Barriers to Electronic Service Development

Costas Vassilakis  
E-Gov Lab, Department of Informatics and Telecommunications

George Lepouras  
E-Gov Lab, Department of Informatics and Telecommunications

John Fraser  
Napier University

Simon Haston  
The City of Edinburgh Council

Panagiotis Georgiadis  
E-Gov Lab, Department of Informatics and Telecommunications

ABSTRACT

E-government initiatives have been proven to deliver significant benefits, both for suppliers of electronic services (public authorities and organizations) and for the public, to whom services are addressed. However, the pace with which electronic services are made available and adopted is lower than planned or expected; governments tend to be slow in releasing new services, and citizens often prefer to conduct business with the government through paper forms and physical presence, rather than using online methods. This indicates that certain barriers exist that hinder the transition to electronic services. In this paper, we present the results of a survey among electronic service stakeholder groups, to identify the most important barriers to electronic service development. Documentation of barriers is considered important, since administrations may take certain measures to overcome them. Hints on how specific barriers may be overcome are also provided.

Keywords: e-services, development, barriers, acceptance and use

INTRODUCTION

Electronic government, driven by an ever-growing and pervasive use of information and communication technologies, is increasingly affecting the public sector (European Com-
mission, 1999). At both European and national level, strong will has been declared to promote electronic governance, mainly expressed through specific projects and initiatives for developing and promoting electronic services (European Commission, 2004; Ministro per l innovazione e le Technologie [Italy], 2004; US Government, 2002) or supporting frameworks (UK online, 2004a; UK online, 2004b) since the benefits from this area have become apparent to both service providers (administrations) and service users (businesses and citizens) (Top of The Web, 2003). However, the current spread of electronic services clearly lags behind the desired level. eEurope has published a list of twenty basic public services (eEurope, 2000), which should be considered as first steps towards electronic government, along with a methodology for assessing the status of government online services (eEurope, 2001). Twelve of these public services are addressed to citizens, whereas the remaining eight are addressed to businesses. A recent survey showed that in EU member states, the percentage of services that offer a complete electronic case handling ranges from 72% to 15%, giving an average of 45% (Cap Gemini Ernst & Young, 2004). From a user's point of view, only 30% of citizens have globally declared that they had accessed government services online (Greenspan, 2002), with the majority of them mainly searching for and downloading information, rather than being involved in trans- actional services. According to Pastore (2002), only 38% of citizens who visited some government site (local or federal) in the US have conducted business with the government, while the remaining 62% merely retrieve information.

These facts clearly indicate that a number of factors place barriers to the development, acceptance, and use of electronic services. These barriers may stem from different areas, including:

1. **Legislative barriers**, related to the existence of appropriate laws, regulations, and directives that allow or facilitate the deployment of electronic services.

2. **Administrative barriers**, related to lack of appropriate business models, justification of costs, availability and allocation of skilled personnel, and the need for structural reforms.

3. **Technological barriers**, associated with the availability of suitable tools, standards, and infrastructure to develop, deploy, and use electronic services.

4. **User-culture barriers**, which are set by the user groups’ culture or profile. User groups can be viewed from different angles and with different granularities: users internal to Public Authorities (PA), external users, local community users, international users, etc.

5. **Social barriers**, i.e., impediments related to stakeholders’ social status, such as fear of job loss or status degradation; established power structures, and contact networks may also view these developments as a threat.
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A successful strategy for promoting electronic government must thus include provisions for overcoming these barriers, in order to increase implementation plan efficiency.

This paper aims at identifying the main barriers that impede the development, acceptance, and use of electronic services, so as to serve as a reference for electronic service stakeholders in preparing their roadmap for promotion of electronic government. Some of these impediments have already been documented in recent publications (West, 2003; Information Technology Association of America, 2003; Scottish Executive Central Research Unit, 2003; The State of Texas, 2000; US Government, 2002; Whitehouse, et al., 2002; New York State Office of Technology, 2002; BT Government, 2000; Progressive Policy Institute, 2001; OECD, 2003). The study presented in this paper extends the work presented so far by collecting extensive data regarding e-service barriers directly from user groups and applying statistical methods to assess the perceived importance of each barrier. These importance indicators can prove valuable to electronic service stakeholders, in order to prioritize their efforts so as to first address the most important issues. Conclusions from discussions and structured interviews with stakeholders are also included in this paper, which may be of further assistance in preparing an e-government roadmap.

However, methods for overcoming barriers identified cannot always be proposed because: (a) such methods are quite often strongly dependent on the interested administrations’ practices, and (b) methods are generally of interest only to stakeholders with appropriate expertise. Taking into account the diversity in the nature of different barriers, it is preferable to present these methods in separate documents targeted to distinct fields of expertise, rather than from a single overall perspective.

The rest of this paper is organized as follows. The next section presents the methodology followed for identifying the barriers, including classification of people involved in electronic services into stakeholder groups, methods employed for collecting information regarding barriers, and statistical processing of data. The findings from the analysis are then presented via organizing barriers into broad categories. The final section concludes the paper.

Electronic Service Stakeholders and Methodology

The first step towards surveying barriers to electronic service development, deployment, acceptance, and use is the identification of relevant stakeholders, i.e., groups that are involved in any stage of electronic service development and delivery. Once stakeholder groups have been identified, an appropriate methodology for barrier identification is selected on a group basis, taking into account the profile, size, and availability of each group. In order to determine the stakeholder groups, informal discussions were conducted, initially with organizational and departmental level managers. In these discussions, managers were asked to identify the different roles that are involved in the full life...
cycle of transactional services, including planning, design, implementation, deployment, and use. Along with the designation of roles, managers were asked to indicate three to five actors within each role. Informal discussions were also held with the indicated actors, who were asked to describe their job in the context of electronic services and other actors they communicated with in the same context, along with the purpose of this communication. This step was used as a safeguard against exclusion of some user group, due to failure of direct referencing by managers. Once all replies were collected, the different roles and functions stated by interviewees were classified into stakeholder groups; as a final quality measure, the resulting stakeholder group identifications were discussed with two to three randomly-selected representatives from each group for final agreement. At this stage, minor adjustments to wording were made.

