

OPEN STANDARDS AND THEIR EARLY ADOPTION: IMPLICATIONS FOR THE GOVERNMENT POLICY

A DELPHI SURVEY

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Summary

As the issue of open standards becomes more involved in government policy-making, an understanding of various perspectives on issues involved in the governance of ICT infrastructure is crucial. This research presents results from a multi-round Delphi survey of key experts in the field of standardization to better understand which issues in governance of open standards must be taken under the government policy control within the next 5 years.

1. Introduction

Influential researchers consider that in post-industrial service-intensive societies informational processes are so critical that governments need to take an active role fostering an Information and Communications Technology (ICT) infrastructure that creates equal access to and an even distribution of knowledge among citizens and businesses, and ensuring the security of this critical infrastructure (Castells, 1996). A modern society requires government efficiency and effectiveness that scales with citizen knowledge and competence and therefore requires standards for effectively implementing interoperability and interchange. The ICT infrastructure interoperability requirements are met by the adoption of broadly recognized standards that do not bias solutions towards specific implementations. Critical infrastructure protection comes with a government policy and action enforcing relevant standards. Efficient government agency-to-business, agency-to-citizen, and cross-agency operations are possible only through a policy formulation including relevant standards and their adoption in government operations ensuring all relevant stakeholders equal access on equal terms to government services each using their preferred standards compliant application.

Publication of research paper 3 on open standards and their early adoption reports on salient issues for governments' open standards policy. In this report we aim to come to grips with issues in standardisation that are the most pertinent to governments at this moment in digitalization of government operations and services to citizens and business.

In the previous studies we have had other objectives:

- In the first report we outlined findings from research into the conception of open standards and the significance of standards to the field of information and communication technologies. Recent studies of the economic impact of international standards reported on significant, long-term productivity effects but studies of economic impact of open ICT standards are still lacking. Studies of the interplay between innovation and standards have generated contradictory findings leading to interpretations explaining these in terms of the timeliness of standards relative to the maturity of the relevant application markets.

- In a second report through the literature review we identified these issues on digital government and open standards that the literature addressed as prevalent. The listing of these into major categories was prepared as a first step to conduct the following research using the Delphi method (see beneath for an explanation).

On the backdrop of the work completed and presented in the first two reports, the aim of this work is to identify important issues related to government policy with regard to open standards and the development of national ICT infrastructure. eGovernment implementations and development of ICT solutions are focal points of this report within the overall idea of a governance framework for open standards and their early adoption.

The importance and currency of our research work are prompted by the growing trend toward open ICT systems and standards as seen through policy actions of national governments, corporate statements of leading global ICT vendors, and consumer demands across many countries in the world.

While the global trends and the currency of this work are clearly the drivers for research, there are numerous barriers that we are facing. Those barriers are mostly attributable to the novelty of the topic (open standards in government policy), scarcity of available literature focused on the very research questions we are pursuing answering, and the general problem of the complexity of the governance of ICT infrastructures. These barriers are truly impressive as the following indicate taking the last mentioned first.

Complexity of the governance of infrastructure development is not a recent problem (Brey, 2003; Ciborra, 2001; Edwards, 2003). Ciborra described corporate information infrastructures and the design and implementation processes that lead to their construction and operation as puzzles, or collages, which are embedded in larger, contextual puzzles and collages (Ciborra, 2001, p.2). “Interdependence, intricacy, and interweaving of people, systems, and processes are the culture bed of infrastructure” (Ciborra, 2001, p.2). Perplexing nature of national ICT infrastructure is a barrier to policy makers in developing appropriate governance models.

Axelrod and Cohen (1999, p.12) argue that a standard procedure of design and policy making for complex organizations is to develop expectations of how the future will unfold and to define actions that would lead to more desirable predicted futures. This approach requires an expert knowledge from similar past developments. The problem is, creation of a new economy is a novel undertaking. Many large-scale developments of the industrial age saw fiasco and, according to Ciborra, “those very principles that were supposed to govern the emergence of the industrial society are even less applicable to the information society” (Ciborra, 2001, p.5).

An alternative approach to cope with difficulty of national policy-making is a generation of various forms of scenario derived from identification of the driving forces of the system (Axelrod and Cohen, 1999, p.12). This approach requires a comprehensive understanding of the *system* and *forces* that operate within it. Moreover, understanding of processes that bring the elements together into a complex network is also required.

While leaving the issue of national ICT infrastructure architecture (i.e., *the system*) outside the scope of our report, it is our intention in to analyse *the forces* that shape its build-out.

2. Governance of the ICT Infrastructure

2.1. What is infrastructure?

ICT Infrastructure (II) is a kind of large-scale initiative that requires mobilization of resources, creation of laws, formulation of political will, and legitimation of ideas. Infrastructures evolve from

different and relatively independent technologies that are meshed into a single overarching structure (Ciborra, 2001; Edwards, 1998; Keen, 1991). To become integrated into an infrastructure, technologies must be harmonized in technological and socio-institutional terms. This is a question of forming a novel socio-technical configuration linking regulatory frameworks, communication structures, user practices, maintenance networks, etc. (Geels, 2002, p.1257).

The formation of large structures such as ICT Infrastructures requires coordination of activities between and within diverse stakeholders involved and alignment of their varying (if not conflicting) interests. This kind of coordination is achieved through the use of standards and conventions of practice (Faraj, et al., 2004; Lyytinen and Fomin, 2002). If infrastructures are the “connecting tissue of modernity” (Edwards, 2003), then standards are the fibres of the infrastructures. It is aggregation of elements by the means of standards that results in the formation of large and complex systems bringing about entirely new properties at each level of complexity (Anderson, 1972, p.393).

As we witness all parts of society becoming more integrated with and by the means of IIs, the socio-institutional and the technological aspects of infrastructure development become intertwined and inseparable. As a result, the identification and assessment of *forces* that operate during the ICT infrastructure process becomes an increasingly difficult task.

2.2. The role of standards in information infrastructure development

One way to understanding *forces* that influence the degree of success of infrastructural development, is through examining processes that lead to continual expansion of the infrastructure. Continuity of infrastructures is in their function – infrastructures as technologies phase out and die, but as functions – they live and grow (Edwards, 2003). The emergence and growth of ICT Infrastructures is sustained by the addition of new *standardized* components and/or services to the existing ones.¹

One can define several important roles that standards play in the process of building information infrastructures. On the *technical* level, information infrastructures demand standards that enable interconnectivity of multiple technologies, or “gateways” (Hanseth and Monteiro, 1997). Creating “gateways” is a highly complex socio-technological task, which includes designing communication and technical interface standards, testing and adapting these to a wide range of different use situations, and ensuring that the standards are developed according to the procedures of recognized standardization bodies, if such exist (Hanseth and Monteiro, 1997; Lyytinen and Fomin, 2002).

From an *organizational* viewpoint, standards align diverse interests of participating groups (Geels, 2002). In fact, interests of these social groups (government organizations, engineers, entrepreneurs, consumers, etc.) *must* be aligned if the development of the technological system is to proceed (Lyytinen and Fomin, 2002). Standards provide a means for system builders and entrepreneurs to share their perspectives, and to gain understanding how the technological potential can be made to meet diverse ends. By doing so, participating groups can better negotiate the desired technical and economic properties of the technology (Bekkers and Liotard, 1999).

Hence, standards inscribe and embed large socio-technical networks of developers, users, and government institutions, and provide a powerful means to create relational aspects of infrastructures.

From an *economic* viewpoint, competition between system standards often leads to a situations where “a winner takes all” due to strong positive network externalities and resulting increased returns. A body or a firm, which successfully establishes a technical standard in a new technical regime, receives normally large returns, whereas its competitors may be effectively locked out or provided only with residual market niches (Schilling, 1998).²

¹Existing infrastructure to which new components/ services are being added often is referred to as installed base.

²Sometimes this “battle of the systems” can culminate with the invention of devices that make possible the interconnection between incompatible systems Hughes, T.P. "The Evolution of Large Technological Systems," in: *The social construction of technological*

Finally, technologies with a high momentum normally spawn a number of competing suggestions for the correct “technical solution”. In such situations standards are both necessary and helpful in that they early on limit the technical design space and help obtain a sufficiently fast implementation of a working design with a large enough user base. This is critical for the emerging markets, where chaotic competition needs to be organized relatively quickly around a relatively stable set of system concepts (Edwards, 2003), otherwise the technology may lose its momentum. Standards thus help reduce the risk of entrepreneurs as well as consumers thereby increasing the momentum behind an emergent system solution (Edwards, 2003).

2.3. Obstacles to ICT infrastructure governance

The aim of this work is to obtain insights on the *governance and policy issues stemming from or related to the adoption of open standards in the public sector's ICT infrastructure*. Given this task, one must immediately note that there is a variety of perspectives on standards and infrastructural development, as summarized above, and hence approaches to their governance.

Standards and their adoption can be studied, for example, from the perspective of timing, the degree of openness, the level of compatibility, the economic and market effects, among others. When it comes to the studies of standards in relation to government policy, the issues of *timing, openness, interoperability, and economic effects* become the most relevant ones.

Economic implications for policy formation with respect to standards are partially stemming from a commonly argued fact that the standardization process and the innovation process are linearly related³ (Blind, 2004, p.188). A recent study in the UK showed a u-shaped correlation between standards and innovation, suggesting that in a stage with few standards, they may hamper innovation due to lack of information, just as well as in a stage with very many standards, they may hamper innovation by the sheer problem of navigating between them. A “medium” number of standards is associated with the most positive effect upon innovation activities where both the number of standards and the median age of standards seem positively to influence innovation activities (op.cit. p. 38) When combined with the issue of timing, significance of standards development can be easily noted: wrong timing in standardization process can lead to economic inefficiencies. So, for example, premature standardization can lead to adoption of sub-optimal technology as a standard. A late standardisation may result in switching costs for adopters of non-standard solution to the newly standardized one being too high (Blind, 2004, p.188). On the macro scale of a long term nation-state's development, such theoretically predictable inefficiencies can result in losing a leading position in the world rankings of global ICT leaders, not mentioning the negative economic effects on business and consumers.

Obstacles to ICT infrastructure governance are also found in the migration costs facing users of established standards when new technological bases have proven worthwhile to early adopters. Shifts in technological base in ICT has been divided into five eras covering the last 50 years (Dickson and DeSanctis 2001). These shifts are summarized as represented in isolated machines (1954-63); distributed access to mainframes (1964-76); midrange computers (1977-84); personal computers (1985-96); and personal digital assistants, mobile technology and the Internet (1997-) (Op.cit.). While these five eras of ICT history generated the present foundation of today's applications, it is not before the commercialization of the Internet in the early 1990s that we can talk about an emerging ICT infrastructure because it is only then when companies started using the internet and digital technology for business information, collaboration, negotiation, contracting and payment. Mutual benefits of a telecommunications network integrated with a computer network have generated the base for the new information infrastructure (II) that we have seen emerging in the last 10 years.

systems: New directions in the sociology and history of technology, W.E. Bijker, T.P. Hughes and T.J. Pinch (eds.), MIT Press, Cambridge, 1993, pp.51-82.

³ Swann argued for a U-shaped linear relationship (DTI 2005, p.37-38).

Today, we are facing the huge migration costs of ICT structures built in previous eras of computerization and never fitted to present day operations. Yet, understanding the future ICT needs are today contested not only by vested venture interests but also by large corporate interests and by new, active players, governments. Where the Bangemann report (The High-Level Group of the Information Society, 1994) would keep all doors open for innovative computerisation development, today's governments must look at their own costs of adopting such an open door policy to vendors. A policy report to an agency in the US Department of Defence has made it clear that due to skyrocketing maintenance and development costs the traditional way of procuring and operating ICT is not a feasible solutions in the future, even in high priority fields like that of the US Defence Department (Hertz, Lucas and Scott 2006). The objective is a frequently updated and flexible technology application pool and that must be based on open standards technologies and open source software based applications.

Governance of ICT infrastructure development needs new instruments both in the hands of (user) businesses and governments beyond the developers. Not having globally accepted standards presents an obstacle to governance of ICT infrastructures. Governance requires but more than standards: architecture of ICT delimitations and boundaries found applicable in the user organisation.

