Information Quality as a Common Ground for Key Players in e-Government Integration and Interoperability

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Abstract

Whereas computer-supported sharing of information is a core issue of e-Government integration and interoperation, the key players involved hardly find any guidance how to settle for an agreement covering the various aspects related to information exchange. Hence, we argue that e-Government research needs an explicit dedication to the phenomenon of information quality (IQ). We base our analysis on key players and constituents in e-Government, and on how those key players' and constituents' needs and wants, roles and agendas shape the view on and the understanding of IQ. We propose detailed and practical steps for information sharing in e-Government interoperation projects and demonstrate how those steps are related to information quality.

1. Introduction

Electronic government services increasingly center on both citizens' and businesses' needs. Likewise, government leaders and e-Government proponents seek streamlined and drastically more efficient internal transactions and services [25, 27]. Both goals require the interoperation and cooperation of government agencies and their respective electronic Government information systems (EGIS) across levels and branches. So far, however, e-Government research has contributed only little to support the actors in achieving the vision of integration. Elsewhere we suggested [28] that e-Government research should focus on (a) foci and purposes, (b) limitations and constraints as well as (c) process and outcomes of e-Government integration and interoperation.

It has been argued before that computer-supported sharing of information is a core issue of e-Government integration and interoperation. Yet, information sharing can be accomplished on fairly different levels of quality and in many different ways requiring different degrees of integration. Hence, we argue that research needs to be explicitly dedicated to the phenomenon of information quality (IQ). In this paper, we specify research questions addressing IQ and related areas, which help shape the academic discussion as well as to inform e-Government practice. E-Government integration and interoperation, as we also demonstrated elsewhere [28], needs to stay within

certain constitutional, legal, and jurisdictional limits of democratic governance. The adequate and mutually supportable level of IQ then it appears has to be negotiated among key players when dealing with the collaborative, organizational, informational, managerial, and performance/technological constraints in e-Government integration. Various needs and wants, roles and agendas shape different IQ perspectives – therefore, making categories and aspects of IQ explicit and negotiable will help key players bring into the open potential disagreements and identify options for consensus.

The paper is organized as follows: First, we outline our research approach to e-Government integration, interoperation and interoperability. Then, we identify constituents and key players in e-Government integration by needs and wants, roles, and their agendas and stances in regard to information sharing and interoperation. Third, we discuss various aspects of information quality. Fourth, we relate the constituents' needs, agendas, and their disposition for negotiating agreements to the required IQ, when sharing information, and vice versa. Finally, we propose how research can understand in detail the practical steps for information sharing and interoperation projects in e-Government and how they are related to information quality.

2. Our Research Approach towards E-Government Integration and Interoperation

The most common vision of e-Government integration is a single gateway (or portal) that integrates every aspect of any given transaction and interaction regardless of its nature such as G2C (government-to-citizen), G2B (government-to-business), G2G (government-to-government), or G2E (government-to-employee). Beyond the visible front-end and interface-level integration, highly sophisticated organizational and technical arrangements are required for the backend integration of the embedding context, the interoperation of organizational units, and the interoperability of EGIS. Such backend integration and interoperation between government agencies and departments also leads it is believed to increased internal effectiveness and efficiency (IEE).

E-Government integration has been defined as "the

forming of a (temporary or permanent) larger unit of government entities for the purpose of merging processes and/or sharing information" [28] referring to the embedding political, economic, organizational, and social process, within which interoperation occurs. *E-Government interoperation*, in turn, "occurs whenever independent or heterogeneous information systems or their components controlled by different jurisdictions/administrations or by external partners smoothly and effectively work together in a predefined and agreed upon fashion," whereas e-Government interoperability refers to "the (technical) capability for e-Government interoperation" (ibid).

E-Government integration it has further been argued is dependent on multidimensional agreements between participating government partners who determine the extent of integration and interoperation. Three levels of agreement-based, voluntary association for integration and interoperation have been proposed: (1) federations, (2) project groups or co-ops, and (3) loose affiliations and interest groups. Memberships in those voluntary associations are inversely proportional to the level of integration and interoperation such that the most loosely coupled affiliation has the highest membership, while the most tightly integrated federations enjoy only small memberships.