From the initial analysis, the following stakeholder groups (roles) were recognized:

1. **Managers**, who are responsible for organizing and supervising public services. Managers make decisions about implementation of new services or alteration of existing ones, based on a strategic view of service provision. They also evaluate the acceptance of services by the public, their usefulness, and their effectiveness.

2. **Domain experts**, who possess and provide the necessary background knowledge for designing and implementing public services, including laws, processes, directives, prerequisites, and so on. Frequently, domain experts play a consultative role to managers for the design, evaluation and possible alterations of public services. Domain experts participate in the design of the electronic service interface (usually electronic forms), they dictate validation checks that must be integrated in the service, and they provide instructions and sets of examples for e-service end-users.

3. **IT staff**, who provide the necessary technological knowledge for the development of an electronic public service. Typical tasks for IT staff include the definition of system architecture, database schema, user interface, and functionality. At the same time, they play a consultative role to managers and domain experts with respect to technological aspects of e-services. Furthermore, IT staff are responsible for maintaining the e-service. IT staff may consist of organization employees, or they may belong to a private company (software house or integrators).

4. **Help desk workers**, who support e-service end-users, helping them to familiarize themselves with the environment of the e-service and cope with possible problems that may occur. This support is offered via e-mail or telephone.

5. **Administrators**, who are responsible for managing user accounts and ensuring data integrity (such as back up functions) and system security.

6. **End-users**, mainly citizens or enterprises that make use of the service.

Out of the six stakeholder categories identified above, the first five are of limited size and can be contacted in person. We collected information from members of these categories
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Please rate how each of the following factors impedes the introduction and operation of electronic services in your organization:

1. Proof of identity for electronic documents
   - Major impediment
   - Is well-developed or does not affect at all
   - N/A

2. Proof of integrity for electronic documents
   - Major impediment
   - Is well-developed or does not affect at all
   - N/A

3. Proof of time of submission electronic documents
   - Major impediment
   - Is well-developed or does not affect at all
   - N/A

4. Establishment of trusted third parties (TTPs)
   - Major impediment
   - Is well-developed or does not affect at all
   - N/A

Figure 1 – Stakeholder questionnaire excerpt

by means of informal discussions initially, followed by structured interviews at a later stage. Structured interviews included sections regarding user background, descriptions of the work they perform within the organization, the context of the work (environment, working teams, required and available resources etc.), and the impediments they face that are related to electronic service development and operation. The impediment section had two sub-sections. The first sub-section was an open question in which users filled in factors that they considered as impeding electronic services. The second sub-section listed a number of impediments sourced from bibliographies (West, 2003; Information Technology Association of America, 2003; Scottish Executive Central Research Unit, 2003; The State of Texas, 2000; US Government, 2002; Whitehouse, et al., 2002; New York State Office of Technology, 2002; BT Government, 2000; Progressive Policy Institute, 2001; OECD, 2003) and users had to fill in whether each of these impediments was relevant or not. Although this order led to some overlapping among replies in the two sections, it was considered preferable so as to avoid any biasing or limitation of replies to the open question. Figure 1 illustrates an excerpt of the questionnaire for stakeholders.

Barriers related to the sixth stakeholder category (end users) were surveyed using structured interviews with selected population groups and online questionnaires. Structured interviews were important for identifying impediments that preclude users from going online in general (such as lack of a computer, computer skills, or Internet connection), whereas online questionnaires mainly collected information regarding barriers for people who opted not to use electronic services. However, online questionnaires provided some input on different types of barriers, such as lack of knowledge regarding the existence of online services, inability to locate relevant sites, and so on. The online question-
Please indicate how much you agree with the following statements:
1. I always know which electronic services have been deployed.
   Do not agree 1 2 3 4 5 6 7 8 9 Agree N/A
2. I can easily locate the website that offers a specific electronic service.
   Do not agree 1 2 3 4 5 6 7 8 9 Agree N/A
3. Using an electronic service is straightforward.
   Do not agree 1 2 3 4 5 6 7 8 9 Agree N/A
4. Online help was adequate when I got stuck in a service.
   Do not agree 1 2 3 4 5 6 7 8 9 Agree N/A
5. Phone/fax support was readily available when on-line help was insufficient.
   Do not agree 1 2 3 4 5 6 7 8 9 Agree N/A

Figure 2 – Service user questionnaire excerpt

Questionnaires and the supporting material for structured interviews again included a citizen profile section and a section with open and closed questions regarding impediments faced in electronic service usage, with most of the choices in the closed sections having been selected from bibliographies (see previous list of bibliographical references). Figure 2 illustrates an excerpt of the online questionnaire for service users.

The number and types of reply documents collected are summarized in Table 1 - Quantitative data for reply documents. All respondents came from three countries in the EU (UK, Spain, and Greece).

<table>
<thead>
<tr>
<th>Reply document type</th>
<th>Number of replies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structured interviews from managers (organisational and departmental level)</td>
<td>9</td>
</tr>
<tr>
<td>Structured interviews from domain experts</td>
<td>18</td>
</tr>
<tr>
<td>Structured interviews from IT staff</td>
<td>12</td>
</tr>
<tr>
<td>Structured interviews from help desk workers</td>
<td>16</td>
</tr>
<tr>
<td>Structured interviews from administrators</td>
<td>11</td>
</tr>
<tr>
<td>Online questionnaires from end-users</td>
<td>346</td>
</tr>
<tr>
<td>Structured interviews from end-users</td>
<td>42</td>
</tr>
</tbody>
</table>

Once the results from interviews and questionnaires were available, the results processing phase commenced. The first step within this phase was the identification of impediments that were considered important by stakeholder groups. To this end, replies to open questions were initially reviewed and catalogued; replies using different wording to describe
the same barrier were merged to a single item (e.g., both replies “it is not possible to create special departments for supporting electronic services” and “current structure is not appropriate for efficient electronic service delivery” express a need for organizational reforms). When the meaning of a reply to an open question was not clear, the corresponding stakeholder was contacted for clarification where possible. (This clarification was not possible for cases of online questionnaires with no contact data entered.)

