be distinguished.

The Four Layer IOP Framework (Table 1) is a good starting point for finding out where and by whom the different solutions to achieve IOP are negotiated and established because there are different kinds of institutions dealing with the solutions on the different layers.

3. ESTABLISHING IOP AND PROVIDING INTEROPERATION

IOP in intergovernmental services can only be achieved by cooperation between the governmental units concerned [2, 5, 7, 8, 10, 26]. These may be agencies of the same kind in different geographical regions or different agencies acting in different stages of a supply chain. Sometimes there is already a tradition of cooperation with regard to non-electronic workflows. Sometimes a cooperative relationship yet has to be established. But some solutions for achieving IOP are not developed within the government sector but rather by technical standardization bodies or similar institutions.

Starting from the Four Layer IOP Framework, there is not one

Layer of interoperability	Aim	Objects	Solutions	State of Knowledge
Technical interoperability	Technically secure data transfer	Signals	Protocols of data transfer	Fully developed
Syntactical interoperability	Processing of received data	Data	Standardized data exchange formats, e.g. XML	Fully developed
Semantic interoperability	Processing and interpretation of received data	Information	Common directories, data keys, ontologies	Theoretically developed, but practical implementation problems
Organizational interoperability	Automatic linkage of processes among different systems	Processes (workflow)	Architectural models, standardized process elements	Still lack of conceptual clarity, vague concepts with large scope of interpretation

Table 1: Four Layers of Interoperability

common governance structure for all layers of (Fig. 1). Rather protocols at the technical level are mostly defined by national and international standardization committees including Internet working groups, while data formats, ontologies and so forth for creating semantic interoperability are - due to their more concrete relation to a particular context - mostly developed by industrial or sectoral organizations (industrial associations, professional bodies, local government associations, etc.). In public administration, at least in Europe, they are also provided by ordinances and legislation. Regulations concerning organizational interoperability are either negotiated by the administrations directly concerned or by superior administrative agencies or ordinances.

"While some organizational choices and formats for integration and interoperation seem obvious, it is unclear how those would evolve or be maintained. Current practice research is still in relatively short supply. Long ago, information system research found centralization and standardization to be key in accomplishing the smooth interoperation of information systems. However, in the public sector neither centralization nor standardization can be imposed on the various and divergent constituencies. Therefore the integration and interoperation tasks in this sector are more complex in an order-of-magnitude fashion" [30, p. 32].

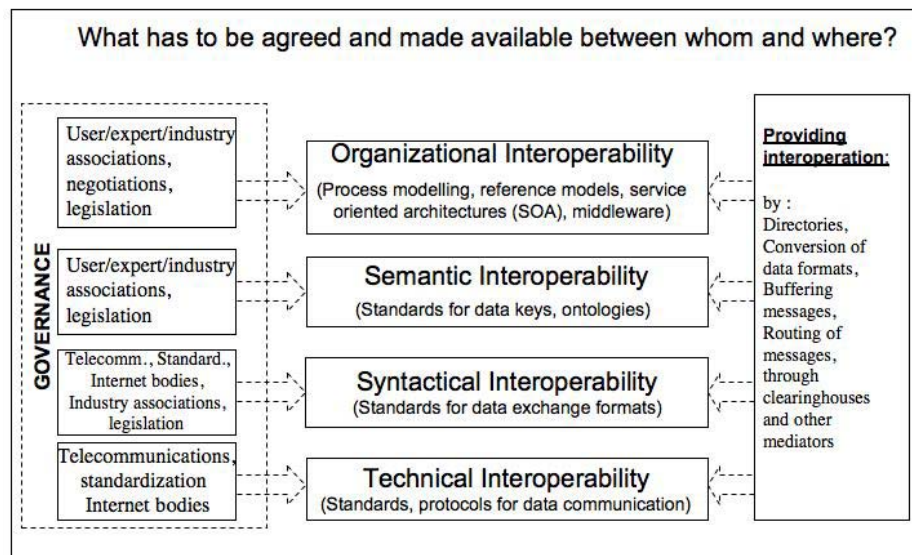Although the author of this paper does not agree with the last