However, in e-Government practice the integration, and in its wake the interoperation of EGIS, encounters multiple challenges and a number of serious constraints. Eight major constraints of e-Government-specific integration and interoperability have been identified: (a) constitutional/legal, (b) jurisdictional, (c) collaborative, (d) organizational, (e) informational, (f) managerial, (g) cost, and (h) performance constraints. The constitutional, legal, and jurisdictional constraints set sharp limits to the extent of e-Government integration and interoperation, which cannot (or, even should not) be overcome.

Research and practice dedicated to the phenomena of integration and interoperation in e-Government should focus on at least three general directions [28]:

– *Foci and Purposes:* In which areas and for which purposes are e-Government integration and interoperation pursued (or should be pursued)?
– *Limitations and Constraints:* What are the specific limitations and constraints for e-Government integration and interoperation, what is their nature, what are their characteristics, and how do they counterbalance or reinforce each other? To what extent and how can (or should) those limitations and constraints be mitigated?
– *Process and Outcomes:* What makes e-Government integration and interoperation successful or unsuccessful (including the question: What are the measures of success and failure?)? Also, what intended and unintended outcomes of such projects are desir-

able or undesirable (including the question: What are the desirable outcomes for various constituencies)?

At the core of e-Government integration and interoperation we see the network-based, computer-mediated sharing of information (information integration), for example, coordinated through peer-to-peer agreements and/or standards. Information sharing can be extended into business process integration if a cross-institutional flow of control is established [13]. Obviously, when engaging into different degrees and levels of integration and interoperation including information sharing, different levels of IQ come into play. Therefore, when addressing those three research directions outlined above, our main *research question* is: What are the particular connections between organizational arrangements for integration and interoperation, on the one hand, and the resulting levels of IQ, on the other hand? To answer this, we proceed by seeking answers for the following four subordinated questions:

(1) Who are the organizational and individual actors in e-Government integration, interoperation, and information sharing?

(2) What drives organizational and individual actors towards different views on information sharing and IQ?

(3) What are the dimensions of information quality and how do they relate to the agenda of the key players?

(4) Which targeted level of information quality requires which level of institutional integration and interoperation (federations, co-ops, or loose affiliations)?

Research questions 1 and 2 are discussed in the following section, while questions 3 and 4 are covered in the subsequent sections, respectively.

3. Why do Key Players have Different Views on Information Quality?

Successful information sharing needs an (implicit) agreement on the quality of information to be shared. While there is a scientific debate on information quality (see below), the key players in e-Government usually do not practice that level of reflection. Rather, their view on what is "good" and "useful" information is framed by their wants and needs, their roles and agendas. With the aim of understanding the players' IQ perspectives and why they are different we undertake a general actor analysis in order to provide a framework for further analysis and case-based application.

Identifying the main actors including the key players of e-Government integration and interoperation is a practical and, at first, a methodological challenge. In an early contribution to the literature on Internet-based technology diffusion, five distinctive types of key players have been identified: (1) the technology champion, (2) the organizational sponsor, (3) the coordinator, (4) the developer, and (5) the content provider [2, 22]. From the previous section it is immediately clear that e-Government integration and

interoperation requires more than one of each key player. One can almost assume that as many of these key players are necessary as are agencies involved. Moreover, the view of technology as the main driver of organizational progress has increasingly been criticized in recent years [19, 20].

In government, a focus on business needs as primary driver of organizational change leading to the introduction of suitable information and communication technology (ICT) has been observed [24, 27]. Consequently, the business need for the integration of specific government services and transactions rather than the technological opportunity must be assumed the regular starting point for e-Government integration projects.

Taking this into account, stakeholder theory has been introduced to the field of e-Government to support requirements gathering and the process of managing stakeholder relations. However, the term stakeholder is a "literary" device meant to emphasize that even in private business there are more legitimate interests than those of the owners or shareholders [11]. Although the term has been frequently used in public sector discourse (e.g., [21, 23, 29, 32], we prefer the terms "constituencies" and "constituents" as more appropriate. When transposing Freeman's original 1984 definition [10] into this context, a constituent of e-Government integration and interoperation is "any group or individual who can affect or is affected by" (p. 25) this integration or interoperation. This definition, although deliberately wide, is not meant to include destructive actors such as terrorists, but those who have a *constructive* interest in the potential outcome or run a major potential risk in the context. Thus, for the discussion below, we can presuppose that the constituents involved basically have a positive attitude towards *entering a discourse on IQ issues* – even though they might not reach agreements due to conflicts or hidden agendas.