The final phase for questionnaire processing was the statistical analysis of replies and the identification of barriers that stakeholders consider important. Since all questions related to the evaluation of barrier importance were actually numbers in the range 1 to 9 (questionnaires also included questions for outlining user profile), the mean value of each reply was initially computed, which also fell in the range 1 to 9. The data analysis team at this stage pointed out that the small number of respondents for some population groups (e.g., 9 managers, 11 administrators, 12 IT staff) rendered the arithmetic mean not to be sound by itself to draw conclusions, and suggested that hypothesis testing with significance levels (Newton, Rudestam, 1999) should be used to determine whether some barrier is considered important or not. The data analysis team suggested that a barrier should be characterized as not important if the mean value of the pertinent replies was greater than 5.8 with a statistical confidence of 90% or greater. This arrangement guaranteed that a barrier is characterized as “not important” if most of the respondents chose a value of six or more, with very few respondents opting for smaller values. (Note that the scoring was arranged so that high values indicate sufficiency of means [or the view that the factor does not affect e-services at all] so a mean value of 5.8 or greater signifies that most respondents perceive the means as being sufficient, i.e., they do not introduce a barrier).

For impediments that have qualified as “important” according to these criteria, the extracted mean values and confidence levels are given in the next section, in order to illustrate the perceived importance for each barrier.

**BARRIERS TO ELECTRONIC SERVICES**

The results from analyzing the replies to the structured interviews are presented in the following paragraphs. The identified barriers have been organized under five major categories, namely legislative barriers, administrative barriers, technological barriers, user culture barriers and social barriers. This organization was chosen mainly because this categorization best matches the structure of public authorities, with different divisions being (grossly) responsible for tackling barriers in different categories. Hints on suitable methodologies for alleviating barriers are given in the text, as appropriate. One may note that many of the barriers identified in this study may apply to electronic services of the private sector as well; however, since the study only included data from e-services in the context of the public sector, it was considered preferable not to generalize our conclusions to cover any type of public service.
The data used to classify different barriers into the listed categories were collected during the structured interviews, where the interviewer asked the respondent to choose the most pertinent category for the barrier in question. In general, there was a consensus in interviewees’ responses, regarding the category under which each barrier should be classified. Notable exceptions were the “partner readiness” impediment (for which opinions were split between the “Administrative” and “Technological” category), the case of legislation expressly prohibiting the use of certain technologies (where replies were divided between “Legislative” and “Technological”) and legislation not allowing suitable organizational reforms (opinions were split between “Legislative” and “Administrative”). In all three cases, the final categorization was determined after a discussion with a small group of respondents (expressing both views) and a second round of “voting.” We note here that these situations demonstrate that the classification of impediments into categories is not clear-cut, and some interaction or even overlapping between categories may exist.

**Legislative Barriers**

Legislative barriers arise mainly from such issues as the lack of a suitable legal framework that addresses submission of electronic documents, liability emerging from electronic documents, and proofing value of electronic documents against paper documents.

Especially for the proof-of-identity and the electronic document integrity issue, there does not currently exist a globally accepted framework for all services. Electronic signatures technology is accepted in some countries and/or for specific services, but there exist countries and service classes for which electronic signatures are considered inadequate, e.g., services involving payments to citizens where fraud detection is important. Additionally, legislation for Trusted Third Parties, i.e., bodies that will testify for resolution of disputes between citizens and public authorities in the context of electronic services, is still immature.

The legal requirements for physical presence, physical inspections, audits, and examinations may hinder the transition to electronic services, since some manual processes will still remain in the workflow.

Legal issues may affect the ability of public authorities (PA) to adapt to the requirements of electronic service introduction. In some cases, PA administrative and organizational structure is strictly defined by laws, and thus reforms that will lead to the adoption of a customer-centric model (as opposed to a department-centric model), which is crucial to the success of electronic service delivery, is inhibited.

For services where multiple parties are involved, multiple changes in legislation, systems, and processes may be required for modernization (Industry Advisory Council eGovernment Shared Interest Group, 2002). For electronic services spanning country borders, two additional issues may be identified:
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There may exist inconsistent legislation in the countries involved with respect to legal aspects of e-services; if such inconsistencies are not resolved, services cannot operate successfully.

The jurisdiction for incidents that require intervention of authorities must be clearly determined.

Finally, in some cases, legislation explicitly prohibits usage of specific technologies, such as Java applets or Active-X controls. For instance, the city of Florida expressly forbids the use of ActiveX controls (Brevard County Board of County Commissioners, 2003), while the use of Java applets in the UK, though generally accepted, is subject to local security arrangements (UK GovTalk, 2003).

