

Barriers To Electronic Service Development

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Abstract. E-government initiatives have been proven to deliver significant benefits, both for suppliers of electronic services (public authorities and organisations) 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 given in this paper.

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

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INTRODUCTION

Electronic Government, driven by an ever growing and pervasive use of information and communication technologies, is increasingly affecting the public sector. (European Commission, 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 Tecnologie (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 20 basic public services (e-Europe, 2000), which should be considered as *first steps* towards “Electronic Government”, along with a methodology for assessing the status of government online services (e-Europe, 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 users' point of view, only a 30% of citizens have globally declared that they had accessed government services online (Greenspan Robyn, 2002), with the majority of them mainly searching for and downloading information, rather than being involved in transactional services. According to (Pastore Michael, 2002), only 38% of citizens

that 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 the stakeholders' social status, such as fear of job loss or status degradation; established power structures and contacts networks may also view these developments as a threat.

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 Darrell, 2003; Information Technology Association of America, 2003; Scottish Executive Central Research Unit, 2003; The State of Texas, 2000; US Government, 2002; Whitehouse Michael 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 insofar 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 prioritise their efforts so as to firstly 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 the 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 -in general- of interest only to stakeholders with appropriate expertise; taking into account the diversity of the different barriers' nature, it is considered preferable to present these methods in separate documents targeted to distinct fields of expertise, rather than in a single voluminous bundle.

The rest of this paper is organised 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. Afterwards, the findings from the analysis, organising barriers into broad categories are presented. 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 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 organisational 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 3-5 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 resulted stakeholder group identifications were discussed with 2-3 randomly selected representatives from each group for final agreement. At this stage, minor adjustments to wordings were made.

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

1. *Managers*, who are responsible for organising and supervising public services. They 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 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. They participate in the design of the electronic service interface (usually electronic forms), they dictate validation checks that must be integrated in the service and 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, they are responsible of maintaining the e-service. IT staff may consist of organisation employees, or may belong to a private company (software house or integrators).
4. *Help desk workers*, who support e-service end-users, helping them to familiarise 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, ensuring data integrity (back up functions etc) 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; thus from members of these categories information was collected by means of informal discussions, initially, and structured interviews at a later stage. Structured interviews included sections regarding user background, descriptions of the work they perform within the organisation, the context of the work (environment, working teams, required and available resources etc) and the impediments they face, which are related to electronic service development and operation. The impediment section, in particular, had two sub-sections: The first section was an open question in which users filled in factors that they considered as impeding for electronic services. The second sub-section listed a number of impediments sourced from bibliographies (West Darrell, 2003; Information Technology Association of America, 2003; Scottish Executive Central Research Unit, 2003; The State of Texas, 2000; US Government, 2002; Whitehouse Michael 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. An excerpt of this subsection is illustrated in Figure 1.

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	1	2	3	4	5	6	7	8	9	Is well-developed or does not affect at all	N/A
2. Proof of integrity for electronic documents											
Major impediment	1	2	3	4	5	6	7	8	9	Is well-developed or does not affect at all	N/A
3. Proof of time of submission electronic documents											
Major impediment	1	2	3	4	5	6	7	8	9	Is well-developed or does not affect at all	N/A
4. Establishment of trusted third parties (TTPs)											
Major impediment	1	2	3	4	5	6	7	8	9	Is well-developed or does not affect at all	N/A

Figure 1 –Stakeholder questionnaire excerpt

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 questionnaires and the supporting material for structured interviews included again 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 above for a list of bibliographical references). An excerpt of the online questionnaire is illustrated in Figure 2.

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 web site 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. On line 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

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

<i>Reply document type</i>	<i>Number of replies</i>
Structured interviews from managers (organisational and departmental level)	9
Structured interviews from domain experts	18
Structured interviews from IT staff	12
Structured interviews from help desk workers	16
Structured interviews from administrators	11
On-line questionnaires from end-users	346
Structured interviews from end-users	42

Table 1 - Quantitative data for reply documents

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, initially replies to open questions were reviewed and catalogued; replies using different wordings 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 organisational reforms). When the meaning of a reply to

an open question was not clear, the corresponding stakeholder was contacted for clarifications, provided that this was possible (this was not possible for cases of on-line 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 1-9 (questionnaires also included questions for outlining user profile), the mean value of each reply was initially computed, which also fell in the range 1-9. 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 characterised 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 characterised 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 analysing the replies to the structured interviews are presented in the following paragraphs. The identified barriers have been organised under five major categories, namely legislative barriers, administrative barriers, technological barriers, user culture barriers and social barriers. This organisation was chosen mainly because this categorisation 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 generalise 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 organisational reforms (opinions were split between "Legislative" and "Administrative"). In all three cases, the final categorisation 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 the lack of a suitable legal framework that addresses submission of electronic documents, liability emerging from electronic documents, proofing value of electronic documents against paper documents and so on.