Competing claims for the future based on vested business interests meet government claims for a standards based development of infrastructures to avoid the calamities of the past (O'Reilly 2005).

3. Literature review

In order to avoid undesirable consequences in the development of national ICT infrastructures, the ambiguity associated with future technology development trajectories must be minimized. The goal of technology policy-makers is to provide a predictive assessment of the success of infrastructure development, given specific choice of technology standards the infrastructure will be based upon.

It is with this goal in mind, that we attempt to aid decision-makers in developing better governance models. We do this by identifying the wide range of interests held by different industry and government stakeholders and providing assessments of the relative importance and urgency of forces in driving standardisation.

3.1. Economics

After reviewing theoretical and empirical work on standardization and its relation to technical change, Blind concludes, that standardization can trigger not only positive, but also negative effects for overall economic development (Blind, 2004, p.193). Whether the economic effect of standardization will be positive or negative depend on a number of factors, such as timing, interface compatibilities, variety-reducing effects, cost-cutting rationalization, etc., – too many to make a sensible theoretical prediction. However, the uncertainty of the problem can be reduced if the economic considerations are analysed in the context of technical interoperability.

ICT products derive much or all of their utility from the interoperability obtained by implementing compatibility standards. In his review of economics of open standards, West (2006), summarizes the economic effects of interoperability. These, according to West, include:

- direct network effects, where increasing adoption by other users of a given standard increases the utility of that standard to the focal user;
- specialized complementary assets⁴, where popular standard attracts a larger supply of complementary products, which in turn increases the attractiveness of the standard (this

⁴ Teece, D. "Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy." *Research Policy*, Volume 15, Number 6, 1986, pp. 285-305..

- positive feedback model provides “demand side economies of scale”⁵);
- switching costs and lock-in effects, which are created by users' investments in specialized assets (i.e., the standard), such that users tend to keep the same standard once adopted;
- up-front research and development (R&D) costs⁶, which are necessary to create both the standard and its implementation.

Given these factors, ICT vendors seek wide adoption of their respective proprietary standards to provide an ongoing stream of rents, while ICT buyers seek out less proprietary alternatives. Thus, West (2006) argues that while open standards have long been considered the universal good for technology users, in real business life different stakeholders assign different priorities to various dimensions of openness. Some stakeholders do not prefer the most open alternative for varying reasons.

However, for ICT vendors/suppliers there are also positive economic effects stemming from open standards. Open standards help consolidate a larger customer base (as opposed to offering products/support based on disparate proprietary technologies). The same effect occurs to end-users – vendors are pooled together, which increases competition and drives the prices down, producing better quantity and quality of end-user options (Sliman, 2002).

It is also generally accepted, that availability of (open) standard reduces the risk of investment through obtaining a durable solution⁷.

The reduction of risk stems from the lower probability for the adopter to become “angry orphans” - to become users of an abandoned technology/platform. Another type of risk, which is reduced, is that of running into interoperability problems, which in economic terms translates to reduced transaction cost for negotiating interoperability agreements.

The tension between the push for proprietary standards by vendors and demand for open by end-users is further complicated by existence of competing standards. In their work on transaction cost theory of standardization, Reimers and Li (2005, p.303) argue that existing economic theories (based on the concept of positive network externalities) can neither explain the phenomenon of colliding standards initiatives (if prospective network participants base their decisions on existing network sizes/structures) nor explain successful standards initiatives (if prospective participants base their decisions on expected network sizes/ structures) except on rather restrictive assumptions. This has a direct implication for policy formulation, when policy-makers are attempting to “bet” on one standard over another in defining it as mandatory (de jure) standard.

Another important implication for standards policy that Reimers and Li (2005, p.308) allude to, is that when standards initiatives are supported by more than one SDO or trade association representing overlapping business networks, adoption of those standards can be slowed down or even blocked.

3.2. Public good and compliance

There are other dimensions of product interoperability pertaining to standardization processes. One of those is the role of standards in vertical industry business transactions. In a recent special issue of *Electronic Markets* journal, Wigand, Markus, and Steinfield (2005) introduce the focus theme of the vertical industry standards by stressing the role of open standards in the emergence and adoption of XML-based EDI standards in different industries.

⁵ Katz, M. L., and Shapiro, C. "Network Externalities, Competition and Compatibility." *American Economic Review*, Volume 75, Number 3, 1985, pp. 424-440..

⁶Where such R&D costs are high, they combine with network effects and switching costs to create a barrier to potential competitors through increased returns to scale; thus, the most popular standard tends to gain increasing advantage over second-tier rivals. West, J. "The Economic Realities of Open Standards: Black, White and Many shades of Gray." In *Standards and Public Policy*, ed. Shane Greenstein and Victor Stango. Cambridge: Cambridge University Press, 2006 .

⁷This idea is closely related to that of future-proof of open standards based solutions (see page 8).

While the firm- or industry-level unit of analysis per se is outside the focus of our analysis, there are several important lessons we learn from the work of Wigand et al. (2005). Specifically, that vertical standards development, while so crucial for industry-wide interoperability of ICT applications, has a public good problem – the standards development process is often (if not always) driven by large companies, while the adopters are small companies. It does not take a huge leap of imagination to substitute the “industry” concept with that of “country” and look at the problem through the prism of public sector agencies as “adopters.” As an example, one can think of a municipality being an adopter of a W3C standards on Web accessibility: A municipality may lack resources for assuring appropriate testing and/or acquisition of development tools to assure compliance with the standard's specifications. Another example would be reluctance of a company providing web hosting service to the municipality to embark on compliance testing, and the lack of the municipality's economic and/or political power to force the supplier act otherwise.

A policy issue becomes whether the degree to which the standards implementations deliver the promised interoperability can or should be mandated conditionally and for how long time.

In an interoperable public sector public agencies need sync their migration to open standards based applications with other agencies to increase economic benefits. An optimal provision of open standard implementation balances vendors supply and agencies adoption schedule, which demands mutually aligned expectations and governance maturity to succeed. This may happen only if government takes an active part in setting the stage for this development, conditional on a level of centralized and coordinated actions.

3.3. Syntax and semantics

Disproportionate sizes of developers and adopters, as well as varying sizes of adopters, not only may cause compliance problems, but also create a risk of encountering functional and/or semantic problems when establishing interoperability processes based on common standards (Wigand, et al., 2005, p.286).

Zhao et al. (2005) point at the apparent lack of standards for syntax and semantics for existing Internet-based (interoperability) standards. “Even though the proliferation of new technologies, especially the XML, has laid the foundation for firms to facilitate information sharing, standards are needed to define the syntax and semantics of information sharing” (Zhao, et al., 2005, p.289). Further, they stress that the role of standards in, and the importance of information sharing has been recognized by many industries as the foremost issue to tackle in order to increase efficiency of electronic communications and business. Zhao et al. (2005, p.290) also note that vertical industry standards are different from traditional IT standards in that there is a more significant role of user groups and less fierce competition among standard adopters in the standard development and adoption processes.

3.4. One-stop service experience

While the term “e-business standard” intuitively may seem irrelevant in the context of public sector, the actual definition of the term proves contrary: “standards that entail inter-organizational web-based communications, transactions, and business processes” (Zhao, et al., 2005, p.290). Thus, a simple substitute of e-business for e-service, for example, brings the arguments of Zhao et al. (2005) to the heart of polemic on Danish public sector's service digitization. Indeed, the demands that end-users of e-business systems place on systems providing different commercial services, and the demands and expectations of citizens in advanced information society are no different – a real-time integration of information across horizontal and vertical layers of public sector's agencies for a one-stop service “shopping” experience.

The acceptance and adoption of open standards by major global vendors such as IBM, HP, and Oracle have created a growing assortment of open-standard-enabled products and services (Simon, 2005, p.228). This accelerated the adoption of open-standard-based products by governments, which are under constant pressure to provide more efficient and reliable services. Specifically, there is an increasing demand for vertically and horizontally integrated services, spanning organizational, administrative, and even national boundaries (Simon, 2005, p.228). The use and reuse of data across public digital registers is another important requirement for the contemporary policy, realization of which requires the use of open standards (ICA, 2005).

3.5. Timing and maturity of standards

Another important issue in development of vertical industry standards (or for that matter vertical public sector standards) is that of technical maturity of underlying technologies, as emphasized by Zhao (Zhao, et al., 2005, p.296). When systems in use (that have to be interoperable) are based on different ICT technologies, different strategies for pursuing choice of interoperability standards should be taken. So, for mature systems, the emphasis should be on resolving interconnection problems, and different stakeholders' conflicting interests. In the case of emerging technologies, however, the standards setting work should be focused on emerging or anticipatory standards.

Another aspect of time and maturity is that of evolution of standards. As there is a shift from interoperability in vertical markets to interoperability in horizontal markets, this calls for open standards developed in open environments that allows for the evolution of specifications (Schoechele, 2005).

3.6. Future-proof

Open standards, such as the Structured Query Language (SQL), have proven to have higher durability over time than proprietary solutions (Sliman, 2002). When no single proprietary vendor has a control over the standard's specifications, i.e., not having enough power to force the adopters replace/ upgrade (as it is common with e.g., new versions of Microsoft Office Suite) the standard-based product, the end-user can continue to use the standard-based technology until something else has proven to meet her requirements better (Sliman, 2002).

3.7. Goals of participation

Drawing on their study of the emerging open standard for financial statements and reporting – XBRL – Chang and Jarvenpaa (2005, p.366) argue that in the case when stakeholders of standardization process are not only user organizations and SDOs, but government /regulatory agencies themselves, the regulators must closely collaborate with the standards organizations to ensure that emerging standard specifications (software code) and regulations (law) work together rather than against each other. In other words, here is a case for early action on behalf of a government as seen in US banking regulatory reporting process.

The decision process and the barriers to participation – whether direct or indirect – have a major impact on whose goals are served in standardization. These goals might include the following:

- Matching existing implementations. One concern is to make standards consistent with existing investments—particularly when standardization is used to codify and harmonize existing implementations. In such *post hoc* standardization, users and complementers want new standards upwardly compatible with the standards they have already adopted. Vendors want the formal standard to closely match their existing de facto implementations.
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- Alignment of technology. Beyond patents, potential implementers have varied technological

expertise, and thus seek to influence the standard in a direction that will give them a (often transient) competitive advantage in implementation. Such tensions are rarely documented outside the SSO; a rare exception is Bekkers' (2001) account of the French and German goals in GSM standardization.

Attempts to make SDOs more open can destroy the revenue model that allows these organizations to operate (West, 2006). Not having a model how to finance standardization with low cost barriers to participation jeopardizes standards initiatives from user associations and others not in a position to capitalize directly from a new standard. High cost standardization processes tend favouring vendors excluding other stakeholders.

3.8. End-user perspective (accessibility, user-friendliness, etc.)

In the context of public sector services, there are different types of communication taking place. Communications between an administration and an enterprise or citizen (G2C)⁸ could be of both 1-to-1 type, and many-to-many, where multiple transactions are possible, services are integrated and transactions between administrations and enterprises and citizens are fully automated (IDABC, 2004). Establishing this type of communication would mean connecting applications which belong to different administrations and which are located in different locales of administration – e.g., in different communes or even Member States. In this complex set-up, only by building on universally agreed open standards and specifications a meaningful interoperability can be achieved.

Moving towards simple, transparent, and user-friendly services is important, as users value less complexity. End-user's access to different kind of services through a single device can not be made possible without technology convergence, which in turn requires open standards (Schoechle, 2005).

3.9. IPRs

The increasing need for interoperability of systems and services drives technology convergence, which in turn drives standards convergence. Increasing demand for interoperability emphasizes the need to collect standards and IP requirements into system specifications that allow products to interoperate. Just as standards of technology are important, a standard for IP is also important to foster interoperability (Schoechle, 2005).