Table 2 - Results of questionnaire processing related to legislation issues

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean value</th>
<th>Standard deviation</th>
<th>90% confidence that mean value is greater than</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisational reforms are not obstructed by legislation/regulations</td>
<td>2.16</td>
<td>1.44</td>
<td>1.79</td>
</tr>
<tr>
<td>Only one party is involved in legislation changes pertaining to e-services</td>
<td>2.62</td>
<td>1.58</td>
<td>2.21</td>
</tr>
<tr>
<td>Proof-of-identity in electronic services is undisputable</td>
<td>2.68</td>
<td>1.85</td>
<td>2.20</td>
</tr>
<tr>
<td>User name and password authentication is sufficient</td>
<td>2.91</td>
<td>1.19</td>
<td>2.60</td>
</tr>
<tr>
<td>Legislation for e-services spanning across countries is harmonised</td>
<td>2.94</td>
<td>2.05</td>
<td>2.41</td>
</tr>
<tr>
<td>Electronic signatures are adequately exploited</td>
<td>3.35</td>
<td>1.43</td>
<td>2.98</td>
</tr>
<tr>
<td>Electronic document liability is strong</td>
<td>3.53</td>
<td>2.21</td>
<td>2.96</td>
</tr>
<tr>
<td>Smart cards are used to their full potential</td>
<td>3.84</td>
<td>0.94</td>
<td>3.60</td>
</tr>
<tr>
<td>Physical presence and inspection requirements do not hinder the use of electronic services</td>
<td>3.84</td>
<td>2.31</td>
<td>3.24</td>
</tr>
<tr>
<td>Requirements for physical presence and inspection are at the absolute minimum</td>
<td>3.92</td>
<td>1.43</td>
<td>3.55</td>
</tr>
<tr>
<td>Proofing value of electronic documents is sufficient</td>
<td>3.97</td>
<td>2.23</td>
<td>3.39</td>
</tr>
<tr>
<td>Revising legislation with multiple parties involved is straightforward</td>
<td>4.13</td>
<td>1.39</td>
<td>3.77</td>
</tr>
<tr>
<td>The legal framework for electronic services is sufficient</td>
<td>4.23</td>
<td>1.69</td>
<td>3.79</td>
</tr>
<tr>
<td>The most appropriate technology for the task-at-hand can always be used (not obstructed by legislation)</td>
<td>4.37</td>
<td>1.78</td>
<td>3.91</td>
</tr>
<tr>
<td>Trusted third parties are effectively used</td>
<td>4.42</td>
<td>1.03</td>
<td>4.15</td>
</tr>
<tr>
<td>Jurisdiction when multiple parties/countries are involved is well-settled</td>
<td>4.88</td>
<td>1.31</td>
<td>4.54</td>
</tr>
</tbody>
</table>

Note: The lower the mean value, the greater the perception that this item is a barrier

- There may exist inconsistent legislation in the countries involved with respect to legal aspects of e-services; if such inconsistencies are not resolved, services cannot operate successfully.
- The jurisdiction for incidents that require intervention of authorities must be clearly determined.

Finally, in some cases, legislation explicitly prohibits usage of specific technologies, such as Java applets or Active-X controls. For instance, the city of Florida expressly forbids the use of ActiveX controls (Brevard County Board of County Commissioners, 2003), while the use of Java applets in the UK, though generally accepted, is subject to local security arrangements (UK GovTalk, 2003).
Legislative barriers must, in general, be addressed by proper bodies; it is important, however, that such issues be included in any plan for electronic service development and deployment. Especially for issues regarding usage of specific technologies, these limitations should be communicated to service developers at the initial stages of design and development, since any changes in used technologies will cause long delays and extra costs.

Table 2 - Results of questionnaire processing related to legislation issues illustrates the results of questionnaire processing that are related to legislation issues. We note again that tables in this section do not list factors that have been characterized as not important according to the statistical analysis results, since these factors do not constitute impediments. (For the criteria used to characterize a factor as not important, please refer to the section on “Electronic Service Stakeholders and Methodology.”) Within each table, factors are sorted by ascending order of mean value, thus factors that are considered as major impediments appear first in the tables.

**Administrative Barriers**

Public authority administration proves in some cases reluctant to introduce electronic services, mainly for the following reasons:

1. *Cost justification.* Development and deployment of electronic services incurs significant costs for hardware platforms, software development and licensing, and employee hiring for electronic service administration and help desk operation. Managers may find it hard to convince people that these costs can be justified in terms of quality of service to citizens, diminishing of productive hours wasted in queues and moving between public authorities, improved workflow within the organization, and reallocation of PA workers from tedious document reception and typing to more fruitful tasks. This is especially true when the service’s target audience is small and/or it is doubtful whether the target audience will finally prefer the electronic version of the service to the traditional paper-based delivery channel; for example, the elderly - who often don’t own a computer - may not be confident or equipped to use Internet services.

2. *Need for organizational reform.* Introduction of electronic services necessitates organizational reforms within the public authority, to adopt its structure to the needs of novel work and document flows or, more generally, to transform the public authority to a customer-centric organization. Organizational reforms may not be well accepted by existing personnel, unless introduced with extreme care. For example, a municipality may introduce an electronic service for certificate issuance; since the channels for paper-based certificate issuance must continue to operate, some employees will remain at their old duties while others will be relocated to the electronic certificate issuance department. The fact that not all...
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employees are treated the same may trigger complaints from either side, e.g.,
employees may complain for changing duties or because they were not transferred
to a more “prestigious” department.

3. Complex policies. Organizational policies may introduce impediments to the develop-
ment of electronic services. A typical example is the requirement for an overwhelm-
ing amount of information from service users, or the definition of complicated
policies that require a large number of interwoven transactions. In some cases, poli-
cies are oriented towards “organizational comfort” rather than “citizen service,” thus
necessitating a need for reform as described in the previous point. For instance, buy-
ing a house may involve numerous taxation-related documents that must be filled in,
e.g., request for tax clearance certificate, declaration of real-estate acquisition, declara-
tion of real-estate sale, or real-estate transfer taxation form. In such documents, citi-
zens need to repeatedly fill in their personal details and the details of the transferred
property, while the order of document submission is rigidly defined. Providing ser-
vices that are oriented towards life events (Tambouris, 2002) instead of organizational
documents is a good approach to tackling this class of problems.

