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The Impact of Information Quality on Information Research

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Abstract

This contribution analyses the impact of information quality on research. It presents a theoretical discussion of the concept ‘information quality’ and shows that good information quality entails good research. The discussion is relevant for both researchers and research users, because it shows that information quality is a critical determinant of research success, as measured by the creation of new knowledge. Thus, information quality fundamentally impacts research. Reasons for the existence of low quality information as well as proposed solutions to this problem are provided in the paper.

Keywords: Information, information accuracy, information attributes, Information timeliness, information cost, volume, information bias, information quality, information relevance, information reliability, Information timeliness, knowledge, research.

Introduction

This article presents a theoretical discussion of the impact that information quality has on research regarding management decision-making. It also discusses the problems experienced and the solution strategies used by managers and intermediaries during information acquisition, information search criteria, information attributes, information search processes,

information evaluation, and information transfer. Throughout the article, the Internet is mentioned as the primary information repository. Finally, information attributes such as information quality, relevance, reliability, trustworthiness, timeliness, cost, volume, bias, volatility, and accuracy are highlighted.

This article provides a theoretical discussion regarding the impact of information quality on research. It explains that the use of quality information is a critical determinant of success for an organisation; equally the use of quality information is a critical determinant of success for research. In research, information is both a production input and output, and good quality inputs are prerequisites for good quality outputs. The objective of this article is to present a theoretical discussion about the impact of information quality on research, using prior research as point of departure.

Literature Review

The literature reviewed is obtained from the World Wide Web. The same keywords are used in three separate search engines, namely *Google* and its scholarly version, *Google Scholar*, the *Association for Computing Machinery (ACM) digital library search engine*, and the *Association for Information Systems e-library search engine*.

Information Quality Definition, Attributes, and Importance

There is evidence that measurements of information quality can be used to predict organisational outcomes (Madnick *et al.* 2009). Data and information quality is acknowledged as playing a critical role in a data-intensive, knowledge-based economy. Data quality and information quality are often used interchangeably. However, there is tendency to use data quality to refer to technical issues and information quality to refer to non-technical issues (Madnick *et al.* 2009). Data can be regarded as a product that is produced by organisations through a data manufacturing process (Madnick *et al.* 2009). Information is said to consist of facts and data, which are organised for a particular purpose; information quality is a major criterion for measuring the success of an information system, and decision quality is a function of information quality (Jung 2004). There is a strong relationship between data

quality and decision quality. Data must be relevant, timely, complete, interpretable, easy to understand, represented concisely and consistently, appropriate, and accessible but secure (Jung 2004).

According to Tang *et al.*, 2003 the four semantic categories of information quality are:

1. **Intrinsic accuracy** (objectivity, credibility, and reputability);
2. **Contextual relevance** (valuableness, timeliness, completeness, information richness);
3. **Representational** (interpretable, understandable, conciseness, consistence); and
4. **Accessibility** (easily and securely obtained).

Information quality attributes can also be regarded to include both the objective and subjective elements of accuracy, reliability, validity, comprehensiveness, currency, credibility, expertise, trust, thoroughness, transparency, and an awareness of bias (Diakopoulos & Essa 2008).

In particular, accuracy can be stated as mistake free, error free, correct, conformity to truth, or exactness to a standard or model, and accuracy states that facts or the version of events presented have been corroborated by multiple reliable sources. Reliability can be defined as dependability or consistency. However, it is more practical to use dependability because consistency requires analysis over time. Credibility is closely linked to reliability through the idea of trustworthiness, and is a perceived, subjective quality of an information source; and trustworthiness is a measure of the truthfulness, fairness, lack of bias of a source or communication; and expertise is the perceived knowledge, skill, and experience of the source (Diakopoulos & Essa 2008).

In addition, comprehensiveness relates to the completeness of coverage of the information, this is equivalent to a principle of thoroughness, which involves methodical learning about the subject. Thoroughness indicates the degree of comprehensiveness of research performed by the information producer, which allows for informed information selections. Comprehensiveness also corresponds to the journalistic principles of fairness and balance that require the inclusion of diverse sources, perspectives, and opinions (Diakopoulos & Essa 2008).

