

**Zeitschrift:** Studies in Communication Sciences : journal of the Swiss Association of Communication and Media Research

**Herausgeber:** Swiss Association of Communication and Media Research; Università della Svizzera italiana, Faculty of Communication Sciences

**Band:** 4 (2004)

**Heft:** 2

**Artikel:** Information quality : organizational, technological, and legal perspectives

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**DOI:** <https://doi.org/10.5169/seals-790971>

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## INFORMATION QUALITY: ORGANIZATIONAL, TECHNOLOGICAL, AND LEGAL PERSPECTIVES

### 1. Introduction

This issue of Studies in Communication Sciences dedicates its thematic section to the topic of information quality and examines the fitness for use of information from three different perspectives: the organizational, technological, and legal viewpoint. We believe that the question of *what makes information valuable* is essential both in theory and practice, since communication, inter alia, can be understood as the exchange of information aimed at creating and conveying meaning. Exploring the question systematically requires an interdisciplinary approach that highlights the many facets of high quality information, whether they regard content, format, time, process or infrastructure. The interdisciplinary approach, which in our case includes legal scholars, management scientists and information technology researchers<sup>1</sup>, can also help to analyze the plethora of problems related to low quality information, such as misinformation, information overload, paralysis by analysis, wrong decisions, scrap and re-work, or distrust.

In this introductory article, we briefly review some of the reasons that make information quality a highly relevant research topic for communication sciences and related disciplines (with numerous practical implications). We offer an overview of the state of the art in information quali-

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<sup>1</sup> Information quality is also a research topic in other scientific communities. In media studies, for example, the question of how editorial policies influence the quality of information in a newspaper has been widely discussed. See Russ-Mohl (2002).

ty research in three disciplines and highlight current research questions as well as unresolved issues. In the last section of this introduction, we provide a synopsis of the various contributions of the thematic section.

## 2. The Relevance of Information Quality

Amidst the increasing quantity of communicated information today, the quality of that information becomes a central concern for the functioning of an information economy. As ever more information is competing for our attention, we as information consumers want to be sure that our time is well invested and that the information at hand is worthwhile and reliable. While the quality of communication does not solely depend on the quality of information, information as the core message is a major part of any communicative action. If information is incorrect, outdated, inconsistent, or unclear, the communication as such will most likely not be satisfactory.

Information quality in this context designates the characteristics of an information product or service (e.g., a set of information bundled for a specific purpose) to meet or exceed the requirements of its stakeholders. The stakeholders of an information product or service are its consumers, creators, custodians (or administrators), direct or indirect content providers, intermediaries, and regulators. High quality information from a functional perspective is information that is fit for use and of high value to its consumers, as it is free of errors or other deficiencies. Information quality can be described more specifically with the help of information attributes or structured criteria lists that categorize information characteristics into several meaningful and manageable dimensions. So-called *information quality frameworks* define information quality by categorizing core criteria that make information useful. They are either generic or application specific. Typical information quality application fields are e-commerce websites, management information systems, customer databases, mobile information services, corporate communication, analyst reports, patient records, accounting statements, financial data warehouses, or e-mail messages, to name but a few of the areas where information quality is crucial. In all of these fields, information quality can be described through attributes as the ones listed and structured below in a sample, generic information quality framework. This particular approach (taken from Eppler 2003) distinguishes among content and media-based prerequisites for high-quality information.

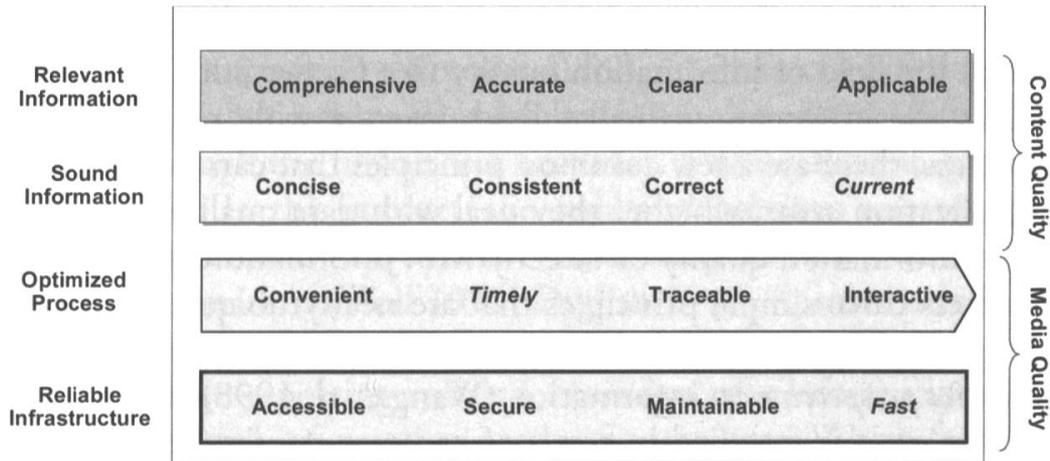


Figure 1: A sample, generic information quality framework.