When governments mandate a standard from a standards organisations the SDO may be tempted to exploit the standard as a cash-cow demanding high fees for use of the standard. If this forfeits the purpose of “industry standards to serve the important function in society by allowing everyone in that industry or field to use the standard for effective communication”, why copyright law should not be applicable to protect such standards (Samuelson 2006, p.30-31). In the U.S., SDOs have been suing institutions which have offered free access to SDO's standards to avoid imposing user costs in adapting to another standard than a widespread industry standard. In these cases copyright law should not be used to protect a standard. This also applies to “design of computer program interfaces though it seems to qualify for copyright protection. However, once an interface has been developed, the parameters it establishes for the effective communication of information from one program to another constrain the design choices of subsequent programmers. The interface thus becomes an unprotectable functional design” (Samuelson 2006, p.30). In open standards the clause of no or negligible fees must apply to help avoid misuse of a market position.

IPR issues also affect collaboration among SDOs. IP terms and conditions in one body may not apply to another. Openness of standardization process becomes a cornerstone for collaboration – collaboration is not possible if documents are not available to SDOs involved in a standards project (Schoechle, 2005).

⁸Government-to-citizens.

3.10. Issues in open standards policy

Through the literature review (Fomin and Pedersen, 2006), we have identified nine important issues pertaining to open standards and ICT infrastructure development policy making (see Table 1). However, doing the literature review proved to generate more questions than answers. We realized there was a need to validate the literature review findings.

Table 1. Issues pertaining to standardization and policy-making

Issue	Description
Economics of standards	A broad category including, but not limited to network economics, switching costs, R&D investments, and investment risk management through standardization.
Public good and compliance	Governance of ICT infrastructure and services through specifying the degree of compliance (recommendation, mandate) to government supported standards by different stakeholders (vendors, government organizations as end-users).
Syntax and semantics	Semantic and syntax interoperability problems in establishing data and process exchange on the national level, and between the nation states.
One-stop service experience	Establishing real-time integration of information across vertical and horizontal layers of public sector's agencies to satisfy the growing demands of end-users for one-stop information access
Assessment of technical maturity of standards	Whether the interoperability, conflicting interests of stakeholders, and ICT architecture- related issues should be decided upon only when mature international (open) standards are available
Future-proof	Control over standards specifications vis-à-vis government agencies' and citizens' power to force vendors assure data accessibility and version control of the software/data formats.
Goals of participation	Should the government be active in monitoring emerging standardization in early state in order to ensure coherence and compliance with existing ICT policies and open standards.
Accessibility	The perceived need for developing e-services based on concepts of simplicity, transparency, user-friendliness, and security to promote trust in public administration.
Intellectual Property Rights (IPRs)	Should there be an explicit policy on IPRs in ICT infrastructure development?

Besides unanswered questions, there is criticism of existing approaches adopted by policy makers towards public sector services and ICT systems. So, for example, Ilshammar and colleagues (2005, pp.35-36) stress that the contemporary debate on e-government is much concerned with interoperability issues, often discussed in terms of Enterprise Architecture. For ICT policy to be successful, it should go beyond the technical interoperability rationale, and have a long-term perspective and focus on strategic problem areas in society.

Another point of criticism in studies of ICT development and policy, is that the political focus is almost always on the producers of ICT systems and services, and on the administrations, but not on the citizens or end-users (Ilshammar, et al., 2005, p.36).

Given the variety of perspectives on the role of standards in ICT infrastructure development in

general, and public policy specifically, and the criticism on existing studies, we felt that the importance and relevance of nine identified issues must be validated. Our aim was to find out to what extent the nine issues should be taken into consideration by decision-makers in developing ICT governance policies. We chose the Delphi method for validating the findings of the literature review.

4. Research methods

The thrust of this work is on the Delphi survey. The Delphi methodology was one of three different methodologies utilized as a part of the larger research effort. In order to obtain a list of issues to be presented to the experts of the Delphi survey, an exploratory sense-making study and literature review were conducted prior to conducting the Delphi survey. The exploratory sense-making was needed to identify general issues related to the subject of governance of ICT infrastructure vis-à-vis the role of open standards and potential economic benefits stemming from their adoption (Pedersen and Fomin, 2005). The literature review aimed at identifying specific issues for open standards and policy-making (Fomin and Pedersen, 2006). Finally, the Delphi survey was conducted to validate and enhance the findings of the other two studies (see Figure 1).

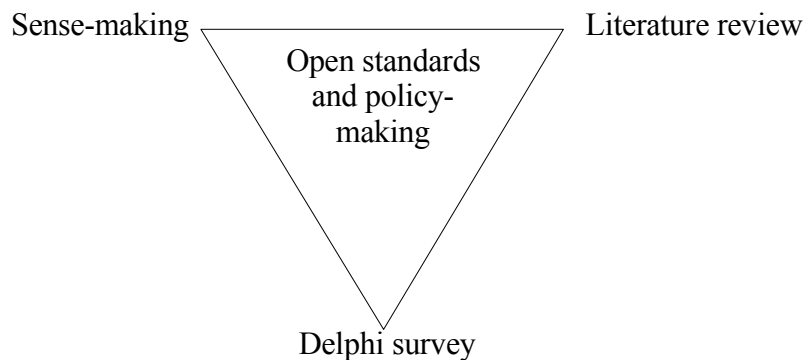


Figure 1. Triangulation approach

4.1. The Delphi method

The traditional Delphi method is one of the effective methods for forecasting by obtaining expert opinions and moving them towards consensus through the feedback mechanisms (Brancheau, et al., 1996; Chang, et al., 1995; Delbecq, et al., 1975). When technology and market development decision makers are challenged by technology choice uncertainty and large scale projects that haven't been attempted before (Hawkins, 1995), highly qualified experts are asked to provide their opinions on pre-defined set of issues.

The Delphi method employs a series of linked questionnaires (Delbecq, et al., 1975), where successive rounds of questionnaires summarize experts' responses to the preceding questionnaire and ask respondents to re-evaluate their opinions based upon the summarized results (Brancheau, et al., 1996, p.266), until a reasonable level of consensus is achieved. Anonymity and feedback represent the two irreducible elements of the Delphi method (Gordon, 1994).

In Delphi surveys on policy issues, typical questions are aimed at discovering desirability of future states, as well as likelihood for achieving this policy within a certain time frame (Gordon, 1994).

The original impetus behind the method is to seek consensus, because expert consensus is believed more likely to be accurate than an individual forecast. However, in the diverse and complex contemporary environment of technology policy-making, consensus is less important than crystallization of reasons for dis-sensus (Gordon, 1994). The Delphi method is seen more as a systematic means of synthesizing the judgements of experts (Gordon, 1994).

4.2. Suitability of the Delphi method

The use of Delphi to forecast the future of technology and business domain is not new. The Delphi method was argued to be well suited for making forecasts for nascent⁹ markets (Mitchell, 1992). Specifically, there are several reasons for that, according to (Mitchell, 1992, p.4). Below, we summarize on specific characteristics of nascent industries and markets, which are most relevant for the policy making and open standards:

- In the early stages of technology market development, there is a tendency for unrealistic expectations and media hype. This holds for the role attributed to open standards in modern ICT industries – open standards are often seen as a universal good and a panacea for incompatibility and interoperability problems at different levels. Besides, quite on the contrary, there can be much doubt over the viability of technology and its claimed benefits, leading to decrease of consumer confidence.
- Rapid growth of technological variety and trajectories increase the risks involved in organizational decision making. These risks can be reduced by gaining better information regarding the future development in the subject domain.
- High rates of innovation and variety of alternatives increase the risk of betting on a wrong technology/standard.
- There is a need to have a long-term focus.
- There is a need for long-term forecasting.

The aforementioned characteristics of nascent markets make the Delphi method a useful tool, as it is most appropriate for forecasts on issues which cannot be made easily, if at all, subject to analytical techniques (Mitchell, 1992, p.5). Subjective judgments on a collective basis help obtain more reliable forecasts.

Suitability of Delphi method to forecasting on future socio-technological trajectories in developing e.g., Information Infrastructures, is obvious since often at the time of decision making on any particular development trajectory, only the components of the infrastructure-to-be are known or can be anticipated by the decision makers. The forces, which will be acting upon the development process are not easily identifiable, let alone quantifiable (Mitchell, 1992, Axelrod, 1999). In this respect, Delphi is argued to be specifically applicable to deal with uncertainty in an area of imperfect knowledge (Mitchell, 1992, p.5).

Specifically for the field of standardization and government policy, Delphi provides the anonymity and group response feedback to help ensure that the diversity of views (e.g., there is a different perception of the benefits and plausibility of open standards for ICT vendors, government policy decision makers, and consumers, just to name the most prominent stakeholders) can be communicated to the experts for obtaining more weighed opinions. There is a need for an industry view, as opposed to specific stakeholder's view on the problem of open standards for government policy-making. Here it is important to note, that the success of Delphi research is critically dependent on the right kind of experts, who understand the issues, have a vision, and represent a substantial variety of viewpoints . Experts who participated in this survey were representatives of standards development organizations (SDOs), industry standardization professionals, academic staff researching and publishing on the issues of standardization, and government decision makers affiliated with ICT development policymaking in general or standardization policymaking specifically. A total of 18 experts have participated in the survey (the list of experts is given in Appendix 2), while opinions of 13 experts who participated in at least two rounds of the survey were taken for data analysis. This represents a sufficiently high number for the obtained results to be considered valid. So, a study by Delbecq et al. suggest that the number of experts should be 5 to 30. In a study by Martino , it is argued that with a panel of 15 experts in a given field, it is highly unlikely that another equally expert group will

⁹The term “nascent” is used to refer to relatively new industries which are technology based.

produce radically different results.

While the aforementioned arguments alone provide a good justification for the use of Delphi method in analysis of government policy on open standards, the method can and should be used in conjunction with other methods for better results (Mitchell, 1992, p.6). In this respect it is important to note, that we used Delphi to complement and validate the research findings of the literature review conducted at the initial stage of the project. By using Delphi as a validation tool, we expect to have strengthened reliability of findings.

4.3. Conduct of the survey

There was a time constraint on the collection of data due to the project's time span. This, plus the fact that most changes in Delphi response occur in the first two rounds, with some researchers reporting that not much is gained by iterating more than twice (Mitchell, 1992, p.7), the number of iterations was limited to three. We used a Web-based survey tool, which allowed facilitate the communication and data collection.

4.3.1. Structure of the initial survey items

The initial survey questionnaire was structured around the nine issues identified through the literature review (see Table 1). Introduction to the survey and invitation to the Web-based questionnaire were sent to the participating experts (see Appendix 2 for the list of experts). Participants were asked to provide their assessment of the 1) importance and relevance of specific issues, which were identified through the literature review as pertaining to open standards and policy making, and 2) the likelihood of having those issues to be incorporated in government policy within the next five years. The exact formulation of the questions was as follows:

- 1) “Please review these important standardization issues, and rate their relevance and importance in the context of an open standard government policy on the scale from 1 (completely irrelevant and unimportant) to 5 (highly important and relevant),” and
- 2) “Please review these important standardization issues, and rate the likelihood of each of the identified issues becoming directly addressed in government’s open standards policy within the next 5 years.”

The experts were also asked to provide reasons for their judgments.

Two feedback rounds were used to present the results of the previous rounds of survey, i.e. the variance in judgments and the reasons for the extreme judgments were communicated to each participant calling for reassessment. Experts were asked to reconsider their former judgments in view of the reasons for the extreme opinions (Gordon, 1994).

The group judgments' consensus calculations were based on the median, with “consistency range” being defined by the standard deviation. If no opinions outside the consistency range were found, the issue was dropped from the further round of the survey.

4.3.2. First round

Experts received invitation to log in to a Web-based survey featuring 9 issues pertaining to open standards and policy making. For each issue, experts were asked to provide a judgment on the importance of the issue in the governance of ICT infrastructure development, and the time perspective on taking the issue under government’s direct policy control. Experts were instructed to rate each issue on a 1 to 5 scale, as well as to provide reasons for their opinion. Finally, experts were asked to provide open-ended comments, if they felt that some important issues were not listed or some of the listed issues were unimportant.

Eighteen experts have completed the first round of the survey. For the consistency reasons, the answers of one expert, who has not fully completed the survey were excluded, leaving the total of 17 collected responses. A median was calculated for all answers. Standard deviation was used to set the “consistency range”, which divided the opinions between “within the accepted consensus range” and “outsiders”.