Constituents it has further been proposed can be distinguished by degrees of salience in terms of legitimacy, power, and urgency [17] as well as their likely stance along the lines of their potential for supporting or threatening the project [3]. The meticulous discrimination among constituents, their salience, their likely stances, and their consequential involvement in projects, in which they hold a stake, has empirically proved to be highly effective also in the public sector [24].

Constituents of e-Government integration and interoperation are numerous in regard to the potential directions of influence ("can affect," "can be affected by," or both). For illustrative purposes, table 1 shows a hypothetical assessment of various constituents' salience and their likely stances with regard to a 'general e-Government integration" project. Suppose the departments of transportation (DOT) at federal, state, and local level would like to vertically integrate processes and interoperate certain EGIS and information repositories (note that the list of constituents with respect to such a

project is not exhaustive). Project managers involved in such a project can use the tool for (1) identifying the constituents, (2) assessing their salience along the lines of power, legitimacy, and urgency, for example, by using a 1-5 score; they can also assess the constituents' likely stances regarding the project.

1-5 Likert Scale (1-low, 5=high)	Power	Legiti-macy	Urgency	Salience Score	Support	Threat	Stance Score
Organizations							
General Public / the citizenry	2	5	3	10	3	3	0
Federal government agencies	4	3	5	12	4	2	2
State government agencies	4	3	5	12	4	2	2
Local government agencies	3	3	5	11	4	2	2
Legislators	4	5	5	14	2.5	2.5	0
Federal courts	5	5	2	12	2.5	5	-2.5
State courts	5	5	2	12	2.5	5	-2.5
Local courts	5	5	2	12	2.5	5	-2.5
Departments within agencies	5	3	2	10	3	3	0
Large businesses	2	5	4	11	4	2	2
Medium businesses	1	5	3	9	4	1	3
Small businesses	1	5	2	8	3	1	2
Interest and activist groups	4	5	5	14	3	3	0
Non-for profit organizations and NGOs	2	5	3	10	3	3	0
Individuals							
Elected officials	5	3	5	13	3	3	0
Exempt employees	4	2	4	10	3	3	0
Civil service employees	3	2	3	8	2	2	0
Government ICT managers	4	3	5	12	3	3	0
Government ICT staff	3	3	3	9	3	3	0
Government unit managers	4	4	3	11	3	3	0
Citizens	1	5	4	10	3	3	0

Table 1 Exemplary Constituentts' Salience and Stance Assessment Sheet

High salience scores typically indicate primary or secondary stakeholders; constituents with high power scores are almost always among the primary stakeholders. The likely stances in terms of supporting or threatening the project further help determining the nature of involvement of such parties. In the table the salience scores are added up, while the stance score for threat is subtracted from the score for support. Negative stance scores indicate a potentially adversarial constituent, whereas zero scores indicate so-called "mixed-blessings" [3], and positive stance score indicate supporters.

The table helps illustrate the potentially difficult nature of e-Government integration and interoperation projects. Since the participating agencies have no or very limited jurisdiction over each other, a vertical and completely integrated process with interoperating EGIS as well as shared information repositories depends on the consent of all participating parties. For various reasons, agencies may choose not to participate. Moreover, even if all agencies smoothly cooperate, the interoperation of systems and integration of processes might be challenged in court by other constituents such as interest groups or negatively affected individuals. In the end, every EGIS integration and interoperation requires a careful upfront assessment of the constituencies' environment [26]. Both salience and stances of constituents may change over time, so that careful monitoring of such changes is of the essence.