In discussing information quality and its relevance in various fields, we must distinguish between two similar, but nevertheless distinct concepts: Whereas *data quality* designates the characteristics of mostly un-interpreted, often numeric or tabular database entries, information quality describes the fitness for use of analyzed, commented or otherwise interpreted data. High quality information often relies on high quality data, stored in databases, data warehouses and the like. This is why *information technology researchers* examine the management of data quality as a prerequisite for the quality of information products, such as data warehouses (e.g., English 1999), websites (Alexander & Tate 1999), or CRM (customer relationship management) systems. These and other applications are mostly used within and among companies. They not only require sophisticated infrastructures, but also systematic management processes (i.e., clarifying tasks, roles and responsibilities). Consequently, *organization scholars* are also a part of the information quality research program (for example Lesca & Lesca 1995). They contribute essential elements that show how to manage information quality systematically. To the extent that information products are required for decision-making processes within an organization (e.g. in the context of board's decisions) or are communicated to third parties, such as contract partners, customers, citizens, or policy makers, the quality of information might also have legal relevance, particularly if there are negative repercussions of distributed low quality information. Laws and regulations that deal with information quality issues – consider, for instance, responsibility for misleading advertisement, liability for false financial statements, libel, or lia-

bility for inaccurate advice – have emerged and create the need for *legal research* in the field of information quality (see Gasser 2004).

Visibly, the information quality field covers a wide range of topics. Nevertheless, there are a few common principles that can be observed in most application areas, whether they deal with data quality as a prerequisite for information quality or directly with information quality. Let us merely stress three simple principles that are nearly ubiquitous in information quality thought: First, the information quality approach is based on a *product perspective* on information (Wang et al. 1998) which implies that information is specified in terms of its usage requirements and how these requirements are met through responsibilities, processes, and systems. Second, information quality is generally perceived as a *multi-dimensional* construct that consists of a number of (at times conflicting) criteria (as shown in Figure 1). These criteria can be both subjective (such as relevance) and objective (such as currency). A third common information quality principle is the call for a *balanced approach* in managing information quality. This means that managing information quality requires a comprehensive approach that considers product and process aspects, as well as technical and social issues. Thus, it requires an effort that addresses the (technical and regulatory) systems, but also the individuals who create, administer, distribute, or use information. This brings us to the three disciplines that are examined more closely in the thematic section and that, in our view, are essential to assure such a balanced approach: organization, Information Technology, and the law.

Within **organizations**, information quality is relevant for most information- and knowledge-intensive applications; not just for information processes tailored towards external customers, but also for internal communication tasks. The development of the information quality field within the realm of organizations has been kick-started by two main sectors, namely accounting and management information systems (Titman and Trueman 1986; Vickrey 1985; Taylor 1986). Both disciplines have long dealt with information as a main research object, so it is not surprising that the quality of information was soon considered to be a key success factor. Information quality is still a highly relevant issue in both disciplines, as recent accounting scandals such as Enron and the many failed information system projects illustrate. Early information quality approaches in these areas focused on defining criteria which make information a high quality product, while more recent approaches put empha-

sis on the management activities that are necessary to consistently ensure high quality information (Wormell 1990). The lesson learned from these early efforts is that information quality is much easier to define than to achieve (although the former is a necessary, if not sufficient, prerequisite for the latter). In this context, the results of previous research on total quality management (TQM) have been adapted and extended to the realm of information (Wolf 1999; English 1999) to solve pressing problems such as the following: How can we create incentives to reduce human errors in reporting systems? How can sales information be better aligned to the real information needs of purchasers? Which factors make a website informative to its target groups? What new roles, processes or training formats have to be created to assure that analyst reports meet the requirements of their readers? In answering these questions, organization researchers need to combine their efforts with researchers in the area of information technology. This field is described in the next paragraph.

**Technology** oriented research in information quality centers around challenges in information environments in which data from diverse structural and semantic sources has to be shared or combined. In modern organizations, there are many such situations as, for instance, in cases where isolated data sources have to be made interoperable beyond organizational boundaries (e.g. supply chain and healthcare management). Another example of increasing importance are web environments, in which diverse data sources are combined to provide new and meaningful information. Data Warehouse and customer relationship systems further illustrate the increasing significance of information quality as size and complexity of informational environments increase.

