

INFORMATION QUALITY PROBLEMS ON WEBSITES

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Abstract: The goal of this publication is to identify and characterize the typical problems with information quality on websites, and to present exemplary remedies for those problems. In this article the information quality problems within their origins, as well as the consequences of using poor-quality information by the Internet user were defined. There were also presented ways of improving information quality - which should facilitate the information needed by producers/authors and the managers/administrators of services in or to find solutions to the remaining problems. The presented varied remedies are not all possible solutions to improving quality in the area of the WWW content and its infrastructure. Broadening them requires further research on identification of new methods and tools of improving information quality in the World Wide Web.

Keywords: information quality problems, information on the Internet.

1. Introduction

The issue of information and its quality has been interesting many scientists from various research centers around the world (Sungren, 1973; Langeforse, 1980; Gerkes, 1997; English, 1996; Eppler, 2000, Kahn et al., 2002). Poor quality of information results in negative consequences in a form of particular problems or difficulties. For instance, R.Y. Wang, L. Lee and M. Ziad (2001) claimed, based on their research, that 70% of all procurement documentation for production contain low-quality information. Therefore, making decisions on the basis of information that is outdated or imprecise may cause adverse effects. Such problems can be also found on the Internet, however, the WWW environment has different specificity. The basic areas where information quality problems may appear are: the information content of a website, content management processes, website infrastructure, users' needs, or requirements towards a website from its owners/managers. Information quality problems that occur need to have their causation identified, and particular methods and tools need to be introduced to guarantee proper quality of information.

The aim of this article is to identify and characterize typical information quality problems occurring within WWW and to present exemplary remedies for those problems. In this article, the specifics of the hypermedia information system (the WWW service) are defined. Moreover, the issue of defining information and its quality is indicated. Thereafter, problems with information quality within its sources and the result of using poor-quality information (from the Internet user's point of view) are presented. In addition, the ways of improving information quality concerning problems that occur are shown.

2. Specificity of Websites

In order to understand how to make the specificity of information quality problems more coherent, the environment of website must first be defined. According to the W3C organization, World Wide Web (WWW) is the information space where documents and other network resources are identified by Uniform Resource Locator (URL) embedded by hypertext links, which may be shared via Internet (W3C, 2004). However, J. Unold describes WWW as “[...] a system of interlinked hypertext documents available via Internet. Websites which can be viewed through proper search engines and browsers contain multimedia content, i.e. text, pictures, videos etc., and it is possible to move within them through so-called hyperlinks, in short – links” (Unold, 2015, p. 124).

From the technical point of view, WWW is an HTML document which is made available for users via internet browsers on the screens of networked equipment. Website is a collection of interconnected webpages presenting hypermedia content, most frequently within one domain. Table 1 presents exemplary types of internet services. In practice, it is difficult to clearly classify the chosen service to a particular type of website. The classification of websites presented below is only illustrative and it can be extended by other such-like services depending on the presented content or its audiences.

Table 1.
Types of Websites

Type of Website	Examples
<i>Weblog</i>	WordPress
<i>Microblog site</i>	Twitter, Plurk
<i>Social networking site</i>	Facebook, Last.fm, Nk.pl, Google+, GoldenLine
<i>Wiki site</i>	Wikipedia
<i>Webmail</i>	Gmail, o2.pl, wp.pl
<i>Web portal</i>	Yahoo.com, Onet.pl, Lycos.com, About.com
<i>Corporate website</i>	Sony.pl, Bwm.pl
<i>Forum website</i>	Groups.google.com
<i>Government site</i>	Bip.gov.pl
<i>News site</i>	Pap.pl, Tvn24.pl, News.google.com

Cont. table 1.

<i>Electronic commerce (e-commerce) site</i>	Amazon.com, Empik.pl, Allegro.pl, Zalando.pl
<i>Archive site</i>	Archive.org
<i>Review site</i>	Cokupic.pl, Opineo.pl
<i>Photo sharing site</i>	Flickr, Instagram
<i>Search engine site</i>	Google, Bing
<i>Comparison site</i>	Ceneo.pl, Rankomat.pl, Skapiec.pl

Source: own elaboration.