Furthermore, transparency and bias are important attributes of information quality. Transparency entails disclosing and describing how sources know what they know, what biases they might have, and whether or not there are conflicting accounts. Bias also relates to sources, including aspects of the communicator's bias or his/ her relationship to sources and information users (Diakopoulos & Essa 2008).

Information quality is a relative not an absolute concept. Information is regarded as of high quality if it is fit for purpose, which can be judged by the consumer of the information only. What is high quality for one group of users may be considered being of poor quality by others (Embury *et al.* 2009). An example is a typical scenario found in both e-business and e-science where datasets are regarded to be of acceptable quality for the application for which they were initially designed, but are found to be of low quality when applied to a new application (Embury *et al.* 2009). In addition, no single definition of information quality exists. It is a multidimensional concept with various dimensions being of relevance for different applications. One study surveyed information professionals and resulted in dimensions including accuracy, completeness, believability, and interpretability (Embury *et al.* 2009).

The term 'information quality' implies a measure of excellence in communicating knowledge or intelligence. In news production the transference of quality information is vital (Diakopoulos & Essa 2008). Indeed, Journalism requires a practical or functional form of truth that endeavours to provide the reader with information of such a quality so that the reader can make his or her own decisions about the subject (Diakopoulos & Essa 2008). Information quality is critical for good understanding, especially good understanding of online media. Information quality relates to the accuracy and validity of claims and the reliability of information sources (Diakopoulos & Essa 2008). There are nine information quality criteria that are considered to be important to the context of news analysis: accuracy, source reliability, objectivity, depth, author credibility, readability, conciseness, grammatical correctness, and multiple viewpoints (Tang *et al.* 2003).

Information Quality Problems and Solutions

Information quality problems result in increased, estimated costs of between ten to twenty percent of revenue cover, for organisations that use the information for both operational and strategic decision making; these costs include reduced productivity due to time spent to recover from data errors; reduced customer satisfaction and loyalty resulting in reduced future business opportunities; reduced employee morale; and reduced ability to change business rules and policies (Embury *et al.* 2009).

Assessing and benchmarking information quality is a difficult and inexact activity, this necessitates a methodology to ensure that organisations develop quality information products and deliver quality information services to consumers, and benchmarks developed for a methodology can be used to compare information quality across organisations and baseline information quality (Kahn *et al.* 2002).

Organisations are often unsuccessful when they attempt to translate data into consequential insights that they can use to improve business processes, make smart decisions, and create strategic advantages; while organisations continue to increase investment into collecting, storing, and processing vast quantities of data (Madnick *et al.* 2009). The difficulties in translating data into information range from the technical, such as integration of data from disparate sources to the non-technical, such as lack of a cohesive strategy across an organization ensuring that the right stakeholders have the right information in the right format at the right place and time (Madnick *et al.* 2009).

The management of data and information quality starts with evaluating data and information quality in existing systems and processes, and there are many difficulties in obtaining accurate and cost-effective assessments of data and information quality due to the complexities of information systems and the information product manufacturing processes (Madnick *et al.* 2009). A problem exists where data and information quality in many data repositories is very inconsistent, however, the data can still be useful if the user is aware of the quality problems and can formulate workarounds (Embury *et al.* 2009). Data and information quality problems can result from missing or inaccurate data, and out-of-date or imprecise information that will propagate through queries to produce results that are

challenging to interpret, reducing the value of the information (Embury *et al.* 2009).

In the IS research environment, there is poor data, inadequate data preservation and reuse practices, and very little advanced data instrumentation; the IS research community must give data the attention, commitment, quality, availability and growth care that is required for valid research (Lyytinen 2009). Poor data results in poor theory and it has limited the scope and scale of IS research; poor data hinders organisational orientation and longitudinal research, obstructs integrated theory development with strong, generalisable results, and results in little or no digital repositories of validated primary data (Lyytinen 2009). One of the causes of this data poverty is IS research's tradition-bound internal norms and research practices. However, there are solutions that are starting to emerge, such as IS instrument sharing of Internet facilities, public data sources, new data mining techniques and sharable archival data sets, institutional data harvesting opportunities, and the digital footprint of Internet traffic (Lyytinen 2009).

In addition, the Internet has changed the information flows by increasing the unmanaged flows dramatically, and serious information quality problems have resulted for ad-hoc information generated from various sources, such as external Web sites and individual users' personal computing applications (Segev n.d.).