In order to combine structurally and semantically different data sources, not only technical interoperability is required, but also an understanding of how these data sets relate to one another in terms of structure, semantic and time dependencies. In the relevant literature, these situations are generally referred to as *distributed, cooperative or integrated information systems*. In this context, three main problem areas can be identified, which also illustrate the developmental stages of this research strand: (1) data merging and interoperability, reconciliation and synchronization, (2) data source assessment and selection, and (3) architecture and information manufacturing models:

(1) Over the last decades many algorithms and tools have been proposed

for synchronizing, merging and reconciling data sources ranging from techniques for data extraction, data cleansing, and record matching to data replication mechanisms (Winkler 1995; English 1999; Maletic and Marcus 2000), whereas interoperability of heterogeneous data sources remains extremely difficult to be achieved.

- (2) Assessment techniques measure data quality criteria such as completeness and correctness of data sources. Frequent examples of assessment techniques include data mining techniques, statistical methods or rule-based systems (Redmann 1996; Lee et al. 2001; Pipino et al. 2002; Dasu and Johnson 2003). Recently, these methods have been extended to techniques such as quality-extended data query processing or data quality notification and certification services (Naumann 2002; Marchetti et al. 2002).
- (3) Architecture and information production models represent the manufacture of information products and evaluate architectural considerations in complex information system environments (Ballou et al. 1998). Examples of this type of research are Information Product Maps (Shankaranarayan et al. 2000; Scannapieco et al. 2004) and quality-oriented design methodologies that consider the impact of architectural choices on information quality (Cappiello et al. 2004).

Research in these areas is theoretically rooted in database and information system research, as for instance data modeling, database constraints, data querying, and data mining approaches. Results enhance the theoretical foundation, but also contribute in a broader sense to information system efficiency considerations, in which the importance of information quality as a factor in providing successful information systems has been evaluated (e.g. DeLone and McLean 1992).

From a **legal and regulatory perspective**, information quality is relevant in a wide variety of contexts. Most obviously, law is often concerned with ensuring a certain level of quality where it is specifically aimed at regulating the production, distribution or processing of information. Examples range from provisions in privacy laws requiring accuracy of personal data, quality standards imposed on broadcasters, quality requirements for product labels or – as mentioned – accounting principles such as “true and fair view.” However, information quality issues are also relevant where the law imposes general obligations and duties such as “duty of care” or “fiduciary duties.” Consider, for instance, the duty of an asset manager to inform her customer about the risks of a specific investment.

Finally and most fundamentally, law is itself information, and law-making as well as the application of legal rules are information-based processes. Consequently, the quality of the legal system is interwoven with the quality of information as its building block (Druey 1995).

This brief overview makes clear that “information quality” is neither governed by a single body of law nor a coherent set of rules. As a consequence, the discussion about information quality issues – both in practice and theory – has in large parts been context-specific and fragmented. It is only recently that, under the heading “information law,” a cross-sectional and interdisciplinary discourse on information quality has emerged.

### 3. Research Issues in the Information Quality Field

Research on the topic of information quality is both long-standing and emerging. It has a long-standing tradition as information has been researched for a long time, in many forms and in many disciplines, ranging from philosophy to biology. Often, the notion of ‘good’ information has at least been implicit in these various branches of research (whether in epistemology, media studies, library sciences or economics). However, the explicit examination of the attributes that make information valuable, and how they can be assured consistently, is a recent research field that has gained visibility with the advent of modern information technology applications, most notably the Internet. In reviewing the roots of the information quality field, one should also not forget that the information quality field builds on the more than thirty years tradition of (total) quality management. Still, there are many open research questions, some of them addressed in this issue. Pressing information quality research questions in the realm of **organization studies** relate to the following issues and unresolved problems:

- Information quality costs: How can the costs of non-quality information be measured, particularly in monetary units?
- Information quality qualification: What kind of training yields the greatest benefits in terms of information quality improvements?
- Information quality investments: How can an optimal point of information quality be determined?
- Information quality institutions: What roles or positions need to be created to assure information quality in an organization (such as a chief information quality officer)?

- Information quality requirements analysis: How can consumer expectations with regard to information quality be captured, represented, and used for internal information quality management?
- Information quality applications: In which application fields do information quality improvements yield the greatest benefits? How do these application areas differ with regard to information quality requirements?