Websites are included in a bigger system called the Web Information System (WIS) (Isakowitz, Bieber, Vitali, 1998, p. 80). Information quality problems within websites should be considered in the context of assessing the quality of a website which is a specific hypermedia information system (Czerwiński, Krzesaj, 2018, pp. 65-71). The hypermedia information system should not be identified with the WIS, for the latter concept is much broader. Evaluation of efficiency of an Information System (IS) plays a special role when assessing it, e.g. in the context of its utilization, information satisfaction of a user, quality of decisions, productivity and general quality of the system (the model of IS success factors in the e-commerce environment by DeLone and McLean (Wang, 2008, p. 545)). The measurement of IS efficiency is performed from the perspective of its quality in general, as well as the quality of its services and the quality of information within the WWW. Evaluation of the discussed system is made analogically to the evaluation of information system functioning in a traditional environment, i.e. in an organization, however, the WWW environment is taken under consideration in this case. Therefore, as Czerwiński & Krzesaj, (2014, pp. 21-23) state, requirements towards IS within WWW should include the following: availability, timeliness, dependability, completeness, comparability, reliability, processability, flexibility, efficiency, effectiveness, reaction time, specificity, stability, precedence, confidentiality, safety and easiness of usage.

However, when considering such requirements towards IS within WWW, the factor which should be considered is continuous development of these systems. Such activity engenders changes in methodology and assessment practices, i.e. in the interpretation of criteria and requirements, methods of measuring, measurements and importance of particular criteria, which can be identified in at least three fields:

1. In the technologies which are used in IS for collecting, gathering, processing, storing, searching, distributing and presenting information;
2. In the needs of users and groups operating on IS who assess it;
3. In the goals and priorities of the governing party which decides about the evolution of legal and ethical requirements towards IS.

The development of the WWW environment causes changes in the methodology of creating websites. The level of complexity of current websites is very diversified, whether considering small informative websites or large services. The same situation occurs when using various types of websites (Table 1). The evolution of websites forces higher expectations towards the stages of designing, developing, maintaining and managing them. Providing information dynamically from differentiated sources (e.g. databases), as well as of different type, e.g. text,

graphics, audio and video, demands balance within content, functionality, aesthetics and efficiency of websites.

By the end of the 1990s, in the subject literature, there appeared many suggestions of improving the quality of websites, e.g.: methodologies (Olsina, Lafuente, Rossi, 2001, pp. 266-277), frames of quality (Donaldson, Cowderoy, 1997; Katterattanakul, Siau, 2001, pp. 45-56; Dhyani et al., 2002, pp. 469-503), criteria (W3C, 1999), guidelines for users (Nielsen, 2000), methods of assessment and measurements (Schubert, 2002).

J. Ruiz, C. Calero and M. Piattini (2003, pp. 384-385) suggested the Web Quality Model (WQM) for evaluation of website quality. The WQM includes three dimensions connected with: service features (content, presentation, navigation), quality features (functionality, reliability, utility, efficiency, portability, maintenance), as well as the processes of service lifecycle (processes of: development, exploitation and maintenance). This model contains as many as 326 measurements. The evaluation of a website regards three major areas (Calero, Ruiz, Piattini, 2004):

1. Content (information resources: text, graphics, audio and video materials, and software, including Java scripts, CGI programmes).
2. Navigation (access to information and navigating the web).
3. Presentation (bound tiers of content and navigation).

3. Defining information and its quality

The word ‘information’ derives from a Latin term *informatio* which means “an idea, explanation, notification”, in colloquial speech – any kind of news (Kieżun, 1980, p. 274). Depending on the field of study, the definitions of information vary significantly, for it is difficult to describe and specify it. According to the information theory, information is a primal concept and cannot be defined in a normative manner. In the quantitative theory of information, the quantitative aspect is dominating (C. Shannon). This area of theory of information is not interested in the content or its meaning. The basic concept in this case is a message that is properly coded and contains some amount of information (Baborski, Duda, Forlicz, 1977, pp. 153-158). Czerwiński (2001, p. 22) adds: “The lower the probability of some message occurring, the more information it contains. The presentation of a particular series of symbols in a message decreases the level of insecurity in its recipient, therefore, its rarity may be the reflection of a quantity of the forwarded information”.