4.3.3. Second and third rounds

Only “outsider” opinions and their extreme opposition were presented in the summary sent out to each expert prior to the second and third rounds. Each expert, additionally, received his/her answers for the previous round of the survey as a reminder. Statistical feedback on the opinion range was also supplied (the median, standard deviation, “consistency range”, and the number of outsiders for each of the questions). After the completion, the statements were analyzed according to the first-round procedure. 12 and nine experts have completed the second and the third rounds of the survey, accordingly. For the consistency reasons, the answers of experts, who haven’t fully completed the survey were excluded, leaving the total of 11 and 8 collected responses, accordingly.

5. Data analysis

Analysis of the Delphi data is relatively straightforward. The Delphi study provides insights into the confidence that the selected issue are appropriate for government intervention and the likelihood of corresponding government policies being established within the specified period of time.

5.1. General trends

There are several general trends in the Delphi data that can be identified by a simple data analysis. First, by juxtaposing the experts assessments on the issues' importance and time perspective, we can clearly see that all the issues had a median importance rating of at least 3 (on the 1 to 5 scale), i.e., all the identified issues are perceived important. At the same time, the likelihood of implementing those issues in government policies within the next 5 years is rated as low (see Table 2), i.e., the median for time perspective is 2 for six out of 9 issues after the third round.

Table 2: Importance and timing of issues – summary

		Economics	Public good and compliance	Syntax and semantics	One-stop service	Technical maturity	Future-proof	Goals of participation	Accessibility	IPRs
Importance	Median Round 1	4	3.5	4	3	3	3	3	3.5	4
	Median Round 2	4	4	4	3	4	4	3	4	4
	Median Round 3	4	4	4	3	3.5	3.5	3	3.5	
	Outsider Round 1	13%	25%	19%	25%	38%	38%	25%	19%	19%
	Outsider Round 2	18%	27%	9%	27%	18%	18%	27%	9%	0%
	Outsider Round 3	0%	29%	14%	14%	14%	29%	14%	29%	
Timing	Median Round 1	2	3	2.5	2	2	2	2	2.5	2
	Median Round 2	2	3	3	3	2	3	2	4	4
	Median Round 3	2	3.5	2.5	2	2	2	2	2.5	2
	Outsider Round 1	19%	19%	6%	25%	19%	13%	13%	13%	19%
	Outsider Round 2	27%	36%	18%	9%	18%	36%	18%	27%	27%
	Outsider Round 3	25%	25%	13%	13%	13%	13%	0%	0%	25%

Further analysis allows us to identify issues perceived to be the most and the least important. We can also identify the issues, where there is the largest and the smallest number of outsiders, which indicates the most and the least of disagreement among experts on the importance of each specific issue.

From the 9 issues offered to experts for rating the perceived importance, *economics of standards*, *public good and compliance*, *syntax and semantics*, and *IPRs* were rated “4” on the 1 (least important) to 5 (most important) scale after the 2nd round of the survey.¹⁰ Those four issues are perceived to be the most important and relevant ones (Table 2).

The median rating for issues of *one-stop service experience*, *technical maturity* and *goals of participation* was “3” after the 1st round, and remained unchanged. Those two issues are perceived as the least important and relevant ones (Table 2).

We can identify issues, whose policy enactment is believed to not likely take place within the next 5 years (those with median 2), and those which are believed to have better chances to be incorporated into governments policies with the next 5 years (those with time perspective median of 3 and above) (Table 2).

From the 9 issues offered to experts for rating the time of policy enactment, *economics of standards*, *technical maturity*, and *goals of participation* were rated “2” after the 2nd round of the survey. Taking those three issues under the direct policy control within the next 5 years is perceived to be least likely (Table 2). Only the issue of *public good and compliance* had a median 3.5 after the 3rd round, while issues of accessibility and IPRs had a median 4 after the 2nd round (Table 2).

Finally, we can also see where the con- and dis-sent on timing issues resides. For the importance of the issues, after the 2nd and the third rounds there were more than 25% of outsiders for the issues of *public good and procurement*, *one-stop service experience*, *future proof*, *goals of participation*, and *accessibility*. These were the issues of the biggest dis-sent of opinions. For the time perspective of issues, after the 2nd and the third rounds there were more than 25% of outsiders for the issues of *economics*, *public good and compliance*, *future-proof*, *accessibility*, and *IPRs*. We can also see that there was more dis-sent for the time perspective, than for the importance of issues.

6. High-level analysis: reasons for con- and dis-sensus

After the superficial analysis of importance, time perspective, consensus and dis-sent, a more in-depth analysis on dis-sent can be performed – i.e., we would like to learn not only on what issues experts disagree the most, but also *why* there is a disagreement. According to (Gordon, 1994), when dealing with complex contemporary problems, such as e.g., governance of ICT infrastructures, crystallization of reasons for dis-sensus is even more important than reaching consensus.

For the high-level data analysis, we used responses of those experts, who answered at least two rounds of the survey. This gave us access to the answers of 13 respondents (see Table 2 and Table 3).

¹⁰The issue of IPRs was dropped from the 3rd round, as the consensus of ratings on this issue was achieved after the 2nd round.

Table 2. Final ratings for the importance of issues

Expert #	Economics	Public good and compliance	Syntax and semantics	One-stop service experience	Technical maturity	Future-proof	Goals of participation	Accessibility	IPRs
1	4	4	4	4	3	3	2	4	3
6	3	2	4	2	3	2	1	4	4
7	5	5	4	3	4	4	4	3	5
8	2	5	5	5	4	4	4	5	4
9	4	2	4	3	4	2	3	2	4
10	1	1	1	1	1	1	1	3	5
11	5	5	4	3	1	5	5	4	5
12	4	4	4	2	4	3	4	3	4
13	4	4	5	5	2	4	3	4	2
14	4	5	3	4	4	5	2	5	4
16	5	5	5	5	5	5	4	5	5
17	5	3	4	4	3	4	3	5	4
18	5	4	3	3	4	4	2	3	5
Median	4	4	4	3	4	4	3	4	
Std.Dev	1.206491319	1.309952797	1.026281851	1.211385827	1.186711432	1.216260639	1.206491319	0.948371385	
Range (min)	3	3	3	2	3	3	2	3	
Range (max)	5	5	5	4	5	5	4	5	
# of outsiders	2	3	1	4	3	3	3	1	
% of outsiders	15%	23%	8%	31%	23%	23%	23%	8%	

Table 3. Final ratings for the time perspective

Expert #	Economics	Public good and compliance	Syntax and semantics	One-stop service experience	Technical maturity	Future-proof	Goals of participation	Accessibility	IPRs
1	2	4	4	3	2	3	2	3	3
6	1	2	4	2	2	2	1	4	4
7	5	4	2	2	2	3	3	2	2
8	1	3	4	2	4	4	4	5	2
9	1	3	2	2	2	2	2	1	4
10	1	1	1	1	1	1	1	3	5
11	5	5	4	3	1	5	5	4	5
12	2	1	1	2	1	1	1	2	1
13	4	4	5	5	2	4	3	4	2
14	4	4	2	3	4	4	2	4	4
16	1	2	2	3	1	1	2	4	5
17	2	1	2	2	3	1	1	2	1
18	2	4	3	3	2	2	2	4	2
Median	2	3	2	2	2	2	2	4	3
Std.Dev	1.495555546	1.327898192	1.249852062	0.929465075	0.997037031	1.336780554	1.186711432	1.120016906	1.439098995
Range (min)	1	2	2	2	1	2	1	3	3
Range (max)	3	4	4	4	3	4	3	5	5
# of outsiders	4	4	3	2	2	5	2	4	6
% of outsiders	31%	31%	23%	15%	15%	38%	15%	31%	46%

We grouped experts' opinions for each issue into four segments “A” to “D” (see Table 4). Segments “A” and “B” contain expert opinions that assess the importance of a particular issue as high (rated “4” or “5” on a 1 to five scale in the Delphi survey). In segment “A” are grouped expert opinions predicting that a particular issue will be taken under direct policy control within the next 5 years (rated “4” or “5” on a 1 to five scale in the Delphi survey). Expert opinions in segment “B” predict that such outcome is unlikely (rated “1” or “2” on a 1 to five scale in the Delphi survey).

Segments “C” and “D” contain expert opinions which assign low importance to a particular issue (rated “1” or “2” on a 1 to five scale in the Delphi survey). Opinions in segment “C” predict that a particular issue will be taken under direct policy control within the next 5 years (rated “4” or “5” on a 1 to five scale in the Delphi survey). Opinions in segment “D” predict that such outcome is unlikely (rated “1” or “2” on a 1 to five scale in the Delphi survey).

Table 4. Ratings of expert opinions

Issue	Expert # (importance-time; segment)												
	1	6	7	8	9	10	11	12	13	14	16	17	18
Economics of standards	4-2 B	3-1	5-5 A	2-1 D	4-1 B	1-1 D	5-5 A	4-2 B	4-4 A	4-4 A	5-1 B	5-2 B	5-2 B
Public good and procurement	4-4 A	2-2 D	5-4 A	5-3	2-3	1-1 D	5-5 A	4-1 B	4-4 A	5-4 A	5-2 B	3-1	4-4 A
Syntax and Semantics	4-4 A	4-4 A	4-2 B	5-4 A	4-2 B	1-1 D	4-4 A	4-1 B	5-5 A	3-2	5-2 B	4-2 B	3-3
One stop service	4-3	2-2 D	3-2	5-2 B	3-2	1-1 D	3-3	2-2 D	5-5 A	4-3	5-3	4-2 B	3-3
Technical maturity	3-2	3-2	4-2 B	4-4 A	4-2 B	1-1 D	1-1 D	4-1 B	2-2 D	4-4 A	5-1 B	3-3	4-2 B
Future proof	3-3	2-2 D	4-3	4-4 A	2-2 D	1-1 D	5-5 A	3-1	4-4 A	5-4 A	5-1 B	4-1 B	4-2 B
Goals of participation	2-2 D	1-1 D	4-3	4-4	3-2	1-1 D	5-5 A	4-1 B	3-3	2-2 D	4-2 B	3-1	2-2 D
Accessibility	4-3	4-4 A	3-2	5-5 A	2-1 D	3-3	4-4 A	3-2	4-4 A	5-4 A	5-4 A	5-2 B	3-4
IPRs	3-3	4-4 A	5-2 B	4-2 B	4-4 A	5-5 A	5-5 A	4-1 B	2-2 D	4-4 A	5-5 A	4-1 B	5-2 B

In the following, we present digests of experts' opinions falling into different segments for each of the nine issues surveyed in Delphi study (Table 5 to Table 13). It is important to note, that the following sections contain only digests of experts opinions, and not authors' opinions.

6.1. Economics of standards

Ten out of the total 13 experts' responses share the view that economics of standards is an important issue in the government policy (see Table 5, segments "A" and "B").

Table 5: Economics of standards

Importance			
High (4-5)	Segment B		Segment A
	1, 9, 12, 16, 17, 18		7, 11, 13, 14
(3)	6		
Low (1-2)	Segment D		Segment C
	8, 10		
	(3)		High (4-5)
Likelihood of implementation			

Main reasons for assigning high importance to the issue of economics of standards in public policy is that the government policy makers must have understanding of the market mechanisms. Specifically, economics are important when establishing a balance between the public development and private supply. Both public administrations and private parties have to invest in ICT systems, therefore theories of economics of standards can be of help to make underpinned decisions. This is specifically

true in the light of divergent views on standards and ICT investments held by public vs. private entities. For private technology vendors standards are strategic coordination mechanisms of technology and market development. Public sector, on the contrary, approaches the issue of standards and its policy by the use of macro-indicators of economic development (e.g., GDP, trade balance, R&D, etc.).

Questions like “How to create a viable market for private vendors? How to foster user demand for products and services? How to protect users from lock-ins into proprietary solutions?” and alike must be answered by the policy makers attempting to control for economics of standards.

Unique role of the government in promoting adoption of open standards is in the governments' ability to mandate procurement policies, and in its obligation to protect end-users from solutions which can have negative economic effect on the end-user (firms, citizens, public administrations) in the long run.

Finally, governments are in a position to decide on the public good status of a particular technology or service, and evaluate standards and/or technologies against them being a barrier to innovation. Economic justification for participation in standardization is always required.