4. Lack of methods for productivity and progress monitoring and accountability. In tradi-
tional, paper-based environments, managers have developed tools and methodol-
gegies to assess employee productivity and to monitor the overall progress of
various tasks. Moreover, specific individuals or groups can be easily appointed
accountable for certain actions. In the context of electronic services, such mecha-
nisms have not been adequately developed yet. A key point for these issues is an
undisputable authentication system, which will guarantee the identity of the physi-
cal person performing the actions. With such an authentication system ensured,
systems may write logs regarding who and when performed which action; such logs
may be directly used for measuring productivity and ensuring accountability. A
complementary requirement for accountability is a well-designed and enforced
security policy that will not allow any user to perform an action without proper
authorization and without being logged.

5. Lack of qualified personnel. Electronic service development and operation cur-
cently depends heavily on IT staff, a resource usually scarce within public admin-
istration authorities. Some activities may be outsourced, but achieving high
availability and error-free operation for electronic services is especially hard with-
out on-site, dedicated staff. Outsourcing the entire service, including hardware
platforms, software, and operation is not always a viable solution due to legisla-
tion restrictions and/or governmental policies.

6. Partner readiness and cooperation. In some cases, the success of an electronic service
may require the involvement of bodies external to the public authority. For
instance, a taxation-related electronic service may require the cooperation of the
besides the key issues presented above, two more administrative barriers can be identified. first, the central government may have no concrete strategy for promoting electronic service usage, and portals directing citizens to deployed online services may have
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not been developed. In these cases, service penetration may remain low, unless substantial advertisement activities are undertaken, and such activities incur additional cost. In (Weiling, 2004) the importance of a concrete strategy for the promotion of e-government is exemplified through the case of Singapore. This barrier does not apply to governments that have developed relevant strategies, policies, and centralized service directories.

Secondly, in some cases, executives lack awareness regarding the potential of electronic services and the added value that they offer to society. Interviewees have noted that the importance of this factor has lessened during the past few years, since (a) governmental positive attitudes towards electronic services have motivated executives to attend awareness events and extend their knowledge on electronic services and (b) newly appointed executives are, in general, more familiar with electronic service concepts.

Table 3 - Results of questionnaire processing related to administrative issues illustrates the results of questionnaire processing that are related to legislation issues.

Technological Barriers

Although the past few years have witnessed significant progress in technologies and infrastructure involved in electronic service development, maintenance and delivery, a number of issues obstruct the development of electronic services. The main technological concerns are analyzed in the following paragraphs:

1. **Security and encryption.** In the context of public networks, through which electronic services are disseminated, the issues of security and data encryption have not yet been addressed satisfactorily. Although techniques and tools that enhance security and privacy do exist, high levels of security cannot be achieved without significant expertise from end-users and use of complex procedures. These requirements are not met in the scope of electronic services. For example, requiring smart-card based authentication, complementary to user names and passwords, requires users to install and maintain smart card readers. It also requires organizations to develop mechanisms to safely distribute smart cards to their rightful owners. Efficient use of public key infrastructure requires that users get acquainted with the notions of “certificate authority,” “trust hierarchies,” “certificate revocations,” and so on. Although the technologies can be used while users do not possess this knowledge, in such a case their full potential is not exploited and fraud cannot be prevented.

2. **Insufficient user authentication methods.** User authentication currently depends on `username/password` combinations, which is considered a weak scheme for “sensitive” services. Public key infrastructure that would complement `username/password` combinations with physical tokens, such as smartcards, would provide a more secure authentication framework and could be exploited to provide guaran-
ees for document integrity in the form of electronic signatures. However, this infrastructure is not yet widely available.

3. **Slow and unreliable Internet connections.** End users perceive the Internet (which is the primary service dissemination channel) as currently being too slow and/or unreliable for their transactions with the government. This is especially true for services for which:
   a. complex forms must be downloaded and/or large volumes of data must be exchanged. It has to be noted that large volumes of data are usually required for enterprises (e.g., when submitting stipendiary work taxes where one record per employee should be transferred), rather than for individual citizens.
   b. failure to meet certain time deadlines or submission of incomplete/inaccurate data may incur severe penalties (e.g., taxation documents, military service documents).

Service designers and implementers must take into account these factors when designing electronic services and they must optimize data exchange wherever possible. Typical measures include more compact and text-based (as opposed to graphics-based) forms, employing compression wherever possible, and suppression of empty value transmission, especially for forms with lots of input fields. Service design should also allow the exploitation of browser-side cache, to avoid re-transmitting the same data. It has to be noted that the emergence and widespread use of broadband networks over recent years has contributed towards alleviating the problem in many countries or regions; still, making good use of the available bandwidth is a good practice.

4. **Use of proprietary technology and lack of standards.** Deployment of complex electronic services requiring cooperation between more than one public authority and/or third party bodies (e.g., banks) is sometimes inhibited due to the fact that some participants use proprietary products that have no adequate interfaces for communication with other systems. Standards for communication, such as XML, SOAP, or WDDI, are emerging but are not always supported by existing installations or are technologically immature and unstable. The scenery changes as technology advances, e.g., the UK government has developed a set of XML schemas called “e-Government Interoperability Framework” (eGIF) to provide a standard for electronic communication between PAs and the commercial sector. All electronic service development efforts should be based on *de jure* and *de facto* standards, such as XML, for information representation and exchange, web services, and so on.