In principle, any group of constituents (under certain circumstances) can have a decisive influence on the path of e-Government integration and interoperation. However, in order to identify the key players we need to focus even more towards those actors who are directly involved in the networking across technical and organizational borders. For example, for the study on stakeholder requirements for pan-European e-Government Services, the following constituents were taken into account (see also figure 2 [4]):

– User/problem owners as the main beneficiaries, e.g. citizens, businesses (or subgroups of these);
– Intermediaries (e.g. consumer associations, chambers of commerce);
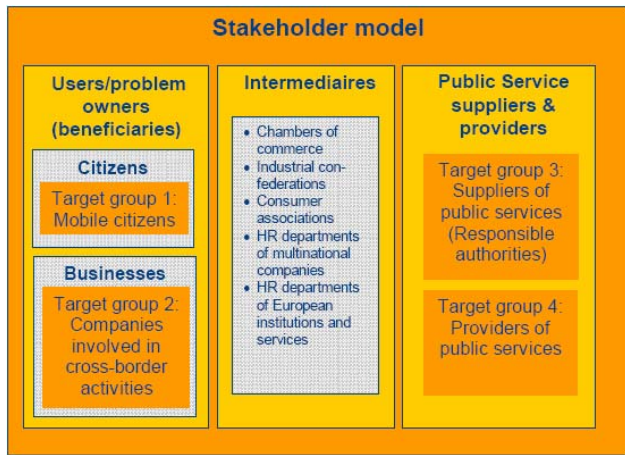– Public service suppliers (responsible authorities) and providers.

Figure 2 Stakeholder model for the study on stakeholder requirements for pan-European eGovernment Services (Capgemini 2005, p. 8)

To put the networked administration into operation, the roles have to be even more specific on the production side (the following has been suggested in a recent position paper by leading public managers in Germany):

– *Salesman:* Understands the constituents' needs and creating demand for a service;
– *Procurer/principal:* Formulates goals and sub-goals of a service, selects and contracts agent(s)/ supplier(s), controls for the overall production, and evaluates quality (if needed);
– *Agent/supplier:* Accepts and fulfills contract on target, coordinates with partners;
– *Provider/producer:* Provides the actual solution to a given demand.
– *Process manager/cooperation manager:* designs the overall process and division of labor, preselects best producers for given tasks, controls for process achievements and quality of results; management of cooperation is important mainly for individual case-based solutions.

In practice, organizations and even individuals can take over several of these roles at the same time (depending on complexity of task and organization). However, the role model is specific in order to help identifying which of these roles can be carried out by EGIS components (e.g. production of a standard solution such as car registration).

In this paper, we restrict our approach to three groups of key players:

(1) Citizens, businesses and even other administrations as users of integrated services and as owners of problems which create a demand for an integrated approach;
(2) Administrations as solution providers and process owners which may organize themselves by assigning a number of roles to accomplish the integration (including enrolling intermediaries and producers which do not belong to the administration);
(3) IT developers and process designers as the main enablers of the technical support required to accomplish the integration.

	Problem perception	Hoping for / vision of
Citizens, businesses (**user**/problem owners)	– How to relate with administration (where, when, with whom …)? – How to find appropriate/accurate information in due time? – Fragmented performance of administrations (actors involved, media, process steps)	– Integrated services – Customer-centric approach – Blending of personal human service and automated technical support
Administrations (**provider**/ process owners)	– Not knowing who has what kind of information – Limited access to existing information – Inability to (automatically) interpret and process shared information – lack of administrative readiness and interoperation performance according to particular positions and related views – Lack of reliable interoperability framework	– Integration of information (sources) and processes – Accepted concept for information ownership in the area of e-Government – Leadership and/or accepted standards in achieving interoperability and integration
IT **developers**, process designers	– Disintegrated data sources – incompatible formats & interfaces – variety of standards – lack of semantic interoperability & process ownership	– Provision of and adherence to standards – Agreement on technical, semantic and organizational issues of data formats, interfaces, and process control

Table 2 Main concerns of key players framing their agenda on information sharing

The different players' perspectives, which need to be aligned and accounted for are illustrated in table 2 (without claiming for completeness). On the one hand, the players' wants and needs are rooted in different problem perceptions; on the other hand, they potentially benefit from information sharing involving and requiring various levels of interoperation.