The content and meaning of information are within the interest of the qualitative theory of information. In this theory, information is perceived as some collection of data owning a meaning given by its producer or recipient of information. There are two approaches: infological and datalogical, which were initiated by B. Sundgren (1973) and B. Langeforse

(1980). The datalogical approach assumes depersonification of information (objective approach). According to B. Sundgren, the relations among data in a message can be called information on a datalogical level. The datalogical interpretation of information defines it as “the flow of data or truths formulated in a sequence of signs of some language from a broadcaster to a recipient” (Forlicz, 1996, p. 5). The core of such understanding of information lays in depersonification of its meaning and in omitting psychosociological factors. The infological approach focuses on information as the content delivered in a message. Providing meaning to information is the process of giving it sense by a person. In this manner, information is subjective and dependent on the recipient taking into consideration the psychosociological, linguistic and semantic factors. The infological approach assumes that the recipient of a message should interpret and understand it in accordance with the broadcaster’s intention. In a situation when the recipient of the message is not able to interpret and understand it, the information included in it is useless (worthless) and it is impossible to discuss its quality. This assumption is necessary for the consideration of utility, and, as a consequence, the value and quality of information.

In the subject literature, authors offer various definitions of the information quality concept. Quality of information means:

- “[...] the degree to which information has content, form, and time characteristics which give it value to specific end users” (Brien, 1991);
- “[...] a difference between the required information – determined by the goal and the obtained information. In an ideal situation there will be no difference between the required and obtained information” (Gerkes, 1997);
- “[...] the characteristic of information to meet the functional, technical, cognitive, and aesthetic requirements of information producers, administrators, consumers, and experts” (Eppler, 2000);
- consistent following of the users’ expectations through information and information services, allowing them to work efficiently (English, 1996).

Other authors define information quality as its property, according to which:

- Information is of great value for users (Wang, 1998);
- Information is *fit for use* for its consumer (Huang, Lee, Wang, 1999);
- Information satisfies or exceeds user’s requirements (Kahn, Strong, Wang, 2002).

The definitions presented above show various kinds of quality: perfect, directed at the information recipient; technical, directed at the information producer. On the basis of the presented definitions it is possible to claim that information quality is multidimensional. Analysis and assessment of information quality should be performed in as wide a context of use as possible. Within the infological approach, the relationships between data, having regard to any possible context connected with the information user/consumer (context: linguistic, social, psychological), and the task are subject to examination. Such approach allows

differentiating information quality from data quality, for the analysis includes a wide range of contexts connected with the reasons of bad information quality and its results.

4. Classification of problems with information quality

In the subject literature, the problem of information quality is presented from various perspectives. H. Lesca and E. Lesca (1995) described eight problems of information quality divided into two groups. In the first group, information is perceived as a *product*, and the problems regard: an overload causing limited usefulness of information, ambiguity, incompleteness, inconsistency and inadequate presentation format. The other group regards information as a *process* and contains three following problems: information is not reliable or trustworthy, it is not accessible, and there is a distortion of information. D.M. Strong and co-authors (1997) proposed ten quality problems that were classified based on the information *lifecycle*. They distinguished problems connected with its origin (i.e. information producer/source), storing and maintenance (i.e. information system) and use (i.e. consumer/task). The groups of problems mentioned above are substantial due to information quality problems within WWW that regard information producers, administrators and consumers included in databases and data warehouses. The issue is still valid. The problems resulting are the following (Strong, Lee, Wang, 1997, pp. 40-45):

1. Multiple sources of the same information produce different values.
2. Information is produced using subjective judgments, leading to bias.
3. Systemic errors in information production lead to lost information.
4. Large volumes of stored information make it difficult to access information in a reasonable time.
5. Distributed heterogeneous systems lead to inconsistent definitions, formats, and values.
6. Nonnumeric information is difficult to index.
7. Automated content analysis across information collections is not yet available.
8. As information consumers' tasks and the organizational environment change, the information that is relevant and useful changes.
9. Requirements regarding safety and privacy – easy access to information may conflict with requirements for security, privacy, and confidentiality.
10. Lack of sufficient computing resources limits access.