5. **Difficulties in interoperability with installed IT systems.** Many public authorities have rolled out IT systems for supporting their internal operation. Interoperability between these IT systems and electronic service delivery environments, which
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is crucial for integrating electronic services and back-office procedures, may be hard to achieve mainly because:

a. Some installed IT systems are “closed” platforms and technologically outdated, providing no means for communication with external systems.

b. Security considerations prevent direct linkage of publicly accessible service delivery environments and back-office systems.

c. Security considerations may also prevent direct linkage between agencies responsible for providing a service. For example, social work care often overlaps with healthcare, but the sensitivity of confidential patient records and client data raises legitimate concerns about linking these two agencies directly. No standard techniques exist for communication between service delivery environ-

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean value</th>
<th>Standard deviation</th>
<th>90% confidence that mean value is greater than</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security can be enhanced without disturbing end-users</td>
<td>1.89</td>
<td>0.64</td>
<td>1.72</td>
</tr>
<tr>
<td>Security mechanisms are adequate for directly connecting back-end systems with the e-service delivery platform</td>
<td>2.05</td>
<td>1.11</td>
<td>1.76</td>
</tr>
<tr>
<td>Security mechanisms are adequate for directly connecting systems of different PAs</td>
<td>2.74</td>
<td>1.35</td>
<td>2.39</td>
</tr>
<tr>
<td>Service design ensures that forms are downloaded only once</td>
<td>2.97</td>
<td>1.19</td>
<td>2.66</td>
</tr>
<tr>
<td>Proprietary IT systems can be used straightforwardly in the context of electronic services</td>
<td>3.06</td>
<td>1.39</td>
<td>2.70</td>
</tr>
<tr>
<td>Large amounts of data can be easily sent</td>
<td>3.51</td>
<td>2.17</td>
<td>2.95</td>
</tr>
<tr>
<td>Public key infrastructure is easy-to-use for citizens</td>
<td>3.72</td>
<td>1.48</td>
<td>3.34</td>
</tr>
<tr>
<td>Large forms can be downloaded with no problem</td>
<td>3.78</td>
<td>1.33</td>
<td>3.44</td>
</tr>
<tr>
<td>Security mechanisms in e-services are sufficient</td>
<td>3.79</td>
<td>2.57</td>
<td>3.13</td>
</tr>
<tr>
<td>Public key infrastructure is well-developed</td>
<td>3.93</td>
<td>1.63</td>
<td>3.51</td>
</tr>
<tr>
<td>IT staff is always aware of the “state-of-the-art” technologies</td>
<td>3.95</td>
<td>1.9</td>
<td>3.46</td>
</tr>
<tr>
<td>Authentication methods are sufficient</td>
<td>4.24</td>
<td>1.23</td>
<td>3.92</td>
</tr>
<tr>
<td>Communication of e-service platforms with existing IT systems is easy to implement</td>
<td>4.26</td>
<td>2.04</td>
<td>3.73</td>
</tr>
<tr>
<td>Internet connections are reliable enough</td>
<td>4.28</td>
<td>1.69</td>
<td>3.84</td>
</tr>
<tr>
<td>Data exchange between parties can always be performed with no problem</td>
<td>4.37</td>
<td>1.86</td>
<td>3.89</td>
</tr>
<tr>
<td>Internet connections are fast enough</td>
<td>4.62</td>
<td>1.36</td>
<td>4.27</td>
</tr>
</tbody>
</table>

Note: The lower the mean value, the greater the perception that this item is a barrier.
ments and installed IT systems, thus necessitating a case-per-case handling of communication. This approach is tedious and error-prone.

An additional impediment, which may be attributed to the high rate at which technological innovations appear, is that service implementers are not always aware of the full potential offered by technology or its most appropriate use. In such situations, services that could be successfully rolled out are either not deployed at all, or are deployed inefficiently. Finally, some service implementations, in particular online forms services, merely play the role of point of presence, rather than being a fully operational transaction service. This discourages users and acts against the attainment of a critical mass of users required to justify the use of electronic services.

Table 4 - Results of questionnaire processing related to technological issues illustrates the results of questionnaire processing that are related to technological issues.

User-Culture Barriers

Certain obstacles to the use of electronic services may be ascribed to cultural or special characteristics of user communities. More specifically:

1. **General attitude against electronic services.** Specific citizen communities have a negative stance against electronic services and would only use “traditional” paper-based service channels. In some cases, this stance has its roots in philosophical beliefs. These can be viewed as barriers set by users themselves in contrast to barriers set to the user group by external factors (items 2 to 8 in this section). It has to be noted, though, that the negative attitude may have its roots in service content, rather than in service quality. Some services such as libraries enjoy positive attitudes, whereas others such as federal tax, suffer from negative attitudes. It can therefore be assumed that citizens would place greater trust in electronic transactions with library services than with the federal tax service.

   The negative perception of electronic services within the public sector, largely developed from experiences of well-documented failures in IT projects, is also a significant barrier to service acceptance and use by customers and deployment by service managers.

   Finally, while Internet usage is increasing, many citizens still prefer to contact authorities by phone, followed by face to face. This may be attributed to fear of services being de-personalized by call centers and online services, or worries regarding the turnaround time for being serviced, since both phone and face-to-face contacts are synchronous, whereas online transactions are generally asynchronous.

2. **Multi-lingual and multi-cultural issues.** Electronic services should be made available to the target population without posing any implications regarding the language or cultural background of users. Some electronic service designs and
implementations, however, do not take into account such issues (e.g., a service may be deployed only in the *mostly spoken* language within a country) effectively excluding portions of the population. This is especially true for countries with minorities or large numbers of immigrants.

3. **Lack of information.** Citizens and enterprises are not always informed regarding the web addresses through which electronic services are available, or even whether e-services exist at all. Administrations should employ appropriate communication channels to advertise the existence of e-services and promote their use. Users have pointed out that it is not necessary to use costly advertisement channels such as TV or radio commercials; rather, organizations delivering electronic services could mount posters at their premises, so that citizens would be informed about the existence of services at their next visit. When a transaction involves documents that are mailed to citizens (e.g., tax return forms or notices for payments), an extra leaflet listing the available electronic channels for conducting the transaction would suffice. Central portals should also prove useful, removing the need for citizens to maintain their own lists of web sites offering electronic services.

4. **Lack of trust.** In all cases, trust has to be built into the target community (McKay-Hubbard and Macintosh, 2003). This can only be achieved by ensuring service users that:
   - private data they submit remains confidential
   - their data cannot altered by malicious parties
   - data will not be disclosed by the receiving PA to any other party
   - data will not be used for any other reason than the one they were submitted for
   - it is impossible for malicious parties to exploit the electronic service for committing fraud against service users.