The reasons why experts believe the many issues of economics of standards will come under direct policy control within the next five years are primarily related to innovation and overall development. Avoiding switching costs in a rapidly developing ICT domain, where versioning and new generations of technologies became a commonplace are definitely a driver. Despite the overall confidence in that economics of standards will become a policy issue fairly soon, experts acknowledge that achieving a policy control on a large scale is difficult. Finally, experts affiliated with government agencies say that attention of the policy makers to those issues has recently increased.

As described above, expert opinions in segment “B” share with those of segment “A” a confidence in the importance of a particular issue, while differ by casting a doubt on the likelihood of a particular issue coming under the direct policy control within the next 5 years.

Experts whose opinions are grouped in segment “B” believe that Governments cannot control the economic models via policy, hence implementation of such policies is unlikely.

Among the reasons for little likelihood of policy implementation, is an opinion that governments have no resources or expertise to get involved, and that standards issue is outside the scope of government's interests. Government is believed not to be interested in open standards, save in a very short term pragmatic and superficial way. Government is not a risk-taker, not pro-active, and not business-oriented to assign high priorities for economic policies implementation on standard. Taking into account problematics of public sector's economics as whole, it seems unrealistic task for administrations to tackle with economics of standards.

Finally, an expert familiar with draft standardization policy of her country says that such policies are not foreseen to be implemented. Another expert comments that economic issues lie outside the scope of EU policy interests, left to the private industry and market regulation.

In the segment “D” there are 2 opinions, which continue the line of segment “B” on low likelihood of economic policy's implementation, and at the same time argue for low importance of economic issues for government policy.

One of the experts asserts that the issue of economics must be considered differently. It should not be focused on the costs of standards or standardization. Instead the cost-control policy should be “the same or less than before for the ever increasing number of services.” In support of this argument, the expert notes that it is possible for the government to avoid the issue of open standards all together by outsourcing ICT service developments and provision.

Experts familiar with the EU-level initiatives on standardization, note that, apart from some isolated initiatives (such as e.g., eGovernment Economics Project – eGEP), there is little evidence that economics of standards will become a major issue.

6.2. Public good and compliance

Eight out of the total 13 experts share the view that public good and compliance issue is an important aspect in the government policy (see Table 6, segments “A” and “B”).

Common infrastructure and services is a prerequisite for wide user acceptance. Compliance across the public service must be uniform or else the exercise will create nothing but confusion. Where it is a benefit to government, it makes sense to have procurement mandates that provide direction (and have these span many governments so vendors have a common target). Where a standard has significant public impact, it makes sense to consider regulatory requirements. However, demanding or recommending compliance is not simple. You don't just say 'comply with this'... it is necessary to be specific on precisely how suppliers should comply. Therefore, while legislation and regulations can be mandatory, standards' implementation should be voluntary. Compliance to standards is essential. Without specification of compliance requirements, standards are useless.

Table 6: Public good and compliance

Importance			
High (4-5)	Segment B 12, 16	8	Segment A 1, 7, 11, 13, 14, 18
(3)	17		
	Segment D 6, 10	9	Segment C
Low (1-2)		(3)	High (4-5)
		Likelihood of implementation	

The governmental support for OSI, for example, might be a wrong choice with the knowledge of today. But at that time it seemed better than leaving everything to the market at the danger of getting sub-optimal solutions. Basic ICT infrastructure is an essential public good. Governments must collaborate in developing a coherent and long term strategy that provides this facility as a foundation for commerce, innovation and competition. Increasing importance of the public good issue can be taken by government as a measure to counter the proprietary developments by large corporations.

Regarding the time of policy implementation, one expert notes that attention to this issue in parliament has recently increased. Another notes, that while taking this issue under government policy control is certainly desirable, achieving it on a large scale is a difficult task. This last comment leads to less optimistic estimates on the temporal proximity of policy implementation, grouped in segment “B”.

As an obstacle to near-future implementation of policy, experts note that governments will continue to work with those issues on a spotty basis, but no comprehensive initiative is likely to emerge.

Opinions grouped in segment “D” share with those in segment “B” not only less-than-optimistic view on the time of policy implementation, but on the importance of the issue as such, too. With regard to the time issue, one expert notes that governments have no powers nor means to enforce compliance,

save cases where except anti-trust legislation can apply. Another expert repeatedly notes that governments have no will, interest, or budget for significant action in this domain.

The reasons for diminished role of the public good and procurement issue in government policy are several, as noted by the experts. A government organization would have a difficulty arguing or recognizing what standard represents public good. In other words, the issue becomes 'what standards to support' and who would require them? Thus, the issue of public good and procurement becomes important only when the government is competent and has no other interests than the total welfare and general good. Therefore, another expert notes that instead of looking for public goods and enforcing compliance, the government will at best ensure that a service or capability they specify is sourced, provisioned, and works to end user needs.

6.3. Syntax and Semantics

The majority of opinions on the issue of syntax and semantics agree on the importance of the issue (Table 7). Five experts believe the likelihood of implementing targeted policies on the issue within the next 5 years is high (segment “A”), while the same number of experts doubt it (segment “B”).

Table 7: Syntax and semantics

Importance			
High (4-5)	Segment B		Segment A
	7, 9, 12, 16, 17		1, 6, 8, 11, 13
(3)	14	18	
Low (1-2)	Segment D		Segment C
	10		
		(3)	High (4-5)
Likelihood of implementation			

The importance of the syntax and semantics issue is prompted by the general trend of globalization, multi-cultural and multi-lingual environment for ICT services, and the requirements of interoperability. Without a shared syntax we can't even make an effort to communicate. Once the syntax is there we can talk about sharing semantics, which actually allows us to do something.

At the same time, the global multi-cultural and multi-lingual environment creates barriers to service development and interoperability. Overcoming this barrier can be done by developing solutions for common syntax and semantics on a community level. Worldwide unification can be achieved through mapping between communities.

Several experts note that syntax and semantics should not be seen as a joint issue - semantics depends on ontology; syntax is less important and depends on protocols. Technically, syntax and semantics is noted not to be a complex issue – XML can be used as a solution. However, implementation of control mechanisms requires coordination and negotiation. E.g., when XML is used, diligence is needed by government to assure that a viable core of XML and other standards are established to avoid in-advertant or deliberate deviations.

One expert notes that due to the divergence of views, this issue absolutely has to be taken into account, but that cannot be allowed to act as a shield for anticompetitive behavior the way it has been in past standards initiatives.

Among opinions touting near-future estimates for policy implementation are those seeing cultural and regional cooperation as driving forces for information society development. The role of EU is noted to play a special role here. Besides, semantic interoperability becomes a major factor in improving services interoperability without having to realign underlying technical infrastructure. Another driver for policy implementation is the nature of the issue itself – it is a service-driven issue, therefore akin to control by the government.

Opinions grouped in segment “B” suggest that there is Insufficient competence of the government to grasp the complexity of the issue, and that this is a technical issue best left to the engineers. Therefore, no consistent or directed action should be expected. One expert notes that government, nonetheless, will engage on a technical level, but just to avoid political issues. Supporting those views, one expert notes on the narrow business oriented approach of the government in open standards' issues.

In segment “D” there are counter-arguments to the importance of the syntax and semantics as a government policy issue. Specifically, an expert notes that syntactic and semantic interoperability problem is “an intractable problem that can not be solved using voluntary standards as they are currently created. Regulation might be the answer, but the regulators would be suspect. Until there is an absolutely dominant supplier - and Microsoft comes close - or an overwhelming competitive (economic or other) advantage, you aren't going to solve the issue.”

6.4. One stop service experience

Table 8 illustrates that there is no dominant expert opinion on the issue of one-stop service policy. The only opinion in segment “A” postulates, as has been repeatedly told for prior issues, that this is certainly desirable feature, but implementing control policy is hard to achieve on a large scale. An expert opinion found in segment “B” points at the U.S. federal government policy of 'No wrong door' as a useful guide: systems should be designed in such a way that a user can access a particular service, whatever the point of entry into a system. Besides, as the expert notes, there are already tools available for implementing lightweight 'semantic navigation' systems – for example the ISO 13250 standard (Topic Maps).

Table 8: One stop service experience

Importance			
High (4-5)	Segment B	16, 1,	Segment A
		8, 17	14 13
(3)		7, 9	11, 18
Low (1-2)	Segment D		Segment C
		6, 10, 12	
		(3)	High (4-5)
Likelihood of implementation			

As barriers to policy implementation are considered administrations' favor for the 'central portal' model of one-stop service delivery. These solutions are predicted to likely to be proprietary, cosmetic 'shells' for which there will be no driver towards standardization.

Less optimistic estimates of the importance of the issue and the time frame for policy implementation are found in segment “D”, which has one of the highest opinion weights with its three entries. Experts note that the issue is important, but the ability to make changes is minimal. The problem is how to

implement it, given human nature, the nature of organizations, and the nature of government.

Opinions found here range from rather mundane and straightforward, such as “will not happen in practice”, and already heard “no will, interest, or budget for significant action”, to well elaborated ones. Among the latter, an expert opinion that government organization go against one-service approach. As a possible reason for such an attitude, an expert notes that protecting user privacy makes such approaches unlawful under EU privacy directive. Finally, the expert points at “disaster projects” in U.K.: following this model is doomed never to become anything else than monstrous projects which fail.

Finally, one expert notes that Interoperability does not imply centralization: one-stop service is even possible with incompatible systems, and therefore should not be discussed as standardization issue.

6.5. Technical maturity

The weight of opinions on technical maturity of standards issue falls into segment “B” (Table 9). Opinions voiced in support of the issue argue that governments should monitor standards and implement them in conjunction with the private sector. This require mature standards. A better understanding of this issue would allow to minimize risk of betting on a wrong solution, i.e., avoid wasting money by standardizing at the wrong time.

However, implementing such policy would put government into a position of being dependent on the availability of “mature” international standards. Another counter argument to fast policy implementation is that this is too complex an problem to make it a political issue, and that governments lack the needed expertise and resources for policy implementation.

Table 9: Technical maturity

Importance			
High (4-5)	Segment B		Segment A
	7, 9, 12, 16, 18		8, 14
(3)	1, 6	17	
	Segment D		Segment C
	10, 11, 13		
Low (1-2)		(3)	High (4-5)
		Likelihood of implementation	

In segment “D” we find elaboration on the problem of government's lack of expertise: “Who judges maturity?”, asks an expert. Is it when a standard is old or is it when the technology is no longer interesting, or is it after the market has settled? Thus, technical maturity is “easy to state, hard to define.” The issue of technical maturity is said to be a secondary problem in formulating standardization policies: standards will only be relevant as long as the technology they relate to is relevant.

Another opinion in segment “D” warns that technical maturity is a red herring, often used by vendors to discourage or block standardization that is not to their advantage. Users, and in particular governments, the expert says, should take a long term (5+ year) strategic view of their interests and become pro-active in facilitating the standards needed. This would require early involvement, and long term commitment.

6.6. Future-proof

The issue of future-proof in standardization yielded quite even distribution of opinions between three segments (“A”, “B”, and “D”, see Table 10).

The issue of future-proof is related to (backwards) compatibility of data and media. Backward compatibility or transition paths are always an appropriate requirement as technology evolves. In the private vendor dominating ICT realm, much if not most of the 'evolution' of technology is not to increase user benefits, but force them to pay for the next generation product. Vendors have a significant incentive to force upgrades and transitions on a regular basis. Governments must allow vendors to provide extensions, but require them to both have modes of operation that are strictly conforming and that they support prior version(s). Awareness by the government of lock-in means that administrations are likely to look for standards-based policies and solutions in the very near future. There are already policies being developed, as e.g., eDocument policy area in the European Commission's eGovernment Action Plan.

Table 10: Future proof

Importance			
High (4-5)	Segment B	7	Segment A
	16, 17, 18		8, 11, 13, 14
	(3) 12	1	
Low (1-2)	Segment D		Segment C
	6, 9, 10		
		(3)	High (4-5)
Likelihood of implementation			

Opinions advocating the importance of the issue range in their assessment of the role of government. One expert believes that governments have no influence nor leverage here, except to ensure that the standardization processes and the market driven tuning are fair and transparent. Agencies cannot force anything at all – says the expert – at best they can force backward compatibility but not future proof. Version control and consistence of an open standard is best achieved when it becomes in effect managed by one single entity with full liabilities vis-à-vis end users.