Figure 1: Three Dimensions of Organizational Interoperability

Taking up the concept of governance introduced by the EPAN Network, the MODINIS Study on IOP by Tambouris et al. [31] refers to the basic form of governance, i.e. hierarchies, markets and networks. The concept of hierarchy refers to ordinances by national government, the concept of markets to de facto industrial standards, and the concept of networks to various forms of contractual or de facto cooperation agreements. Dawes and Cook [8] mention the coordinate-authority model, the inclusive-authority model and the overlapping-authority model to distinguish different modes of cooperation between government units on the local, state and national level. Scholl and Klischewski [30] speak of E-Government Integration, defined as the forming of a larger unit of government entities, temporary or permanent for the process of merging processes or sharing information. They distinguish between loose affiliations, project groups or co-ops and federations. In addition, Homburg [15], Homburg & Bekkers [14], Dawes [7], and Scholl [29] discuss various aspects of the cooperation among administrations from a perspective of political science or organization theory. In spite of the 81 sources in their survey on integration, interoperation and interoperability research, Scholl and Klischewski reason that there is a considerable lack of clarity on fundamental questions:

part of this statement, there is full support for their demand for research relating to the governance problem resulting from the structural differences between cooperation and linkage of data processing systems in public administration and private business. While companies can decide in which field they want to cooperate with others, how far they want to make their data processing systems interoperable, and how they can achieve certain forms of integration and interoperation by coordinating mutual interests or exerting power, public administrations are subject to the strong influence of law. They have to offer many services in the same way all over their area of jurisdiction. This can be regulated by state or federal legislation. The concrete technical and organizational implementation, however, can be carried out differently and thereby posing the problem of IOP.

At this moment there is no classification available of the different arenas where in particular semantic and organizational IOP has been negotiated and decided. There are different forms of governance for different areas of public administration and there are huge differences between member states of the European Union and compared to the US according to differences in constitutions and traditions of cooperation between administrative sectors and levels.

Moreover, there is also a demand for research on the question posed by Scholl and Klischewski how IOP is practically created and how it is maintained and which roles centralization and standardization play in this connection. This question does neither fit to the level of organizational interoperability nor is it a typical governance aspect. Rather it refers to organizational facilities to support the application of standards.

In analyzing data exchange in branded goods industry and retailing [22, 23] we found that ordering and billing information between retailing and producers of branded articles are not exchanged directly but via intermediaries providing certain services such as conversion of data formats, up to date directories, authentication or authorization services and many more. They can be called clearing houses generalizing from interbank clearing.

In contrast to the bodies where interoperability is achieved by negotiating standards, these organizations provide and guarantee "interoperation" using a distinction Scholl and Klischewski have introduced [30]. While IOP refers to the ability and preconditions for interorganizational data exchange, interoperation points to the practical application of the standards and other arrangements for maintaining smooth data exchange in daily operations. These arrangements should be considered as a separate dimension as they may well be the outcome of the governance process (Fig. 1.)

4. PHASE-DEPENDENT GOVERNANCE

When trying to apply the suggested governance forms to the 32 cases we found that there was not only one governance structure in each case. Rather the planning and decision making authority shifted in the course of three different phases of the development process. In a conceptualization phase we found the working groups and ad hoc committees mentioned by Scholl and Klischewski as well as staff units, mainly composed of experts from the respective application contexts and ICT specialists. The organizational forms in this phase can be distinguished by the degree of institutionalization and representation. Sometimes the IOP standards on the organizational and semantic level are elaborated in existing permanent institutions, sometimes by ad hoc groups put together for a particular IOP project. Representation refers to the extent to which the different sectors or levels of government, which will be affected by a standard, are represented in the respective working group (i.e. the inclusive model of Dawes and Cook).

Standards elaborated by such working groups in most cases are proposals, which have to be adopted, issued, recommended or made mandatory by authorized bodies. They need legitimization by law or ordinance, contract or agreement or just by the decision of an authorized and recognized board. In contrast to E-Business, in the 32 European cases almost all semantic and organizational IOP standards for nationwide services have been established by law or ordinance, while on the regional level contracts or agreements were most frequent.

In a third phase standards, which have been recommended or made mandatory still have to be implemented and put into operation by assigning certain tasks to certain organizations or units. They can be public or private or public-private-partnerships. In many cases boards or committees are assigned tasks of control or supervision, in particular for promotion, diffusion, maintenance and updates of the respective standards,

while tasks of operation are assigned to governmental agencies, joint ventures or private enterprises as service providers.