5. **Service use costs.** Using an electronic service requires access to a computer with sufficient communication capabilities, either at home or at public installations. In both cases a cost is incurred (purchase of equipment and communication fees for home installations; pay-per-use for public installations) which may not be affordable to all citizens. Thus, financially weak portions of the population are effectively excluded and will opt for traditional service delivery channels that incur no direct costs. Notably, some governments or local administrations have policies for digital inclusion and actively combat the issue through initiatives such as inclusion of free Internet access to citizens in libraries.

6. **Technological competence.** A prerequisite for using electronic services is the ability to master end-user devices, typically PCs. Still, large population percentages are not computer literate, and are hence incapable of using e-services. Though this issue can only be tackled through training, it is very helpful if services are designed to only require basic computer usage skills, in order to broaden the target popula-
tion. For example, standard HTML forms should be preferable against some proprietary but more cumbersome Web form-filling interface that offers some non-crucial functionality extensions, since a complex interface may put off citizens from using the service.

7. **Lack of expert assistance.** When users visit a public authority to make use of a service, they may get expert assistance from service workers within the PA premises. On the other hand, when using an electronic service, such assistance is not available, thus hindering electronic service use, especially for complex services. To this end, it is imperative for electronic service designers to include much more analytical and comprehensive help texts in electronic services than in traditionally delivered services. This is especially true for complex services such as tax return forms or real estate transactions. Messages resulting from validation errors should also be descriptive and informative, e.g., “A positive number is required” rather than “Improper input.” Furthermore, users must be able to receive help not only regarding service content, but regarding service operation as well, an issue sometimes disregarded in the design phase of electronic services.

8. **Accessibility.** Service design must take into account user groups with special accessibility needs. Failure to make adequate provisions for such user groups results in their exclusion from service use. Conformance to the Web Content Accessibility Guidelines, published by the W3 Consortium (W3 Consortium, 1999), is a very important step towards making services accessible to a greater portion of the citizens. For example, auditory content can be provided as an alternative to visual content for sight-impaired users, color-coding should be complemented with other distinction means for color-blind users, frames should be avoided if possible, font sizes should be user-selectable, and so on.

Table 5 - Results of questionnaire processing related to user-culture issues illustrates the results of questionnaire processing that are related to user-culture issues.

In Table 5 - Results of questionnaire processing related to user-culture issues, it is worth noting that the standard deviation metric for a number of questions is very high, as compared to tables showing results from other categories. This is owing to the existence of population groups with radically different views on the same question. For example, for the question “Services are available in a language I am fluent with,” most replies (approx. 88%) indicated a score of 8 or 9 (fully agree), while the remaining 12% indicated a score of 1 or 2 (fully disagree). Negative replies were mainly given by foreign residents of the respective countries, while some of them actually expressed complaints about the complex terminology used in electronic services (mainly taxation and legislation-related services). Similar remarks hold for the questions “The cost for using the e-service is small/negligible” and “I have enough computer knowledge to use e-services.”
Barriers to Electronic Service Development

Table 5 - Results of questionnaire processing related to user-culture issues

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean value</th>
<th>Standard deviation</th>
<th>90% confidence that mean value is greater than</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone/fax support was readily available when on-line help was insufficient</td>
<td>3.1</td>
<td>1.03</td>
<td>2.83</td>
</tr>
<tr>
<td>On-line support was adequate when I got stuck</td>
<td>3.8</td>
<td>2.04</td>
<td>3.27</td>
</tr>
<tr>
<td>e-service failures of the past are not bound to be repeated</td>
<td>3.91</td>
<td>2.18</td>
<td>3.35</td>
</tr>
<tr>
<td>I am not concerned about the &quot;de-personalisation&quot; introduced by e-services</td>
<td>4.1</td>
<td>2.69</td>
<td>3.41</td>
</tr>
<tr>
<td>I always know which e-services have been deployed</td>
<td>4.52</td>
<td>1.48</td>
<td>4.14</td>
</tr>
<tr>
<td>I am confident that the data I submit will not be disclosed</td>
<td>4.54</td>
<td>2.73</td>
<td>3.84</td>
</tr>
<tr>
<td>I can easily locate the web site that offers a specific electronic service</td>
<td>4.7</td>
<td>2.64</td>
<td>4.02</td>
</tr>
<tr>
<td>I am confident that the data I submit will not be misused</td>
<td>4.79</td>
<td>2.99</td>
<td>4.02</td>
</tr>
<tr>
<td>I am confident that the data I submit will remain confidential</td>
<td>4.81</td>
<td>1.85</td>
<td>4.33</td>
</tr>
<tr>
<td>I am confident that no fraud will be committed</td>
<td>4.83</td>
<td>2.80</td>
<td>4.11</td>
</tr>
<tr>
<td>Characters in an e-service were big enough for me to read, or they could be appropriately customised</td>
<td>4.89</td>
<td>2.96</td>
<td>4.13</td>
</tr>
<tr>
<td>I am confident that the documents I submit using an e-service will be processed</td>
<td>5.3</td>
<td>2.25</td>
<td>4.72</td>
</tr>
<tr>
<td>I could easily navigate across different forms and form elements</td>
<td>5.82</td>
<td>2.47</td>
<td>5.18</td>
</tr>
<tr>
<td>I never missed a chance to use an electronic service because I did not know it existed</td>
<td>5.83</td>
<td>2.42</td>
<td>5.21</td>
</tr>
<tr>
<td>I would use a tax return form electronic service</td>
<td>5.89</td>
<td>2.92</td>
<td>5.14</td>
</tr>
<tr>
<td>The cost for using the e-service is small/negligible</td>
<td>6.43</td>
<td>3.70</td>
<td>5.47</td>
</tr>
<tr>
<td>Services are available in a language I am fluent with</td>
<td>6.51</td>
<td>3.20</td>
<td>5.68</td>
</tr>
<tr>
<td>Symbols and metaphors used in the service are always known to me</td>
<td>6.58</td>
<td>3.41</td>
<td>5.70</td>
</tr>
<tr>
<td>I have enough computer knowledge to use e-services</td>
<td>6.64</td>
<td>3.59</td>
<td>5.71</td>
</tr>
</tbody>
</table>

Note: The lower the mean value, the greater the perception that this item is a barrier.