Another expert states that sophisticated procurement and contractual procedures can determine formats and shapes, and hence are appropriate tools for future-proof control intervention. While disagreeing on the capabilities of the government with regard to implementing constructive policies on future-proof of ICT, both experts agree that version control is needed. This can be achieved by letting government entities trial out future services in consortia modes with developers and users, suggests one expert.

One expert suggests that the issue of future-proof should be diverted from data formats. The real big danger and challenge – the expert notes -is in ensuring that data carriers and media are future-proof. There will always be a rich and varied market for converters of data formats, but this is not so obvious for conversion between media.

Voices of doubt with regard to the time-frame for the policy implementation are found in segment “B”. One expert notes that future-proof is not a central task of IT-architects in the central public administration. Another expert points at the diminishing technological quality of standards, which inadvertently reduces the longevity of the standards that the professional community can develop. Yet another reason for scepticism stems from the question “How do governments 'force'?” The expert

believes that as long as it is in the economic interest of a vendor to use unique formats, they'll find a way to sell incompatible solutions to the government. An extreme opinion suggests that one "can't future proof during a period of rapid technological change." Finally, a reconciling voice suggest that future-proof control can be achieved if one allows the vendors some latitude to experiment.

As for almost every issue taken in the survey, experts doubt that government has a needed expertise to take an appropriate action on future-proof issues: "Government will play a role here as a large consumer, but beyond that they are likely to do more damage than good."

Most sceptical opinions are found in segment "D". An expert predicts that the government can't and won't stay focused long enough to fight the fight. Nor do they have will, interest, or budget for significant action.

As for the reasons for unimportance of the issue, those are rather related to incapability or inappropriateness of the issue, not to its importance. The question asked here, again, is "What compelling force does the government have?" Does a government have a choice of not buying products "that the governmental users want"? The expert points at the importance of the installed base, not only that of hardware, but most importantly "nearly a 100 years of installed base data".

6.7. Goals of participation

Table 11 shows that expert opinions side on little importance of the issue of governmental participation in standardization. Given the weight of segment "D", we start the analysis from less-than-optimistic evaluations.

Administrations should monitor and define grey areas, common interests where market fails to get agreement. So it is not problem of type of standards or lack of them, but defining sectors of implementation, setting priorities and scopes. While in rapidly changing IT environment continuous improvements and change management are crucial, more important role play interfaces and principles, not technical solutions.

Table 11: Goals of participation

Importance			
High (4-5)	Segment B	7	Segment A
	12, 16		8, 11
(3)	17	9	13
Low (1-2)	Segment D		Segment C
	1, 6, 10, 14, 18		
		(3)	High (4-5)
Likelihood of implementation			

Opinion in support of the one above advises governments "not do this", except at interoperability levels like set by ITU, CEN/CENELEC and ISO. The reasons for "do not do this" is, again, in incompetence and lack of power for appropriate action. Governments should only fuel the demand side of standardization, not part take in the supply, and compare alternatives once at end-user service level.

But even that much government participation is put on doubt by another expert, who states that government is in general incapable of doing this monitoring and testing. Where government has taken

an active stance on this, as in e.g., the U.S. Federal Information Processing Standards (FIPS), those are believed to be just rubber stamped company proprietary standards where some escrow and IPR terms and conditions have been added.

Active participation in standardization would require the government(s) to acquire the competence, skill, will, and money. Not the least, they'd have to join any of the 1000+ consortia that really make the standards in the ICT sector, and coordinate internally and severally. “Not a chance!” - concludes the expert. The question of government participation in standardization is as simple as “who pays?” - will the general population “see benefit in a bureaucrat going to a meeting in Switzerland to decide how to do correct syntax?”

Finally, experts suggest that it is better for government to be followers than leaders. Policy makers should leave these issues largely to the SDOs.

Opinions supporting governments participation in standards setting are found in segments “A” and “B”. Experts here suggest that government should not leave everything to the market, otherwise this will lead to wrong advice and wrong investment decisions. Government's participation can be seen as a valuable 'insurance policy', enabling governments to keep abreast of standards development and avoid investing in technology that looks to be going down a blind alley. Government must intervene to minimize the industry cartels that seek to exclude users, government and competing vendors.

A door for government involvement can be the increasing awareness that the main 'standards' bodies and consortia are still too heavily industry-driven, and require a broader user and public sector base. The expert notes that this observation is often made by industry representatives themselves, who see public sector involvement in a 'referee' role.

Governments must be proactive, long term participants, forcing consortia transparency of all agreements, terms, conditions, fees, IPR agreements, etc. This would create a much more 'open' standards process. However, currently low levels of government involvement will continue out of inertia or lack of knowledge, an expert predicts.

6.8. Accessibility

The issue of accessibility gathers the weight of opinions in segment “A”, indicating the importance and timeliness of the issue (Table 12).

Table 12: Accessibility

Importance			
High (4-5)	Segment B		Segment A
	7, 8, 12, 17, 18		6, 9, 10, 11, 14, 16
(3)		1	
	Segment D		Segment C
	13		
Low (1-2)		(3)	High (4-5)
Likelihood of implementation			

Among the topics found in the opinions supporting the importance of the issue are such as usability and development cost. An expert notes, that government should mandate simple dependable services, while “avoiding the integrators wanting to add man x years to their bills”. This need for simple and

dependable services is prompted by the opinion that simple, transparent in-use services are the driver for the diffusion of services, trust and adoption.

One expert elaborates on the importance of the issue: “The principle of equality of treatment of all citizens by public administrations must prevail. It should never be a requirement of eService access that any citizen or user be required to have a certain level of competence in the technology used. In fact, there will always be some users who cannot or will not use electronic services ever, and there must be alternative means of access (face-to-face or using a delegated 'proxy' on their behalf).”

Another expert points at another side of the coin: not only citizens are the beneficiaries of seamless access to services. Inter agency flows of information, subject to strict privacy controls, are essential for good government.

While acknowledging the importance of the issue, one expert notes that we tend to overestimate the degree to which various actors and bodies will access government services electronically. Virtually no citizen-oriented services other than forms, licenses or taxation can be delivered on-line.

A near-future implementation of services with universal accessibility is believed to be possible if governments will commence trials for simple usable services, thus creating trust among the users. A complimenting opinion postulates that timing will work if small focused public services are deployed and adopted with trust and simplicity (e.g., reporting by utilities, car insurance and use, etc.).

Other drivers for speedy adoption of universal accessibility will come from the government's perception of vendor manipulation of standardization processes. As such perception strengthens, a pressure for government to drive for transparency, and trust will increase. Already, in the E.U. there are eAccessibility and eInclusion programs, which are predicted to become foundation for major public policy issue in eGovernment investment.

Finally, bottom-up push is predicted to materialize, as user frustration over services in-accessibility may reach a sufficiently high volume if government does take action within the next 5 years. Another expert notes that such user frustration may be avoided, as issue of accessibility is probably the area in which governments are most active and even successful, mostly through outsourcing.

In the heart of counter-arguments for speedy policy/ service adoption is, again, complexity of the problem – offering universal accessibility “isn't easy”, as one expert notes.

In segment “D” we find counter-arguments to the importance of the issue. Experts opinions found in this segment argue that the issue of accessibility is a secondary issue, and not a standards issue.

6.9. IPRs

Eleven out of 13 expert opinions are grouped in segments “A” and “B”, which contain opinions giving high importance to the issue (Table 13). Despite the nearly-unanimous support of the importance of the issue, we find a peculiar divergence of reasons for this importance among the opinions voiced.

The level of elaboration on reasoning varies greatly, too. Most general explanations to support high ranking of the issue are “IPRs are important for policy reasons” and “IPRs are very important to make sure progress and competition can happen”. In other comments we find more sophisticated presentation of reasoning.

While not neglecting the importance of IPRs, some experts would like to see the IPR-free standardization, for the reason that IP-related issues are “splintering the ICT business market place.” This is a critical and important issue, acknowledges the expert, that has surfaced because the

standardization process has been allowed to run out of control with new and amateur players. While reversing the trend is not possible, taking the issue under government control will help counter-balance the predatory nature of some of the players in ICT development.

Table 13: IPRs

Importance			
High (4-5)	Segment B		Segment A
	7, 8, 12, 17, 18		6, 9, 10, 11, 14, 16
(3)		1	
Low (1-2)	Segment D		Segment C
	13		
		(3)	High (4-5)
Likelihood of implementation			

Another expert notes that standardization policy-making must build upon the existing laws - there are explicit IPR laws in place already, and there won't be special laws made for standards. However, governments must be aware of the pitfalls IP can bring to the national ICT development. First, there is no single test for RAND or FRAND that is culturally and nationally neutral. Patents are routinely abused (when people buy and sell them as a commodity), and standardizers are in significant denial. Second, existing IPRs make it difficult to enter the market for new players. Some countries are positioned better than others to either keep or remove those barriers. In China, according to the example given by the expert, they've filed over 600,000 national patents in the last 3 years - to catch up with US patents and European patents.

Another expert elaborates on why (F)RAND issues, mentioned above, are important. He notes that IPR is the secret (in many senses of the word) tool of vendors to manipulate the standards process. The patent process can be easily manipulated to exclude competition, and flagrant abuses of it can be used to preclude challenge by smaller companies who cannot afford the fight even when they are right. Without meaningful policies on IPR, operating on a global basis, standardization will be manipulated using this 'business opportunity.' The expert continues, that there are probably public interest standards where IPR should be either excluded or bought-out by governments to avoid this. "There are definitely things being patented today that should not be allowed." Yet another comment sheds a light on what those "forbidden" areas may be: "Just get rid of sui generis copyright and disallow the patenting of algorithms". According to this expert, IPR is a good example of where governments have gotten all of the issues exactly wrong. This expert predicts that the whole ICT industry will soon grind to a halt in the litigation courts if current interpretations of IPR are sustained. In the realm of short life cycles of technology in the ICT domain, the expert believes IPRs are unsustainable and mean nothing more than nasty little monopolies. Open source could be a way to get around them, but if the legal principles don't change 'open' won't mean anything.

Other experts note that there is too much reluctance to change the principles operating in the IPR domain, as mentioned above. Specifically, there is a reluctance to reduce the power of IPR (running time of patents and copyrights), and way too much reluctance in threatening with expropriation of proprietary standards. Thus, the dilemma is presented by, on the one hand, IPRs being related to much of the available technology, and, on the other hand, that any public money used in developing ICT solutions for the public sector, should mean that any IPR is owned by the public sector and not by the private companies that undertake the work. One solution for solving the dilemma is offered: IPR policies must be implemented mostly as an internal tool (for consistency), and not as a means to encourage industry "to deal FRANDly with IP."

With regard to the timing for policy implementation, experts disagree. Some call for prompt policy implementation, predicting that it will be established at the EU level (but may diverge from WTO views). The reason for near-future implementation of the policy is grounded in the problematics of the issue – the problem requires some kind of governmental intervention if it is to be solved. One opinion is that it will happen only when the non-G7 countries force the issue. Others predict that this will happen sooner rather than later to aid interchange-ability. Finally, another reason for prompt implementation of IPR policies is that governments should minimize the abuse (IPR is a key issue often used by industry to block or control standardization) that is rapidly expanding in the ICT domain and strongly diminishing the openness of open standards.

Other experts are sceptic with regard to the very capability of government to attempt the change – IPRs are the holy grail of standards manipulation, industry will fight for a long time before they yield to any IPR policies, much less one that is in the public interest. While governments will continue to get involved, predicts an expert, they will “screw things up even worse than they are now - total capture by the ICT vendors on this front.” One expert is suggesting that a remedy for such a pitiful situation can be in delegating these issues largely to the SSOs. Another expert concurs to the latter opinion, suggesting that coordination at an international level between administrations may improve the situation. Without cooperation, many administrations will continue to 'give away' their IPRs on public-funded ICT development, either through poor contracts or lack of attention to the management of ICT assets.

The only opinion voiced in segment “D” is, once again, a repetition of the concern that this establishing IPR policies is certainly desirable but hard to achieve on a large scale.