Information Acquisition, Analysis, and Transfer

A factor that has an effect on the information acquisition task is a user's literacy. In a study of how a user's literacy level affects the information acquisition task, it was found that low literacy users take eight times longer than high literacy users to complete an information search task and also were significantly less accurate than high literacy users. Low literacy users on average spent one-third more time on a web page than high literacy users, but did not seem to be informed by it. Low literacy users employed a much less focused information search strategy than high literacy users visiting eight times more web pages in total. Low literacy users back-tracked thirteen times more frequently than high literacy users and are four times more likely to re-visit web pages. Low literacy users are thirteen times more likely to

lose their way on web sites than high literacy users (Kodagoda & Wong 2008).

According to Kodagoda & Wong (2008) an information search originates from a specific task and the difficulty of that task has a direct effect on the quality of information sought. Four factors determine task difficulty:

1. Having multiple paths to reach its goal, each of which yielding its own outcomes and thus contributing differently to the end goal;
2. Conflicting interdependencies among these paths in reaching the end goal;
3. Doubts whether a given path would materialize into the end goal, and
4. Multiple possible goals

Therefore, an information search originates from a task, and it is influenced by the characteristics of the task, namely how the user approaches and retrieves information, the difficulty of the task, and the search strategy chosen (Kodagoda & Wong 2008).

Information quality analysis is a more complex task than just calculating a single measure. Separate items of evidence must be gathered for the analysis then decision procedures must be applied to the evidence gathered to assign specific quality scores to each information item being analysed. The evidence gathering task and the decision procedures will be different in scale and complexity for each application domain (Embury *et al.* 2009). Also, knowledge about data or information sources and the processes used to derive the data or information is important when users evaluate the data or information quality; and when users decide on the appropriate use of the data or information (Madnick *et al.* 2009).

The Internet as an Information Repository

The exponential growth of the Internet has fundamentally changed how information is generated, stored, manipulated, and consumed (Gates 2000, Madnick *et al.* 2009). Also, each Web user has individual knowledge, which results in varied predictions, expectations, and evaluations of information on

the web (Diakopoulos & Essa 2008). Further, information retrieval systems have been almost exclusively the domain of the librarian, but since the advent of the World Wide Web (WWW) this has changed and many people are now only familiar with information retrieval systems such web search engines (Jung 2004). In the research environment, the Internet has changed the way research scientists produce knowledge; the Internet provides access to information on which scientific inquiry is now highly dependent (Ding *et al.* 2009).

The Internet is a massive social network that has emerged without central planning, the addition of pages and links to the Internet is a distributed, asynchronous, complex, and continual process, however the Internet has resulted in the vast majority of web pages having a small number of links and a few pages having huge numbers of links. Only the few pages with huge numbers of links benefit from high volume traffic, search engine indexing, good search engine ranking, good visibility, holding consumer attention, and experiencing the 'winners take all' phenomenon (Pennock *et al.* 2002). This phenomenon has implications for information searching on the Internet, especially via links.

Methodology

The methodology was decided upon after the researchers gained insights about the information quality during the literature review. Repeated searches regarding the nature of information quality, using the search terms given at the beginning of this article, incrementally brought to light relevant literature on the nature of information quality how to obtain and evaluate the quality of information. The literature review therefore created a basis for addressing the objectives of the paper. The methodology applied describes the process that is used to accomplish the aims of this paper. The methodology applied in this article is a systematic process, which increases the reliability and validity of the outcomes.

This article uses a document survey methodology. A non-probabilistic sampling technique is used, called purposive sampling (Oates 2006: 98). This sampling technique is used because the exact universe of relevant documents is unknown and choosing documents based on the search criteria will provide data suited for the purpose of this paper. The documents

are selected based on their relevance and ranking by the search engines. The number of documents selected is suited to the scale of this paper.

Qualitative data analysis is then performed on the documents found. A matrix was used to analyse the data. This was done by searching the literature for any of the following themes that are relevant to this paper: information quality definition, attributes, and importance; information quality problems and solutions; information acquisition, analysis, and transfer; and the Internet as an information repository.