Introducing interoperability technology to the organization is mostly intended to help enhance the extant IT infrastructure via automatic processing and dissemination of information across system and organizational borders. The success of the technology application for maximizing the integration relies largely on the quality of information being exchanged through these infrastructure enhancements. Obviously, there are not only technical, but also many organizational issues involved, which have to be addressed at the same time. For example, in the European interoperability framework for pan-European e-Government services [7] we find organizational, semantic and technical interoperability on the same agenda:

Participating administrations should (among other aspects):
– Jointly determine requirements for integrated services via a demand-driven approach
– Analyze business processes, actors involved and business interoperability interfaces
– Formalize respective expectations, for example by means of service level agreements
– Agree upon a common security policy
– Publish information on the corresponding data elements involved at national level
– Agree on the data and the related data dictionaries required (as well as on multilateral mapping tables between the various data elements, if needed)
– Take due account of linguistic traces of the specific legal vocabularies used in delivering services
– At front-office level, make sure of technical interoperability in the fields of data presentation and exchange, accessibility, interface design principles, multi-channel access, character sets, collective authoring, file type and document formats, file compression
– At back-office level, make sure of technical interoperability in the fields of data integration and middleware, XML-based standards, EDI-based standards, Web Services, distributed application architecture, interconnection services, directory and domain name services, network services etc.
– Ground common guidelines on recognized open standards

Even though this framework and its recommendations are just one example, it reflects all of the basic issues involved and to be solved, and we will find similar demands for agreements and cooperative strategies in any community or network striving for e-Government integration. Most of these issues are related to content, form and other attributes of the information being shared during interoperation. While the technical aspects of the information exchange seem to be solvable (at least in principle), there are still many issues unresolved concerning the semantic and organizational aspects.

The main non-technical issue is ensuring that the precise meaning of exchanged information is understandable by any other application that usually was not initially developed for this purpose. "In order to obtain mutual understanding of interchanged data, the actors have to share a model of what the data represent. Semantic interoperability is about how to achieve such mutual understanding [30]. Semantic interoperability enables systems to combine received information with other information resources and to process it in a meaningful manner. It is therefore a prerequisite for the front-end (multilingual) delivery of services to the user. Furthermore, reliability, trustworthiness, confidentiality, security and timeliness of information exchange are also success factors for which mutual understanding is needed.

Unlike projects within a single organizational unit, cross-departmental or cross-agency information sharing projects are far more complex due to the diverse missions and purposes of the participating parties, the relatively high number of primary and secondary constituents, and the diverse mix of needs and wants. This complexity can be dealt with it has been proposed through a thorough and step-wise approach (see table 3) that ensures the necessary support and alignment of participating agencies and constituents [26].

Step	E-Government Information Sharing Project Steps
1	Identify General Information Sharing Need/Purpose
2	Identify and Involve Salient Constituents; Jointly Create Project Vision
3	Identify Salient Constituents Specific Needs/Wants; Identify Potential Benefits and Costs
4	Analyze and Evaluate Likely Organizational and Social Impacts
5	Identify Salient Constituents' Likely Stances
6	Discern Constituents' Predisposition for Collaboration
7	Identify and Facilitate Critical Success Processes
8	Analyze and Evaluate Technical Architecture Alternatives
9	Pilot with Prototype Components
10	Evaluate the Organizational and Social Acceptability-Modify as Necessary
11	Evaluate Technical Robustness/Soundness-Modify as Necessary

| 12 | Incrementally Deploy and Use System Components |
| 13 | Establish the Level of Acceptance and Satisfaction with Constituents |

Table 3 E-Government Information Sharing Project Steps

Unlike technology-oriented approaches, this approach relies on an inclusive organizational and social alignment process between the prospective partners and their constituents, which explicitly recognizes and takes into account the ultimate autonomy and self-determination of the participants. The technology-related arrangements for interoperation are embedded into the overall process. The degree of integration, interoperation, and information sharing, and, hence, ultimately, also the level of IQ, emerges as a result from that overall process. In this approach it is assumed that continuous integration between sufficiently independent parties can only be maintained as long as the sum of all organizational, social, and technological benefits offsets the respective costs by a margin high enough. Constituents' perception of its perceived value is seen as a key factor in driving and maintaining e-Government integration.

Since so many issues need to be agreed on as prerequisite for information sharing, the importance of standards cannot be underestimated. Federations, project groups or co-ops (see above, section 2) may rely also on specific bilateral or multilateral agreements and/or commitments by which the partners involved specify and publish their commitments of the methods through which they are able to interoperate. But to minimize the effort of agreement making prior to interoperation, accepted standards (covering as many aspects as possible) are the key to any large scale information sharing (especially among loose affiliations and interest groups). In addition, the more parts of the agreement are machine-readable and within an expected range, the more can even be accomplished through computer-based "negotiation" (thus reducing human involvement and organizational decision making).