6.10. Issues, not identified through the literature review

During the survey, we have asked experts to indicate important issues, which were overlooked in our questionnaire. 13 experts have responded to our request (see Appendix 1), which allowed us to review the original 9 issues. Specifically, the following additions should be made.

The issue #2 “Public good and compliance” should be extended to encompass the following:

2.1. Public interest in standards (public value): a value that needs not have anything to do with economy and business. Public Interest Standardization might be better served under the responsibility of Interior Affairs (in stead of Economic affairs).

2.2. Role of the national standards body (NSB) and other relevant organizations: the NSB is the core institute for standardization matters. The national policy on open standards should not ignore this role.

The issue #6 “Future-proof” should be extended to encompass the following:

6.1. The relation between open source and open standards: with open source, the 'industry' incentive towards planned obsolescence is reduced - along with this many of the conflict-of-interest factors involved in standardization.

The issue #7 “Goals of participation” should be broadened to encompass goals *and rules* of participation. Two additional sub-issues must be considered:

7.1. Hierarchy of norms: an objective classification of the relative importance of different standards and different standards authorities, that serves administrations as a way to determine who to follow on what standard issue. Too many "competing" and sometimes contradictory standards, will require some method of assessing relative importance of each. This should also cover the issue of *antitrust policy towards SSOs*.

7.2. Who pays? : addressing the budgetary issues of government's participation in standardization activities. Looking at the appropriations committee activities of the various government and seeing where standards might fit and how it could be funded.

7.3. Risks and liabilities: risks in costs and adoption, and liabilities to public authorities and suppliers as well when no single legal party can be held accountable.

Finally, new issues should be added to the list:

10. Ownership and management of ICT assets: the many ICT "assets" (whether complete services, their components, or data models, schema, taxonomies, requirements studies, source code...) must be considered as strategic assets, that should be managed as any other business asset by the government. In order to manage assets, measurement and management framework are needed, such as e.g., "eGovernment Resources information model."

11. Trial-ability: early deployment of simple services, to prove and measure gains from open standards.

7. Summary

This research helps shed light on the complexity of the issue of open standards and the governance of ICT infrastructure. The key findings of this work are the following:

1. There is a great diversity of views on each of the nine surveyed issues.
2. The importance and relevance of the nine issues offered for the survey is perceived in general higher than the likelihood of taking those issues under direct policy control within the next 5 year. Given the diversity of (often conflicting) views, the less-than optimistic predictions of the policy implementation time frame do not come as surprise.
3. Issues perceived to be the most important are economics of standards, public good and compliance, syntax and semantics, and IPRs.
4. Issues perceived to be the least important are one-stop service experience, technical maturity, and goals of participation.
5. Eight new issues suggested by the experts as important and relevant.
6. The diversity of views expressed by the experts is:
 - to some extent reflecting the diversity of professional affiliations of the experts,
 - representing three different perspectives (technical, economic, and social) on standardization and infrastructure development, as suggested by the literature, and
 - providing an excellent aid to policy decision-making through versatile and comprehensive analysis of the most important issues.

8. Managerial implications and conclusions

The Delphi method substantiates the assessment of experts through rounds of convergence of extreme positions ensuring that such positions are maintained only if subject to convergent support. We have found different overall weight given to items through the several rounds of evaluation and none of the 9 items are irrelevant to standard setting and diffusion processes.

The number of experts that rank an item identically shows the overall weight given to that rank. Yet, the weight given may rest upon divergent views. By presenting these views we reveal the complexity and sometimes show how and why an item is contagious to some more than to others reflecting how different experts view and evaluate standards' stakeholders. We know that there are divergent views, we also know why, so we can take experts' different views on same extreme position as proof of the

reason why to look carefully on a standard or type of standardization before submitting a view.

In the following sections we will suggest to look at government's role in standardization processes in the context of the proliferation of ICT standards in recent years; the vertical standardization approach; and finally the globalization issue.

8.1. Governments at a disadvantage

Experts' comments on rankings bear witness of the scale of ICT standardization activities globally. More than a 1.000 consortia are contributing to the global standards pool. And 10s of thousands of standards are already available in the field of information and communication technologies. While the pace with which new standards appear is higher than previously, the total amount of standardization activities are hard to gauge as most of them take place in private consortia and not all of these are made known to the general public. "Ironically, standards have not been completely standardized" Hemenway wrote in 1975. Addressing highly differing types and scopes of standards as if these were homogeneous would in most cases lead to contradictory assessments and in other cases to a stalemate or an impasse. Yet, it does not solve hard questions just to pose them to few instances of standardization, unless we add conditions and constraints to the questions.

Standardization processes triggered by industry motives may have little to do with government needs for interoperability and process exchange because standards are also ways to strengthen leverage of patents and technologies that are an IT vendor's differentiating assets in competitive markets. Governments will rarely be protagonists of technology standardization and when following the market they will have to rely on SDOs capability in attracting industry interests, balancing out particular interests to the advantage of ensuring a public good, an open standard. Eventually, governments may reduce SDOs' financial dependency upon industry, enhancing their powers to invite non-commercial interest groups to balance the influence of commercial groups. An alternative to "sit and pray" would be to become a participant in vertical information systems standardization where end-user interests are voiced. Taking upon a protagonist role also raises the question if that role could facilitate a transition to open standards adoption in industry.

Researching the transition from a proprietary standard to an open one shows that the change process encounters network effects and path dependency barriers. A study of 1394 firms in the US on the migration from an EDI to an open standard IOS came to the conclusion that prior use of EDI reduced adoption costs for open standard IOS adoption, but that it tended to increase switching costs. This finding validates the path dependency effects in standards migration. The network effects of a standard were translated into significant economies if associated with a trading community. Managerial complexity, as opposed to financial costs, was a more significant determinant of adoption costs (Zhu et al. 2006, 534). The findings of studies on the economics of standards so far have not provided useful insights how government could facilitate transition from industry standards to open standards.

If government itself adopts an open standard and industry has to comply, then government inflicts on the industry the migration costs. The size of migration costs will depend on previous standards' use in industry. The adoption costs would then need to be balanced by benefits spill-over from government adoption and from concomitant reduced coordination costs in industry.

8.2. Vertical standardization

Recent literature on standardization distinguishes between vertical and horizontal standardization (Wigand et al., 2005, Markus et al., 2006) to account for different types of stakeholders in standards setting (see Table 14). The traditional standardization is horizontal because it depends upon an industry to consent on a common standard. Vertical information systems standards (VIS) are defined as “user-led development of voluntary, open, industry-specific inter-organizational coordination standards” (Markus et al., 2006) and the examples are e.g., the bar code and electronic data interchange (EDI) standards. “The bar code, intended to facilitate coordination among grocery manufacturers and retailers, spread rapidly beyond its grocery industry origins to become a “universal” product code” which was in contrast to the low level of diffusion of EDI “despite massive standardization efforts by both international standards development organizations (e.g. EDIFACT) and specific industry groups” (Markus et al., 2006, p. 440). These facts reveal the two linked collective action dilemmas: standards development and standards diffusion, meaning that both demand a level of collective action to be realized and yet there is little assurance that one leads to the other. In Denmark, the Digital Construction Model represents an instance of VIS type of standardization.

The involvement of a highly mixed group of interests in standard setting challenges a convergence of incentives for participation. Bringing about a working group is therefore subject to many risks. To those seriously needing the standard such a situation is a hassle. Research indicates that success is highly dependent on the content of a standard. If to succeed in arriving at a standard and to diffuse it to all relevant parties, the content of the standard has to benefit all stakeholders.

Table 14: Vertical vs. horizontal standardization

	Non-VIS standardization; e.g. Consortia of IT vendors	VIS standardization; IT vendors and user organizations
Standardization development	Rival fractions combine to set standard	Non-fragmenting, heterogeneous collective group
Standardization diffusion	Standards war between. industry fractions	Group loyalty supporting and promoting the standard

8.3. Reflections on the high level data analysis

When we apply the expert views on the 9 items of standardization to the VIS type of standardization for digital government we spot the “economic” issue as the one of financing public participation.

Since we have much more than a handful of opportunities to develop VIS standards the question comes up naturally: “In which of the many areas do governments want specifically to apply their limited standardization resources?”. “Where will government have leverage in both standards setting and in diffusion, either as a powerful buyer (monopsony) or as capable (by law) of demanding transactions, licensees or certificates that demand use of a particular standard in applications for a particular service?”. In Denmark, government has upheld a specific e-business XML standard for facultative e-invoice messages trying to bypass the challenge of forming a standardization consortium.

Concerning “public good and compliance” VIS standardization touch upon the means available to government assuring diffusion of a standard. IT vendors implement standards in their applications or end-users may take over some of the implementation as is the case when government itself decides on XML schemes compliant to a version of an internationally agreed XML standard. The public good nature of a standard depends upon the process of standardization (closed vs. open consortia or SDO) as well as upon its way of diffusion. If developed as a club good (a consortia) most standards are

challenged by other players in the industry (offering another club good) leaving government divided between options or eventually trying to accommodate several standards and therefore facing costly conversion issues.

“Syntax and semantics” are the flesh and soul of interoperability at the level of data and process exchange nationally and internationally. VIS standardization would be in particularly well suited to cope with these challenging requirements to make vertical structures digitally operational. In fact, some would argue that these issues can only be resolved in a successful VIS standardization process. XML schemes developed within government for intra-government purposes may fail to ensure government-to-business data interchange and the reverse why a VIS standardization process would need include industry in the process.

“One-stop-service” has been found extremely ambitious by the experts and offering as an alternative the US policy of 'No wrong door' as a useful guide: systems should be designed in such a way that a user can access a particular service, whatever the point of entry into a system. The standardization issues in this may be highly complex but are mainly indirect because they should provide data and process exchange required for the one-stop-service purpose.

“Technical maturity” refers to conditions that government needs ensure before deciding upon matters of interoperability and architectures. Experts are little in doubt that governments cannot move far beyond the level of existing technical maturity without high risks of investment losses. And this is irrespective of the particular standardization process since any ICT application is multi-standard dependent all through its layers and in its interfaces.

While maturity of technology holds back government in moving (fast) forward the “future proof” issue concerns governments' power to influence IT vendor products' backward compatibilities which seem a two-edged sword that keep tying customers into a particular platform and at the same time try to liberate the customer base to move to a richer but incompatible platform. Rather than having industry solely to determine the incompatibility character in the shift governments may declare a minimum set of compatibility requirements to be available in conversion protocols and hence both speed up and target the technology shift creating a “win-win” in the diffusion of a new platform. For instance, governments may in all document production software prescribe a function that allows for all registered documents to be archived in ISO Archive PDF format (ISO 19005-1:2005 is an ISO Standard that was published on October 1, 2005) that keeps document content in the file and makes all content fully searchable. In this way, backward compatibility would be a non-issue for all archived documents leaving government free to choose a document production platform irrespective of the one previously in use by the government enforced distinction between production of documents and their archiving that in most instances also would include their publishing. Thus, government interference at the level of (some) standardization processes may be pro-innovative rather than a barrier to the development of new applications.

“Participation” is one thing vis-a-vis thousands of industry consortia and something else in end-user defined and service oriented standardization in a VIS institutional set-up. Experts warn against naive expectations of compatibility below the service surface for a range of reasons. Government participation as a general clause is unmanageable to any government or group of governments, the experts stress. Selectivity and ICT application procurement policies on open standards may take industry some of the way towards ensuring a wide and open interoperability capacity. Due to its nature, selectivity and general procurement clauses are subject to exemptions and the concomitant uncertain impact upon interoperability.

“Accessibility” follows upon demand for less-than-the-most-advanced and complex technologies being applied to government digital services prioritizing simplicity, transparency, user-friendliness and security promoting trust and low-cost access to public services. Experts agree strongly to this and yet they also stipulate that no citizen-oriented services other than forms, licenses or taxation can be

delivered on-line. Others have added that it is a no less important for third parties and intermediaries to ensure these qualities of accessibility.

The final important item we have deduced from literature and had confirmed by experts concerns “intellectual property rights” (IPR). Though experts are clearly divided on this item they clearly represent the dilemma of government. If opting for a VIS standardization process heterogeneous interests may be brought to accept government priorities for non-IPR dependent infrastructures while IT vendors will reflect the status quo of an already heavy reliance upon IPR in the field of ICT and the sometimes apparent negligence of government itself allowing for new IPR clauses in their applications and contracts. The VIS approach meets all these challenges in both setting and diffusion of a standard.