Beyond isolated answers to these questions, their interdependence is another major issue for information quality research. To learn more about these interdependencies, management researchers need to collaborate with information technology scholars. Their main research challenges are outlined in the next paragraph.

With recent advances in **information technology**, more complex information system environments have been established in many organizations. In essence, these environments can be characterised as exchange-intensive information systems of high dynamicity and diversity. In order to ensure a beneficial application of technological innovations, information quality with its product perspective shifts the traditionally technological and application oriented approach towards a user-centric and requirement-based focus. Many advances in information quality research have been made over the last years. However, there are still many challenges to overcome. To illustrate some applications, the following examples demonstrate the potential as well as the research problems in the technology-oriented domain of information quality:

- Regardless of the many efforts to design and implement enterprise-integrated information systems and data warehouse concepts, many organizations experience inadequate and inconsistent information (for example outdated addresses in customer databases or wrong codes in product information systems). Various techniques and commercial tools for data cleansing and record matching have been developed. However, gathering and reconciling data quality requirements, assessing the current quality level as well as designing enterprise-wide information manufacturing systems of increased complexity are highly challenging tasks.
- Customer Relationship Management systems are widely applied in all kinds of organizations. After initially high expectations, numerous projects have failed, often due to an overrated or poor information

quality. One of the most challenging problems in order to analyze customer behaviors is to provide consistent customer information. Most organizations provide multiple points of contact to customers, which increase the challenge to identify (unique) customers and group their diverse business transactions.

- No other sector is as information intensive as healthcare, and due to the severe consequences for patients there is no doubt that healthcare professionals must be supported by information of high quality. Against this backdrop, it is surprising that the importance of high quality healthcare information has only recently become a subject of information technology research. In this field, many challenges still have to be met, as for example the quality assessment and quality certification of electronic healthcare records, or the determination and improvement of the quality of the enormous amount of medical and biological data.
- Web environments with rich multimedia contents include many information quality research areas, including the development of generic quality criteria for websites, requirement-based information searching and filtering, information quality measures and user preferences-based content presentation, or the long-term preservation of web contents.

From this 'traditional' domain of information quality research, we move to the more recent legal discussion on the topic.

Information quality as a cross-sectional matter has only recently become a subject of **legal scholarship**. In essence, we can distinguish between three stages in the evolution of information quality as a research topic in law: initially, legal scholars addressed particular aspects of the information quality problem – mostly against the particular backdrop of a new piece of legislation, a court case, or the like – within the well-established, but rather fragmented sub-disciplines such as constitutional law, copyright, contract or corporate law. In this early stage, information quality was neither perceived as a distinct research field nor explored from a conceptual angle. In a second stage, triggered by Jean Nicolas Druey's (1995) groundbreaking monograph on information as a subject of law, a debate about the definition of information quality, about quality criteria and about the question of legal assessments of information quality emerged. The insights gained from this scholarly work have been applied to specific problem areas such as the regulation of mass-media where the quality of information as a "product" came up for discussion (see Zulauf 2000;

Gasser 2000), or to privacy-related issues (Weber 1999). Most recently, however, a more fundamental debate about information quality regulation has been launched. A book edited by one of the authors of this introduction addresses the promise and concerns associated with information quality from the perspective of information law, analyzes key problems of informational quality regulation, and provides theoretical overviews of legal approaches to information quality regulation as well as practice-oriented and sector-specific exemplifications and analyses (Gasser 2004). Contemporary legal research seeks to analyze what players and/or what forces are regulating quality of information by what means, for what purposes, and with what effects. As far as regulation by law is concerned, the following issues are on top of today's research agenda:

- Need for legal intervention: Initially, the question arises whether there is need for regulation at all, since legal interventions into social processes in general and content-related regulation of information and communication processes in particular require compelling factual justification and legitimation (e.g. in cases of market failures due to external effects or asymmetric information; see, e.g., Mackaay 2004).
- Modalities of regulation: Different legal strategies and techniques can be used to regulate information quality, for instance direct or indirect modes of regulation, substantive provisions or procedural approaches, ex ante or ex post regulation, minimal versus comprehensive regulation, rules or standards, etc. (Trudel 2004).
- Sources of normativity: One important strand of research explores in what manner the law values information quality and what the possible sources of normative criteria for law-based information quality assessments are. Increasingly, the law derives normative criteria for quality assessments from the economic system (e.g. efficiency, functionality), especially where information is regarded as a "product".
- Regulatory context: Some contributions have considered as to what extent there is need for a uniform information quality framework in law or, by contrast, whether sector-specific approaches to quality regulation are more adequate.
- Limitations: One of the most important issues concerns the question where the limitations of the law regulating information quality ought to be. Such limitations are necessary due to factual constraints (context-sensitivity of information versus the generalizing nature of law) and fundamental values such as "free speech" (see, e.g., Bezanson 1998).