In summary, the agenda for issues to be clarified as prerequisite for successful information sharing is long and complex. For the constituents involved this presents a great challenge, and they address this challenge on the basis of their wants and needs, their roles and agendas. Reconsidering the theoretical model of interagency information sharing (Dawes 1996), standards related to the quality of information sharing now become the most important components of the "policy and management framework" which promotes the benefits and mitigates the risks of any interagency information sharing. Therefore, improvements in this direction are expected to have boosting effect on large-scale e-Government integration and interoperation. However, not all issues can be clarified upfront on the basis of information standards, and the case-based aspects of information sharing still need to be identified and agreed on. For this kind of discourse we

seek to provide an analytical frame in order to facilitate e-Government research in this direction.

In the following section we discuss the aspects of information quality in more detail in order to determine what kind of contributions by e-Government research in this area are likely to address the concerns of the key players and thus contribute to e-Government integration and interoperation.

4. Information Quality in e-Government Integration and Interoperation

When engaging into e-Government integration research or practice, a needs-and-wants-based perspective has been proposed for guiding both the analysis and the extent of engagement into the integrative effort [28]. From that perspective specific needs and wants of institutional and individual actors can be distinguished along three dimensions of (a) purpose (specific versus general), (b) frequency of need/want (ad-hoc versus occasional versus permanent/high frequency, and (c) principles, requirements, and choices in terms of governance, economy, organization, and ICT (ibid). When identifying constituents' needs and wants in the context of e-Government integration, the area of information sharing is of particular importance, since it immediately poses the problem of what information quality is expected from or required by the parties involved. Information quality is a defining aspect of all information sharing efforts, and hence central to e-Government integration.

Information Science (for example, [14, 16, 31, 35, 36] as well as Information Systems Research along with Computer Science and Engineering (for example, [1, 6, 8, 9, 34, 37] have studied various aspects of information quality (IQ). Interestingly, even though the literatures started from different vantage points, they seem to converge in major areas towards similar dimensions. In his study on value-added processes in information systems, Taylor was among the first to develop criteria and measures for IQ [31]. Since the value of information can be defined only relative to its actual user [15], IQ is a context-sensitive and elusive concept. Furthermore, the meaning of information may change in time and over time, so its usefulness will also vary even for the same users (ibid), that is, IQ can further only be defined relative to its actual use. It is obvious, if needs and wants of constituents change, so change their information needs and wants. However, along with these changes also the user-perceived IQ varies, even for previously assessed and used information. This has important consequences for information sharing in e-Government, in particular, and for e-Government integration, in general. The issue of IQ is becoming even more important, as concepts and technologies of the Semantic Web are employed to enhance information sharing on a large scale [12], based on tech-

nical, semantic and organizational interoperability standards.

Before discussing those consequences, the various dimensions of IQ deserve a brief introduction (see table 3): IQ can be distinguished relative to its (1) *accuracy* [31], which holds that a user of a piece of particular information has received "a true copy" (p. 62) without any claim to its validity or veracity. In e-Government, this IQ criterion refers to government agencies making sure in their information sharing procedures that information is accessed, or transmitted and received accurately such that an undistorted representation reaches the respective requestor of that information.

Further, IQ depends on the (2) "*objectivity*" or *comprehensiveness* of the information accessed or received (ibid). Sub-dimensions of comprehensiveness are consistency, presentation, and completeness. Also, this criterion of comprehensiveness depends on the scope defined by the need or want of a particular information seeker. In e-Government, the needs/wants-related scope of information sharing has to be well understood among and between the participating government agencies and departments, both when initiating and maintaining the sharing activity over time.

IQ also depends on the (3) *currency* of information (ibid). Like other IQ criteria before, currency is a relative concept. Taylor gives the examples of the air traffic controller versus the strategic planner. While the former needs information in real time, the latter has no need of this kind of currency (p. 63). In e-Government, the information currency needs will also widely differ between users of the same information. A police officer stopping a car has a real-time information need, while the city road construction planner has most certainly not.