The resulting themes emerging from the literature are extracted and presented in each theme category in the literature review. In the theory discussion chapter, the objective of the article is discussed as the theory, with reference to the article and the relevant parts of the literature review. Thereafter conclusions are drawn in the conclusions chapter of this paper. The methodology applied demonstrates the process used by the authors to address the objective of the paper. The methodology applied is tailored to the scope and purpose of the paper, which is to provide a theory discussion by referring to similar themes found in the article and prior research. The methodology applied is valuable for assessing the approach adopted by the authors and the validity of the resulting theory discussion. The methodology provides a description of the method used to carry out the objective of this paper.

Theory Discussion

The theory discussion analyses the objective of the article by splitting it into its constituent themes, which are: information quality definition, attributes, and importance; information quality problems and solutions; information acquisition, analysis, and transfer; and the Internet as an information repository.

Information Quality Definition, Attributes, and Importance

The quality of a decision is determined by the quality of the information that it is based on, and that the correct use of timely information is critical to the success of an organisation. The article continues to state that decisions must be based on reliable and responsive information, and the information criteria

that must be tested are reliability, empathy, assurance, tangibility, and responsiveness.

The information used in research includes literature and empirical data, both provide evidence for the research. The information from the literature is used to determine how worthwhile the research topic is and to show that the research work will create new knowledge; and the empirical data gathered is the foundation of any research conclusions. Research is completely dependent on both these information aspects; the quality of these information aspects must be high in order for the quality of the resulting research to be high.

Information Quality Problems and Solutions

Information quality problems arise from broad definitions of information quality and the inability to define information quality so that it can be measured and managed (Kahn *et al.* 2002; Madnick *et al.* 2009). Another information quality problem is the validity of claims, referring to the well-groundedness, or logical correctness of a claim (Diakopoulos & Essa 2008). The Internet has also created information quality problems by dramatically increasing the unmanaged information flows, and from ad-hoc information generated from various sources (Segev n.d.).

Solutions to information quality problems include triangulation, corroboration of information sources, and developing a chain of evidence to support inferences (Diakopoulos & Essa 2008). Also, exact and measurable information quality definitions and information quality management programs are a solution to information quality problems (Kahn *et al.* 2002; Madnick *et al.* 2009). Indeed, information quality problems can be solved by implementing methodologies and benchmarks to develop and deliver quality information (Kahn *et al.* 2002).

Research is negatively impacted by low quality information due to poor data, inadequate data preservation and reuse practices, and very little advanced data instrumentation; solutions include increased data attention, commitment, quality, availability and growth care (Lyytinen 2009). Low research information quality causes poor theory, limited scope and scale; hindered organisational orientation and longitudinal research, and obstructed integrated theory development with strong, generalisable results (Lyytinen

2009). Solutions are IS instrument sharing Internet facilities, public data sources, new data mining techniques and sharable archival data sets, institutional data harvesting opportunities, and the digital footprint of Internet traffic (Lyytinen 2009).

Information Acquisition, Analysis, and Transfer

The article proposes that the information search task become a collaborative task performed by both information searchers and users. The article shows that the attention span of Internet searchers to web sites is very limited; searchers require leadership, motivation, adequate breaks, focus, and well define search requirements. The article exposes the costs of information searching, being time, effort, money, transmission costs, knowledge transferral costs, opportunity costs, and information filtering costs to ensure that information is trustworthy, unbiased, and usable; these costs must be managed carefully.

The article explains that deciding between delegating the information search task or self-acquisition is an important choice for information users, because delegation may affect the specificity of the information search and self-acquisition may be technically difficult and time consuming. Human knowledge transfer is critical between the information user and the information searcher, to ensure correct information acquisition. The article presents the information search task as a process that starts with a description of the search phenomenon followed by search phenomenon theory articulation and ending in an evaluation of the collected information. The article presents criteria for evaluating information before it is used for decision-making; these are author authority, comparability, stability, format appropriateness, software requirements, ease of scope determination, and ease of author identification, last update date, accuracy, and ease of use. In particular, the article indicates that Internet information evaluation criteria be content, credibility, critical thinking, copyright, citation, continuity, censorship, connectivity, comparability, and context.