- Effects of regulation: First experiences with legal attempts to regulate information quality suggest that the actual effects on information quality are not easily predictable. It turns out that information quality regulation by law also causes unwanted or at least unexpected effects.

Information law and regulatory approaches to information quality are still in their early stages. Most of the themes and questions outlined in this paragraph remain to be studied in greater detail and discussed from various perspectives, by integrating knowledge from different disciplines such as communication studies, information science, economics, and sociology.

Having outlined the relevance and background of information quality, we can now focus on the articles in the thematic section and briefly summarize and position their contribution.

#### 4. The Articles of the Thematic Section

The thematic section of this issue of *Studies in Communication Sciences* aims at introducing readers from diverse disciplines to the multi-faceted topic of information quality. In order to achieve this goal, the guest editors have published a call for papers that was addressed to three distinct, but complementary scientific and professional communities, namely management, information technology, and law. Based on this call, we have received close to fifty submissions which were then carefully selected and reviewed. The final selection of papers in this issue should illustrate the range of issues discussed under the umbrella term of information quality. It should also highlight the various methodological approaches and (professional and scientific) perspectives. Another requirement for the contributions in this issue is that they should reflect research-based, theoretical insights, as well as industry-relevant practical experiences. We start with contributions from the legal domain, move to the articles with a focus on organizations, and finally present contributions with a strong focus on information technology.

*Herbert Burkert*, professor of information law and president of the Research Center for Information Law at the University of St. Gallen (Switzerland) as well as an international fellow at Yale Law School and a visiting scholar at New York Law School, offers in his contribution "Law and Information Quality" some skeptical observations on law aimed at

regulating information quality. In essence, he argues that information quality is a subject best to be avoided by law, although the pressure on law to regulate increases in the context of issues that law has to decide upon. In this fascinating article, Burkert provides a theoretical framework of law's relations to information quality and explores information quality in the context of law's own products.

*Larry English* (U.S.A.), one of the pioneers and thought leaders in the IT-driven information quality field, examines the role of information quality-related regulation from a management point of view and analyzes its impact on management practices. His normative approach rooted in information technology also consists of outlining ways of improving information and data quality pragmatically.

*Tom Redman* (U.S.A.), another early leader in the information quality community, discusses various barriers that companies must overcome if they want to manage information quality systematically. Redman not only focuses on key barriers and outlines their logic, he also shows ways of how to overcome them.

*Retha de la Harpe* and *Dewald Roode* (South Africa), investigate data quality through a theoretical lens by applying the relatively novel theory of actor-networks to data quality. Their discussion is grounded in the context of medical practice and demonstrates that actor-networks are a powerful conceptual framework that emphasizes technical and social issues. Their theoretical framework can be used to explore data quality in a way that complements the traditional management oriented approach to this topic.

*Pankaj Kamthan* (Canada) examines the quality of visual information that is generated with the help of UML – the universal markup language, which can be seen as the new, graphic lingua franca of software developers. The contribution extends the application of information quality frameworks to graphic information. This is surely a future application field for information quality that offers great potential.

*Fabrizio De Amicis*, a business consultant and researcher working in the financial services sector, and *Carlo Batini* from the Università di Milano Bicocca (Italy) propose a detailed methodology for data quality assessment that combines both subjective, qualitative and objective, quantita-

tive data quality assessment. Both types of results are compared and provide a detailed data quality analysis which helps to identify actions for data quality improvements. The methodology is applied to financial data from a real case study that demonstrates the richness of this approach.

*Cinzia Cappiello, Chiara Francalanci and Barbara Pernici* from Politecnico di Milano (Italy) present a semi-automatic and rule-based methodology to perform quality assessment and improvement. The results demonstrate how data quality monitoring rules are defined with an initial data and process analysis and how they can trigger both information process-oriented and data-oriented improvement actions. The monitoring and assessment component is organized around a data quality management architecture – the quality factory – providing a complete set of tools for data quality management.

In concluding, we would like to thank the numerous reviewers for their valuable time and assistance in assessing the submitted articles and providing insightful and constructive feedback to further improve the information quality of the contributions in this issue of *Studies in Communication Sciences*. We hope that their efforts and, most importantly, the authors' contributions lead to a more integrative view on and interdisciplinary approach to this multi-faceted and highly relevant, but also immensely complex research topic.

Lugano, Dublin, and Boston,  
December 2004

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