Social Barriers

Social barriers are a class of impediments mainly observed within the context of public authorities and are relevant to the following issues:

1. **Shift of power.** Employees possessing a certain amount of tacit domain knowledge are considered to have more power (or a more distinguished status) within
the organization. Introduction of electronic services may convert tacit knowledge to explicit, thus depriving these employees of their source of power; moreover, a new group of distinguished employees is formed, consisting of the ones most closely related to electronic services.

2. **Change of duties.** Introduction of electronic services will require structural reforms in the organization and modifications of job descriptions. Employees may be opposed to such changes for several reasons. The study has revealed objections to giving up working methods and habits, and a negative stance against changes in the working environment, as shown in Table 6 - Results of questionnaire processing related to social issues.

3. **Fear of job loss.** Many employees, especially ones involved in paper-based service delivery channels, perceive the introduction of electronic services as a threat jeopardizing their jobs. Management should present a clear plan for the transition to the electronic service era, indicating that only job descriptions will change and no jobs will be cut due to the introduction of electronic services.

Table 6 - Results of questionnaire processing related to social issues illustrates the results of questionnaire processing that are related to social issues.

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean value</th>
<th>Standard deviation</th>
<th>90% confidence that mean value is greater than</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisations with e-services require the same number/more employees that ones without</td>
<td>2.54</td>
<td>1.28</td>
<td>2.21</td>
</tr>
<tr>
<td>No jobs are lost when e-services are introduced</td>
<td>2.68</td>
<td>1.36</td>
<td>2.33</td>
</tr>
<tr>
<td>I am enthusiastic about learning and applying new methods/procedures</td>
<td>2.97</td>
<td>2.16</td>
<td>2.41</td>
</tr>
<tr>
<td>It is best if knowledge about services is spread within the organisation</td>
<td>3.86</td>
<td>2.83</td>
<td>3.13</td>
</tr>
<tr>
<td>My working conditions will improve/remain the same with the introduction of e-services</td>
<td>4.56</td>
<td>2.31</td>
<td>3.96</td>
</tr>
<tr>
<td>I will easily adopt to any organisational changes that e-services will cause</td>
<td>4.69</td>
<td>2.27</td>
<td>4.10</td>
</tr>
<tr>
<td>My status in the organisation will improve/remain the same with the introduction of e-services</td>
<td>4.82</td>
<td>1.78</td>
<td>4.36</td>
</tr>
</tbody>
</table>

Note: The lower the mean value, the greater the perception that this item is a barrier

**CONCLUSIONS**

In this paper we surveyed and documented the most important barriers that hinder electronic service development, deployment, acceptance and use. These barriers were orga-
nized into five major categories, in order to provide each organizational unit of the public authority or body with more specialized input on issues they may need to confront. Statistical indicators for each of the important impediments have also been given, denoting its perceived importance. Finally, suggestions on appropriate methodologies for removing impediments have been given where appropriate.

Having available the information presented above, e-service stakeholders can plan their e-service roadmap more effectively. First, the impediment lists presented in the section on “Barriers to Electronic Services” should be scanned, in order to determine whether each barrier applies to the current situation. For example, if the central government has well-developed portals directing citizens to currently deployed services, the issue “Central government gives e-services enough publicity” does not apply, although it has been identified as an impediment in the general case. This step produces a situation-specific barriers list, which lists all barriers that are pertinent to the current administration or organization. Subsequently, the barriers within this list should be tackled according to their importance in the specific context; note that the perceived importance extracted for each barrier in the section on “Barriers to Electronic Services” is a statistical measure and thus indicates a generic view, which can be considerably different in specific situations.

From the discussions and the structured interviews with e-service stakeholders that we conducted, the predominant opinion was that legislative issues should be addressed first in the general case, because (a) legislative bodies need considerable time to validate the appropriate laws and regulations, and (b) services cannot be delivered at all unless the relevant legislation is in effect. It has to be noted, however, that concerns regarding the legislation have been found to depend on the nature of the service. For example, a service for electronic issuance of birth certificates has far less legal concerns as compared to a taxation service, because the latter includes financial data that necessitates strict confidentiality requirements and many accompanying concerns, such as the need to define data integrity and authenticity requirements, or the need to define rules for handling cases where a taxation document has been submitted both in paper form and electronically, and the content of the two documents differs.

The second major category that should be addressed is that of user-related issues, because without a critical mass of users, development and deployment of a service has no actual impact. Some barriers in this category can be effectively addressed at the service design stage, by cataloguing appropriate items as indispensable requirements (e.g., multilingual content, help items and examples, conformance to accessibility guidelines). Other aspects require separate actions, such as advertisement of services to the public, building trust into the prospective user community or promoting digital inclusion for the financially weaker portions of the population.

The final three categories, namely administrative, technological, and social barriers can be addressed last, since barriers included therein mainly affect the effectiveness of
delivered services, rather than the ability to deliver them or their overall impact, as is the case with the first two categories. Out of all the impediments identified in the categories of administrative, technological, and social barriers, precedence should be given to those directly supporting legislative or user-relevant items (e.g., security in communications may be a legal requirement, while it also contributes to the development of trust in the user community), while issues related to the internal operation of the organization (such as progress monitoring and development of executive awareness) could be assigned smaller priorities.

References
Barriers to Electronic Service Development