Another IQ criterion is (4) *(cognitive) authority,* which refers to an influence an information seeker attributes to certain sources of information, such as persons, books, instruments, and organizations [35]. The credibility of information and information sources represents an important part of cognitive authority [18]. Again, the "cognitive authority is relative to a sphere of interest" (p. 94). In e-Government information sharing, the cognitive authority of another government information source or provider may vary widely contingent on an agency's relative distance to the source or provider, the provider's perceived resourcefulness, the past experience with or respect for the information source or provider, and other factors. The famous 9/11 report gives ample evidence of how investigators of various agencies attributed little or no cognitive authority and credibility to department- or office-external sources of information.

Also, (5) *Assurance / reliability* is another, closely related criterion of IQ. Taylor calls it the summation of other values [31, 64], which rests on past experience a user has accumulated with an information system over time, such that "its output will be perceived as reliable and worthy of trust" (ibid).

IQ is further distinguishable by the classical information retrieval criteria of (6) *relevance, precision, and recall* [33]. Under relevance it is understood how many documents in a (finite) information retrieval system are relevant relative to an information seeker's need. Precision then refers to the number of relevant documents retrieved over the number of all retrieved documents from querying the system, whereas recall alludes to the number of relevant documents retrieved over the total number of relevant documents in an information repository (provided that number can be known). In e-Government, both precision and recall will influence the user perception of usefulness, credibility, and assurance of the information sharing capacity of interoperating systems.

Another IQ criterion is (7) *timeliness* of information [1]. In contrast to currency, timeliness indicates how fast an information seeker can access or receive the information she is looking for. In highly interconnected information networks, such as the Web, users are now accustomed to finding information in the nick of time (although obviously at the expense of precision and recall). In e-Government, the patrolling police officer, for example, does not only need current but also timely information relative to the task at hand.

Finally, IQ is measured by users from the perspective of (8) the *perceived value* of information retrieved [15]. The perceived value (similar to reliability and cognitive authority) is determined by the information seeker's accumulated experience with the information itself and the information sharing, seeking, and retrieval process. In e-Government, the perceived value of information in an information-sharing environment can strongly influence the extent of information stewardship and information use [5].

5. Future Research Avenues for Paving a Common Ground (Concluding Remarks)

In summary, most, if not all, IQ criteria are interdependent and also aligned to the subjective perspectives of users or information seekers. Those, in turn, are strongly influenced by the users' or information seekers needs and wants, which as we have seen above, may change over time. E-Government information sharing (as part of e-Government integration) has to account for the very different and subjectively colored measures of IQ employed by different users. It is unlikely that agencies that attribute only low IQ scores to the information sharing practice will massively engage in information stewardship and use of shared information. It can also reasonably be assumed that positive experience with information sharing (that is, high perceived value and perceived high quality of shared information) will continue and intensify their engagement in information sharing activities.

Further, it can be concluded that a thorough analysis of needs and wants of cooperating constituencies leads to more precise specifications of the extent of the information sharing exercise. The narrower the scope and the better aligned the information needs of participating parties, it appears, the better are the prospective results of information sharing among government agencies. This converges with the analysis presented elsewhere [28] that e-Government federations provide the most elaborate format of e-Government integration and, hence, the highest potential IQ, while more loosely coupled formats like e-Government co-ops, or interest groups facilitate lower IQ in information sharing.

We have argued above that all constituents who are concerned with e-Government integration and interoperation will also be concerned with the conditions of possible information sharing from their point of view, their role, profession, and involvement. Therefore, the quality of (shared) information is a central issue, and it actually provides a common point of reference through which the key players involved can express their wants and needs, their expectations, concerns, and potential contributions.

Since IQ is such a central concern for the key players involved when striving for a joint strategy in e-Government integration, the negotiation regarding the desired and indispensable quality of information provides them with a common ground as well as with a strong incentive despite and in acknowledgment of the numerous constraints incurred. In practice, of course, we find this kind of rational discourse being challenged, for example, by single-handed and non-inclusive approaches towards e-Government projects, or, by the lack of reflection on constituents' wants and needs, or, by hidden agendas related to power and aspiration. However, providing means for the rationalization of the discourse and supporting the key players in the effort of clarifying their information sharing strategies can also help identify and remove obstacles, which otherwise remain obscured.