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 modernisation (Industry Advisory Council eGovernment Shared Interest Group, 2002). For electronic services spanning across country borders two additional issues may be identified:

- there may exist inconsistent legislations in the involved countries regarding 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, Active X controls etc. 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 should 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 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 characterised as *not important* according to the statistical analysis results, since these factors do not constitute impediments. (For the criteria used to characterise a factor as *not important*, please refer to section, “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.

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

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

Table 2 - Results of questionnaire processing related to legislation issues

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 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 against 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 organisational reform.* Introduction of electronic services necessitates organisational 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 customer-centric organisation. Organisational 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 paper-based certificate issuance channels 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 employees are treated the same, may trigger complaints from either side (employees may complain for changing duties or because they were not transferred to a more "prestigious" department).
3. *complex policies.* Organisational policies may introduce impediments to the development of electronic services. A typical example is the requirement for an overwhelming amount of information from service users, or the definition of complicated policies that require a large number of interwoven transactions. In some cases, policies are oriented towards "organisational comfort" rather than "citizen service", thus necessitating a need for reform as described in item 2. For instance, buying a house may involve numerous taxation-related documents that

should be filled in (request for tax clearance certificate, declaration of real-estate acquisition, declaration of real-estate sale, real-estate transfer taxation form etc). In these documents, citizens need to repeatedly fill in their personal details, the details of the transferred property etc, while the order of document submission is rigidly defined. Providing services that are oriented towards *life events* (Tambouris, 2002) instead of organisational documents is a good approach to tackling this class of problems.

4. *lack of methods for productivity and progress monitoring and accountability.* In traditional, paper-based environments, managers have developed tools and methodologies to assess employee productivity and for monitoring 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 mechanisms have not been adequately developed yet. A key point for these issues is an *undisputable authentication system*, which will guarantee the identity of the physical 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*, which will not allow any user to perform an action without proper authorisation and without being logged.
5. *lack of qualified personnel.* Electronic service development and operation currently depends heavily on IT staff, a resource usually scarce within public administration authorities. Some activities may be outsourced, but achieving high availability and error-free operation for electronic services is especially hard without on-site, dedicated staff. Outsourcing the entire service, including

hardware platforms, software and operation is not always a viable solution due to legislation 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 banking sector for payment handling. External bodies may not be ready at some given time (either technologically or administratively) to play the required role within the electronic service.

Besides the key issues presented above, two more administrative barriers may be identified: firstly, the central government may have no concrete strategy for promoting electronic service usage, and portals directing citizens to deployed on-line services may have not been developed. In these cases, service penetration may remain low, unless substantial advertisement activities (incurring additional costs!) are undertaken. In (Weiling Ke, 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 centralised service directories.

Secondly, in some cases executives lack awareness regarding the potential of electronic services and the added value to society they offer. Interviewees have noted that the importance of this factor has lessened during the past few years, since (a) governmental positive attitudes towards electronic services has 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 illustrates the results of questionnaire processing that are related to legislation issues.

<i>Question</i>	<i>Mean value</i>	<i>Standard deviation</i>	<i>90% confidence that mean value is greater than</i>
Reorganisation to better accommodate e-service delivery is well-accepted by employees	2.72	1.81	2.25
Enough qualified personnel is available to run the service	2.76	0.77	2.56
A whole service could be outsourced, if this was considered beneficial	2.85	0.93	2.61
Central government gives e-services enough publicity	3.01	1.12	2.72
Minimisation of time wasted by citizens is adequate cost justification	3.12	1.31	2.78
Accountability for lack of progress can be determined	3.17	1.55	2.77
E-service transactions are independent of one another	3.18	2.09	2.64
Accountability for errors can be determined	3.19	1.42	2.82
Executives are well-aware of e-service benefits	3.19	2.54	2.53
The individual employee productivity in the context of e-services can always be assessed	3.24	1.45	2.87
Improved quality of service to the citizens is considered adequate cost justification	3.42	1.38	3.06
Central government portals effectively direct citizens to services	3.58	2.16	3.02
Improved workflow within PA is adequate cost justification	3.69	1.89	3.20
Only the absolutely necessary data are entered by the citizens in e-services	3.76	2.73	3.06
The progress of cases can be statistically monitored	3.78	2.12	3.23
Central government policy for e-services is well-developed	3.96	1.57	3.55
More effective use of personnel is adequate cost justification	4.1	1.63	3.68
When e-service transactions are interdependent, they are straightforward to carry out	4.11	1.69	3.67
Cooperation with other parties is technically possible	4.12	2.24	3.54
The progress of each individual case can be monitored	4.16	1.37	3.81
Cooperation with other parties is administratively possible	4.36	1.96	3.85

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

Table 3 - Results of questionnaire processing related to administrative 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 analysed 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, and organisations 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 guarantees 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 etc).