5. PROVIDING INTEROPERATION BY STANDARDIZATION AND CENTRALIZATION

As mentioned above, the way interoperation is provided and maintained follows different lines and should be considered as a separate aspect. If we conceive the provision of interoperation as a coordination problem organization theory offers two main strategies: centralization or standardization [25]. Organizations or networks of organizations may achieve coordination of tasks or processes either by giving authority to one unit, i.e. centralization, or by agreeing on standards, which all decentral units have to apply [19]. In empirical studies, Child has shown that organizations combine both strategies, but to different extents [3, 4].

Following this distinction, the next question is whether these two dimensions can be differentiated further in order to show different options within each of these dimensions. One idea is to look for what is standardized and what is centralized in interorganizational data exchange networks.

After analyzing the cases collected in the MODINIS study (see http://www.egov-iop.ifib.de for the individual case studies), following distinction is proposed:

In order to achieve fully interoperable data exchange across governmental units, there is a need for

- common directories providing the address data for routing,
- common workflow definitions to describe the source and target processes of the exchange,
- standardized data exchange formats on the syntactical layer,
- standardized data keys or ontologies on the semantic layer.

In order to support the application of these standards, we find intermediary units, which serve as central providers for

- the routing of messages,
- providing access to files of selected (master) data,
- the conversion of data exchange formats if there are more than one,
- carrying out primary tasks for all participating units by providing complete data files and executing certain functions.

It is obvious that in all cases, messages are exchanged between different organizations and that some kind of routing is necessary based on directories to find and determine the target address. Instead of each participating organization maintaining such a directory individually, it is much more efficient to have one central provider who maintains and updates this directory. In order to exchange data between automated processes there is also a need to define the source and target workflow as well as data exchange formats. Examples are applications for social benefits, notice of change of address or invoices. In some cases, the standardization covers the syntax of the messages, e.g. XML schemes for an order, in other cases the meaning of certain data fields is standardized as well, e.g. a unique citizen or business number in an application form or a unique article number in an order or invoice. Again a central unit may

maintain a database with this kind of reference data more effectively. And if there are several formats, it may provide a conversion service as well.

6. AN EMPIRICAL TEST

From a pragmatic point of view, there is the question whether the four kinds of measures on each of the two dimensions cover the relevant decisions to be taken in order to provide for and guarantee interoperation. Are there other measures, which should be considered? Are they still too general and should be differentiated further?

From an analytical point of view, there is the question, whether these indicators allow for identifying certain patterns and relations to build a taxonomy. One question is whether there is an order of the four kinds of action on each of the two dimensions. Do they have a cumulative structure, i.e. is there a rank order according to which a measure ranked higher only appears where all the measures ranked lower exist as well?

Coding the 72 cases of the MODINIS study, we find the following distribution (Table 2):

Standardization of		Central Provision of	
- Data Exchange Formats	71	- Selected Data	53
- Workflows	67	- Routing of Messages	43
- Directories	56	- Conversion of Formats	18
- Data Keys and Ontologies	42	- All Data and Certain Functions	14

Table 2: Distribution of MODINIS Cases

The distribution of the standardization indicators shows a plausible cumulative structure. In all cases there is a standardization of data exchange formats, in most of them there is also a standardization of workflows, a little bit less frequent are joined directories, and the standardization of data keys and ontologies is even less frequent. With regard to the central provision of certain services the picture is less plausible. One should expect that routing of messages is the most frequent service provided centrally. But the provision of certain data is more frequent. This may be because some of the cases are portals which integrate information from different sources but do not need any routing. This is in line with the distinction of Scholl and Klischewski [30] between data integration and process integration and should be pursued further.

The empirical analysis of these relationships between different measures and the search for patterns is subject to an ongoing research process, which has just started in May 2008. In the course of the second phase of this research, each case will have to be checked again and additional information will have to be collected. This is much effort for just a classification of different organizational arrangements. But such classifications are at the core of IOP related research and the present ad hoc classifications do not meet methodological requirements of scientific research but urgently need empirical assessment and refinement, towards which the research presented here may contribute.

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