With what we have developed so far in this paper, we are now in a position to propose a path along which research can be organized to understand in more detail the practical steps for information sharing in e-Government interoperation projects and the related level of information quality.

Above, we have introduced the following analytical instruments: (1) we distinguished three levels of institutional integration; (2) we invoked the framework for analyzing the salience and stances of primary constituencies (key players); (3) we introduced the constituency-related wants & needs perspective; (4) we also introduced an analytical outline of the interoperation project agenda; (5) we finally distinguished the dimensions of information quality.

All five analytical instruments can serve as starting points and initial perspectives, from which the relation to the other issues can be explored. The choice of the primary accent depends on the research interest as well as on the intended contribution to practice.

If, for example, researches primarily seek to improve the management of integration development, research might focus on the steps of information sharing projects and investigate the salience and stances of key players who need to be involved as well as the dimensions of IQ to be addressed in each step according to the player' wants and needs (as demonstrated in table 4).

E-Government Information Sharing Project Steps	Key Players who should be Involved	Dimension of IQ to be addressed
1 Identify General Information Sharing Need/Purpose	User, provider	1-5, 7,8,
2 Identify and Involve Salient Constituents; Jointly Create Project Vision	User, provider	2, 4, 5
3 Identify Salient Constituents Specific Needs/Wants; Identify Potential Benefits and Costs	User, provider	1-4, 6
4 Analyze and Evaluate Likely Organizational and Social Impacts	User, provider	4, 5
5 Identify Salient Constituents' Likely Stances	User, provider	6
6 Discern Constituents' Predisposition for Collaboration	User, provider	5
7 Identify and Facilitate Critical Success Processes	User, provider	6, 7
8 Analyze and Evaluate Technical Architecture Alternatives	Developer	6, 7
9 Pilot with Prototype Components	User, provider, developer	1-7
10 Evaluate Organizational and Social Acceptability; Modify as Necessary	User, provider	5, 8
11 Evaluate Technical Robustness/ Soundness- Modify as Necessary	Provider, developer	6, 7
12 Incrementally Deploy and Use System Components	User, provider, developer	1-8
13 Establish the Level of Acceptance and Satisfaction with Constituents	User, provider	8, 5

Table 4 Relating Information Sharing Project Steps with Key Players and IQ Dimensions

However, if researchers primarily seek the improvement of the quality of the information sharing and the overall integration result from an information perspective,

then research might focus on the dimensions of IQ. In this case, research needs still to perform an analysis of key players' salience and stance helping determine who needs to be involved in the negotiations on IQ and the level of institutional integration necessary for reaching a sustainable agreement/commitment (figure 3).
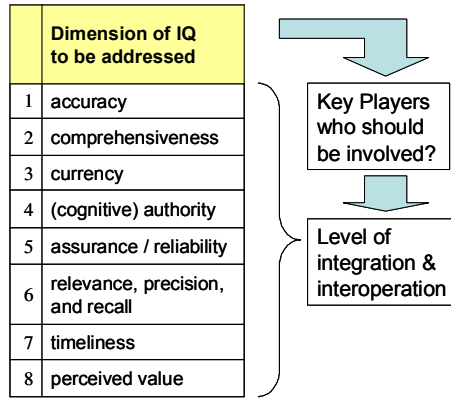

Figure 3 Relating IQ Dimensions with Key Players and the Level of Instituional Integration

Another approach using the analytical tools presented here might be aimed at improving the information sharing and IQ-related capacity of key players or their skills regarding agreement/commitment making, in which case research would assess the various IQ dimensions and required levels of IQ relative to key players' stances, wants, needs, prior experiences, and negotiating styles.

In this paper, we intended to demonstrate that (1) information quality is at the core of e-Government interoperation and integration; (2) IQ is also a very suitable concept for entering into the necessary discourse between key players. IQ has the capacity to serve those key players as a common ground in cross-agency information-sharing and interoperation projects, and (3) e-Government research on IQ and interoperation may contribute to key players' practical skills and capacity for coping with the complexity of the tasks at hand; and, finally, (4) research can also facilitate the integration development through specifically targeted investigation in this area.

Using the proposed analytical instruments when exploring the various relations in detail along those avenues outlined above, will, we are certain, provide both the research and practice communities with valuable and critical insights in the complex relationships of IQ, information sharing, integration, and interoperation in e-Government.

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