Service designers and implementers must take into account these factors when designing electronic services and optimise 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 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, which have no adequate interfaces for communication with other systems. Standards for communication, such as XML, SOAP, WDDI etc. 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 have 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, etc.

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 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 environments and installed IT systems, necessitating thus 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 that 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 deployed inefficiently. Finally, some service implementations, in particular online forms services, play merely the role of *point of presence*, rather than 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 illustrates the results of questionnaire processing that are related to technological issues.

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

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

Table 4 - Results of questionnaire processing 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 2-8 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 enjoy positive attitudes such as libraries, whereas others suffer from negative attitudes, such as Federal Tax. It can therefore be assumed that citizens would place greater ‘trust’ in electronic transactions with Libraries 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-personalised by call centres 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 e.g. TV or radio commercials; rather, organisations 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, notices for payments etc), an extra leaflet listing the available electronic channels for conducting the transaction would suffice. Central portals would 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, A. and Macintosh, A., 2003). This can only be achieved by ensuring service users that:

- private data they submit remain confidential
- their data cannot be 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, which incur no direct costs. Notably, some governments or local administrations have policies of 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 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 population. 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, hindering thus 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, real estate transactions etc. 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), are 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, colour-coding should be complemented with other distinction means for colour-blind users, frames should be avoided if possible, font sizes should be user-selectable etc.

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

<i>Question</i>	<i>Mean value</i>	<i>Standard deviation</i>	<i>90% confidence that mean value is greater than</i>
Phone/fax support was readily available when on-line help was insufficient	3.1	1.03	2.83
On-line support was adequate when I got stuck	3.8	2.04	3.27
e-service failures of the past are not bound to be repeated	3.91	2.18	3.35
I am not concerned about the “de-personalisation” introduced by e-services	4.1	2.69	3.41
I always know which e-services have been deployed	4.52	1.48	4.14
I am confident that the data I submit will not be disclosed	4.54	2.73	3.84
I can easily locate the web site that offers a specific electronic service	4.7	2.64	4.02
I am confident that the data I submit will not be misused	4.79	2.99	4.02
I am confident that the data I submit will remain confidential	4.81	1.85	4.33
I am confident that no fraud will be committed	4.83	2.80	4.11
Characters in an e-service were big enough for me to read, or they could be appropriately customised ¹	4.89	2.96	4.13
I am confident that the documents I submit using an e-service will be processed	5.3	2.25	4.72
I could easily navigate across different forms and form elements	5.82	2.47	5.18
I never missed a chance to use an electronic service because I did not know it existed	5.83	2.42	5.21
I would use a tax return form electronic service	5.89	2.92	5.14
The cost for using the e-service is small/negligible	6.43	3.70	5.47
Services are available in a language I am fluent with	6.51	3.20	5.68
Symbols and metaphors used in the service are always known to me	6.58	3.41	5.70
I have enough computer knowledge to use e-services	6.64	3.59	5.71

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

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

In Table 5, 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

¹ Only the answers of service users with sight impairments were taken into account

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”.

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 organisation. 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 to the organisation and modifications of job descriptions. Employees may be opposed to such changes for several reasons. The study has revealed objections to giving up of working methods and habits, negative stance against changes in the working environment etc, as shown in Table 6.
3. *fear of job loss*. Many employees, especially ones involved in the paper-based service delivery channels, perceive the introduction of electronic services as a threat jeopardising their jobs. The 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 illustrates the results of questionnaire processing that are related to social issues.

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

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

Table 6 - Results of questionnaire processing related to social issues

CONCLUSIONS

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

Having available the information presented above, e-service stakeholders can plan their e-service roadmap more effectively. Firstly, the impediment lists presented in section “Barriers to Electronic Services” have to 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 organisation. 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 section “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 the e-service stakeholders, the predominant opinion was that in the general case legislative issues should be addressed first, 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 though that concerns regarding the legislation have been found dependent 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 (thus strict confidentiality requirements are needed), data integrity and authenticity requirements should be defined, cases of submitting both electronic and paper documents should be catered for (while for the birth certificate this will simply result to two certificates being issued) and so on. 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. multi-lingual 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 organisation (such as progress monitoring and development of executive awareness) could be assigned smaller priorities.

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