The literature emphasized the effect of user literacy on the information acquisition task, both negative and positive for poor literacy and good literacy, respectively (Kodagoda & Wong 2008). In addition, the complexity of the need or task giving rise to the information search will

affect the difficulty of the information acquisition task and the search strategy employed (Kodagoda & Wong 2008). The information search process can consist of the following stages, initiation, selection, exploration, formulation, collection and presentation; and four information seeking models are presented, being the undirected viewing model, the conditioned viewing model, the informal search model, and the formal search model (Kodagoda & Wong 2008). Further, information search tasks can include building manual inclusion and exclusion rules with the disadvantages that they can be expensive to maintain (Tang *et al.* 2005).

The literature states that information quality evaluation is a complex task consisting of evidence gathering, application of decision procedures, and assignment of specific quality scores; the task will be different in scale and complexity for each application domain (Embury *et al.* 2009). Information quality evaluation can be performed empirically by counting hyperlinks or conducting advanced statistical models (Tang *et al.* 2003). Also, knowledge about information sources and the processes used to derive the information is important for evaluation of information quality (Madnick *et al.* 2009). In the health industry, health information evaluation has been done by health experts using manual assessment protocols of medical web site information quality, based on either scientific evidence or accountability criteria (Tang *et al.* 2005).

One can search for Research information in many and varied sources, including books, manuals, journals, conference and workshop proceedings, reports, newspapers, magazines, radio, television, art exhibition catalogues, multimedia literature, resource catalogues, the Internet, online databases, gateways, and people; and information and data can be generated through documents, observations, interviews, and questionnaires (Oates 2006). All searches must follow a well-defined systematic process that directly addresses the research objectives; this is the basis for the acquisition of high quality information. Research information quality evaluation is a vital task and includes an assessment of the author, publisher, editor, reviewing peers, citations and references, environment and date published or produced, intended purpose, the intended audience, appropriateness, production process and method, flaws and omissions, conclusion justifications and generalisations, limitations, format, relevance, reliability, validity, and bias (Oates 2006).

The Internet as an Information Repository

The article reiterates that Internet information searchers require motivation and good search definitions in order to successfully provide for the information needs. Searching on the WWW is characterised by the 'rich get richer' phenomenon, where a relatively small number of sites receive a large proportion of hyperlink references and traffic; this may limit a searchers search landscape and prevent access to infrequently accessed but high quality information. Internet information must be treated with caution because there is a great deal of grey information on the Internet, which is low quality and biased information presented as high quality information. In addition, Internet sites that provide evaluation of other sites may also be subjective and biased. WWW information is rarely neutral, it usually represents a certain point of view, it frequently cannot be verified, so the truthfulness of WWW is questionable; these aspects contribute to making WWW information difficult to trust.

The Internet has had a profound effect on the research community, changing the way scientists produce knowledge and creating a dependency on the Internet for information (Ding *et al.* 2009; Oates 2006). Researchers must critically evaluate Internet information before it is used as evidence for new knowledge because of the unregulated nature of information on the Internet; of particular research concern is the transitory nature of information on the Internet, ethical considerations, and copyright laws and practices (Oates 2006). Nevertheless, the Internet has also presented new and efficient opportunities for researchers to search for information, use information, and gather data and information.

Conclusions

The article provided the salient topics emphasised in the article, and explained how research is impacted by information quality in a similar way that decision makers are impacted by information quality. The article stated its objective, which is to present a theory discussion about the impact of information quality on research, using the article as a basis, and prior research as a supporting reference. The article then set out the prior research that related to the objective of the paper. The article also explained the

process used to accomplish its objective, and thereafter a detailed theory discussion was written.

The article shows that information quality is a critical determinant of research success, as measured by the creation of new knowledge. Thus, information quality fundamentally impacts research. Low quality information will guarantee low quality research. Even though it is known that information quality has a huge impact on research, the literature explains that low quality information is evident in the research community. Reasons for the existence of low quality information as well as proposed solutions to this problem were provided. It is an imperative for researchers to develop information acquisition and evaluation methods to systematically ensure high information quality, both for the integrity of the research itself and ethically for the users of the research. The Internet is a particularly important aspect of information quality because it is so widely and extensively used as an information repository; the quality of information obtained from the Internet has a significant impact on research quality.

The article is valuable to all information users, including decision makers and organisational management who rely on information to affect reality for their purposes and objectives. The article is directed toward the research community, which uses information comprehensively as a production input. The quality of this production input, being information quality, has a direct effect on the quality of the research output, being the quality of new knowledge created.

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