This section has drawn up some of the challenges that confront governments embarking on end-user, open, voluntary, industry-specific, inter-organizational coordination standard setting and diffusion. At the same time it is shown that certain limitations to the process of standardization may while others are unlikely to become corrected by adoption of VIS.

8.4. Globalization

The scope for standards increase along with the fast growth in globalization: trade, manufacturing, services, capital and labour.

We consider open standards and their early adoption in the light of their position vis-a-vis the global information infrastructure on the one hand and the scope for innovative business and citizen applications supported by early adoption of open standards on the other. In the former case, we need to take steps to ensure standard compliance and standard evolution where standards are seen as needed by governments and citizens. The “need” perception is formed through realization of the role of open standards in the global information infrastructure. The government logic follows along the lines, that if “remnants” of proprietary standards are found, they need to be filtered out to ensure the nations global connectivity by enforcing open standards. Here it makes little sense to apply a “comply or explain” principle, since that is only to the disadvantage of the national interest to opt out of interoperability.

In the latter case, two types of issues need to be addressed. If we do not have a completely mature technology but a variety of technologies defying interoperability, then we are still chasing the spirit of innovation but at higher costs to industry than necessary. If innovation is a vendor strategy for market share protection, then innovations may come about reluctantly and not necessarily in the interest of end-users. If innovation is an “open market operation”, then there will be no dominant players in that market to bias future innovations. If this is a clause that cannot be validated, then the experts agree that incentives to innovation will be biased against governments' interests – at least if government policy are that of a globalization policy.

As the final remark, we would like to stress that there is strong expectations of innovations to come. The challenge could be taken into consideration in the following way:

- Assume innovative potentials in IT have not been exhausted by now because there are ample opportunities for innovations. These should be considered worthwhile if they are targeting government needs and aligned to citizens expectations and benefits. There are reasons to consider open standards a facilitator of innovation in IT, witness the vast pool of innovations associated with the Internet. Though the Internet was based and is based upon standards these have not excluded a vibrant and fertile innovative climate. Both software (SW) and hardware (HW) have proliferated in innovation (take Cisco for HW and take Google and Yahoo and

countless others in SW). We cannot argue to the contrary that open standards *ensure* innovations. And likewise, we cannot exclude that some standards may be perceived as barriers to innovation in some cases. The point is that the value from standards in reducing coordination costs and in stimulating productive (relevant) innovations are there to be harvested while the counter argument is a concern for potentials that are much harder to assess as they - by the very argument - have not proven their case in the market (yet).

- Globalization risks turning information infrastructure based on national standards from assets of coordination and facilitation into liabilities of competitiveness disadvantaging the nation. Avoiding that risk entails both government and industry to be agile towards ICT innovations and developments that trigger standardization in select (advanced) countries disregarding others. This has been seen in the digital television standards war where the whole TV-industry has been set-back by lack of consensus now, just as the same lack of a global consensus caused US cellular industry to loose to Scandinavian mobile industry, which in the 80s was pushing for a common GSM standard to replace a nationalistic Nordic standard, NMT.

To conclude, we believe that while governments are disadvantaged participants in standardization due to a range of factors explored in our report, the vehicles of VIS and the powers of globalization should motivate governments to opt for select positions and interventions in standardization.

9. Epilogue

Our project started in early fall of 2005. Both authors have attended SIIT (www.siit2005.org) conference in Geneva in late September 2005, which became a kick-off event for writing a preliminary report on the issue of open standards in government policy. During the months of October-December, the report was finalized, allowing us to obtain funding for more in-depth analysis on the topic. The official launch of OStEA project took place on the 1st of February 2006. The scope and deliverables of the project were to large extent left for us to decide upon, which necessitated us to have 6 meetings during February, engaging in sense-making, planning, negotiating, defining the goals and objectives. By the beginning of March, we have agreed to have 3 deliverables: a literature review, a study of the Danish public sector's ICT infrastructure (its architecture), and the Delphi survey.

Unfortunately, given the 4 month time remaining for the project and the responsibilities both authors have had outside the project, we have not had time to work on the ICT architecture paper. We believe this work would have helped us to make a better-informed Delphi survey, ask more specific questions, among other things. However, the importance of this Delphi study should not be underestimated. The mere fact that we were able to solicit participation of the leading experts on issues of standards, standardization, and government policy, engage them in a moderated discussion, obtain their opinions on controversial yet important issues – all this shows that there was a perceived need for the debate and for airing diverse views and reasons.

One important Danish event took place on June 2, 2006. The Danish Parliament adopted a resolution on open standards policy (see Box 1 below), which makes us believe that our earlier reports, and the following to come will find a fertile soil in the Danish government policy landscape for contributing to the growth of an Information Society in Denmark.

November 23, 2006

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“On June 2, 2006 The Danish Parliament unanimously adopted a decision requiring the government to ensure that use of software in the public sector is based upon open standards. The government must no later than January 1, 2008 or as soon as it is technically an option, adopt and maintain a set of open standards, which may serve as an inspiration for all other public authorities.

Open standards needs from then on be part of the basis for the public sector development and procurement of IT-software in order to promote competition.

The government needs ensure that all digital information and data that are exchanged with citizens, businesses and institutions are available in formats that are based upon open standards.”

Box 1. Open standard decision adopted in Danish Parliament on June 2, 2006¹²

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¹² Translation of the parliamentary decision by the authors.

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List of acronyms used

CEN	European Committee for Standardization (see also SSO, SDO, ESO)
CENLEC	European Committee for Electrotechnical Standardization (see also SSO, SDO, ESO)
EDI	Electronic Data Interchange
ESO	European Standardization Organization (see also SSO, SDO)
EU	European Union
FRAND	Free, Reasonable, And Non-Discriminatory
HW	Hardware
GDP	Gross Domestic Product
GSM	Global System for Mobile communications
ICT	Information and Communication Technologies
II	Information Infrastructure, ICT Infrastructure
IP	Intellectual Property
IPR	Intellectual Property Right
IOS	Inter Organizational System
ISO	International Standardization Organization (see also SSO, SDO)
IT	Information Technology (see also ICT, II)
ITU	International Telecommunications Union (see also SSO, SDO)
OSI	Open System Interconnection (model)
OStEA	Open Standards and their Early Adoption
R&D	Research and Development
RAND	Reasonable And Non-Discriminatory
SDO	Standards Development Organization (see also SSO, ESO)
SIIT	Standardization and Innovation in Information Technology
SQL	Structured Query Language
SSO	Standards Setting Organization (see also ESO, SDO)
SW	Software
VIS	Vertical Information Systems (standardization)
W3C	World Wide Web Consortium
WTO	World Trade Organization
XBRL	Extensible Businesses Reporting Language
XML	Extensible Markup Language

Appendix 1. Issues offered by experts as “not being identified through the literature review”.

(Round 1, Expert #8): Hierarchy of norms: an objective classification of the relative importance of different standards and different standards authorities, that serves administrations as a way to determine who to follow on what standard issue.

Importance: 4:

Too many "competing" and sometimes contradictory standards, will require some method of assessing relative importance of each

Timing: 3:

Although many administrations complain about the complexity of the standards landscape, there is little evidence that they will do anything directly about, with the exception of some isolated initiatives (such as the Austrian government "eGovernment Resources Network" initiative)

(Round 1, Expert #8): Ownership and management of ICT assets

Importance: 5:

Too many ICT "assets" (whether complete services, their components, or data models, schema, taxonomies, requirements studies, source code...) are locked into a deliverables set of a particular project, rather than being considered as strategic assets, that should be managed as any other business asset. In order to manage assets, you need to have a measurement and management framework: such as an "eGovernment Resources information model"

Timing: 5:

This is starting to be addressed both by the European standards agency, CEN; by the OASIS eGovernment technical committee and raised as a policy issue in the context of the European Commission's eGovernment Action Plan to 2010, as a major issue of public eGovernment policy.

(Round 1, Expert #6): Early deployment of simple services

Importance: 4:

Prove and measure gains from open standards.

Timing: ?

Expect no policy control other than efficiency and budget constraints.

(Round 1, Expert #5): Antitrust policy towards SSOs

(Round 1, Expert #4): Open standards definition

Importance: 1:

In order for government to take an active role in standardization some definitions are needed: What is a standard? What is an open standard? What is standardization or standardization? If the definitions that emerge agree with my definitions of these terms, then I suggest that a government policy might be to require public adaptability standards, defined in public standardization committees, for all important programmable and changeable interfaces.

(Round 1, Expert #17): Public interest in standards (public value): a value that needs not have

anything to do with economy and business

Importance: 5:

[This issue] is sadly absent in my country's policy/ priorities; only token interest. Public Interest Standardization might be better served under the responsibility of Interior Affairs (in stead of Economic affairs)

Timing: 1

(Round 1, Expert #16):

The main issue as I see it, is that governments will have to make some sort of deal with the vendors. They will not act against the vendors as long as they perceive them to be the primary source of wealth and jobs. Governments will eventually be forced to act by non-ICT vendors, most of whose R&D is IT (mainly software) related. For many of these, the current closed source environment is intolerable so they simply switch over. Once governments realize that it is these companies that stand to create most of the wealth from IT, they may act on the open source issues.

[Certification and accreditation of open source products and technicians]: Without some rationalization here, no viable market is likely to develop for open source systems.

(Round 1, Expert #12): Role of the national standards body and other relevant organizations, if any

Importance: 4:

The NSB is the core institute for standardization matters. The national policy on open standards should not ignore this role.

Timing: 5:

In the Netherlands, openness is a major issue in the governmental standardization policy, but not in the sense you seem to use it. Unfortunately, you have not defined what you mean with Open standards. See Ken Krechmer's contribution in the International Journal of IT Standards and Standardization Research

(Round 1, Expert #11): The relation between open source and open standards:

Open standards discussions should be expanded to include consideration for some of the principles of open source code. While these are different in fact; there is a significant area of overlap. With Open source, the 'industry' incentive towards planned obsolescence is reduced -- along with this many of the conflict-of-interest factors involved in standardization.

(Round 1, Expert #18): The relation between open source and open standards

Importance: 4:

The current confusion (on many sides) regarding this relation will have to be sorted out.

Timing: 4:

It's getting urgent - confusion is prevailing and if this is not sorted out soon e-government activities will become even more complicated to complete.

(Round 1, Expert #10): Who pays?

The most important thing in government is "who has budget"? You have assumed that the government values standards - but where, in the shrinking list of budgeted items, does it fit? I'd suggest looking at the appropriations committee activities of the various government and seeing where you might fit standards and how it could be funded.

Producing white papers and research reports with no hope of ever seeing government action because of resource constraints is both frustrating and wasteful.

(Round 2, Expert #8): Syntax and semantics

The issue of syntax and semantics should be separated into two questions, as they both are important issues, but have very different interoperability dynamics and concerns.

(Round 3, Expert #6): Risks and liabilities: Risks in costs and adoption, and liabilities to public authorities and suppliers as well when no single legal party can be held accountable.

Some large city administrations (Stockholm, Paris) have stated reporting of their painful experiences with trying to trial/enforce open standards. Lesson learnt (or once again) is that only end user accessible capabilities matter, not the ingredients! Far too often the hoped for gains from open standards are turned into losses because of complex legacy issues. So the toolkit of the government is still the set of standards for heterogeneous systems of proprietary standards, such as XML, CORBA, IDL, Web Services, SIP, etc...

Question asked in this survey missed completely on two fundamental ones: risks and liabilities! Risks in costs and adoption, and liabilities to public authorities and suppliers as well when no single legal party can be held accountable.

Appendix 2. List of experts

Academic / University	Standards pro/ vendor	Government	SSO (present or past)
Kalle Lyytinen, Prof., Case Western Reserve University, kalle@po.cwru.edu	Carl Cargill, Director of Standards, SUN, Carl.Cargill@sun.com	Alexander G. Øst, IT Architect, Danish IT&T Agency, alx@itst.dk	Yves Chauvel, Director for European Co-ordination, ETSI, yves.chauvel@etsi.org
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