M.J. Eppler (2001, pp. 329-346) presents a remarkably interesting attitude from the perspective of problems connected with information quality within WWW based on the information quality frameworks. This author defines information quality problems as “[...] a situation in which the content or medium of information does not meet the requirements of its producers, administrators, or users” (Eppler, 2006, p. 45). The areas of content and media

quality gather the quality criteria (16 properties of information quality) in four dimensions: information relevance, information soundness, optimized process, reliable infrastructure. The first two dimensions regard information content quality within a website. The latter two relate to media quality, i.e. processes and infrastructure by which information is delivered.

Based on the notion of information quality frameworks, M.J. Eppler groups information quality problems into three information areas (Eppler, 2006, pp. 41-46). The first area regards origins of the problems connected with information quality. The second one stands for responsibility for origins of information quality problems. The third area concerns consequences of using incorrect information from the user's point of view. These areas of problems are normative, therefore, they can be adapted within the area of information quality problems in WWW.

According to M.J. Eppler, the specific information quality problems may relate to any kind of information constructed as being a *product* or a *process*. Classification of information quality problems may be related with information *lifecycle*, beginning with the information creation processes, finishing with information consumption and including the complete range of various problems connected with it. Such approach is analogical with information given within WWW. Some problems originate with information producers/creators within websites (e.g. incorrectly generated information), some problems concern information administrators (e.g. incorrect content management processes), and some relate to information consumers (e.g. lack of reliable information).

Therefore, information quality problem may be analogous with a situation when the content positioned on a WWW or its functionality does not follow the requirements of website creators, administrators or users. Information quality problems cause specific outcomes that may be expressed in particular properties of information quality. For instance, the problem of information irrelevance may influence given features of information, e.g. inaccuracy, incompleteness, or lack of possibility of using it by a website user; whereas the problem of sub-optimal content management within WWW may cause delays in loading a website or inconvenience while using it. Such exemplary problems will be subject to further reflection.

5. Sources of problems with information quality within WWW

The four categories of origin of information quality problems are the following: information irrelevance, wrong information, suboptimal content management process on the website, and unreliable website infrastructure (Table 2).

The first category of quality problems of information placed on the WWW is its irrelevance for the information consumers. Therefore, it is important to define the audience of information from the website. The very frequent reasons for information quality problems are wrong

selection (the materials are aimed at other customer group) or incorrect profiling/filtering information that may cause incompleteness or even inutility of the forwarded information. Additionally, the information must be presented precisely and accurately. Moreover, the information placed on the website must be at once useful for implementing the current information requirements of a potential user. For instance, a university's website should provide all necessary information regarding courses, subject syllabuses, schedules, material support, scholarships, Erasmus+ programme, students' loans, etc.

Now suppose that such information is placed on a university's website, but a user is not able to use it. In this case the suitability of information for use means lack of necessity of transforming or converting it, e.g. timetables, instructions, tutorials for students are ready to be printed without the necessity of copying, formatting, or adjusting them for usage.

Table 2.
Sources of information quality problems on WWW

Problem category	Solution	Examples of remedies	Exemplary information quality problem
Information irrelevance	Improving information quality	Selecting information adjusted to the needs of users Specificity of the placed information – precise and detailed information Usefulness of information	Incompleteness Inaccuracy Ambiguity Not applicable
Incorrectly generated information	Development of the information producers/authors	Updating information Information presented clearly and intelligibly No false or distorted information Avoiding placing unnecessary information	Obsolescence Prolixity Falsity Incoherence
Suboptimal content management process	Improving content management processes within WWW	Flexibility of content presentation methods Useful website interface Validation of information sources Systematic process of placing information without delays	Rigidity Inconvenience Anonymity Delay
Unreliable infrastructure	Improving the infrastructure within WWW	Providing data safety, confidentiality and integrity Improving accessibility of the website's content Optimization of the website's efficiency Vigilance in servicing the website	No precaution Unavailability Slowness Slovenliness

Source: adapted and extended based on Eppler, 2006, p. 42.

Another category of information quality problem concerns the information creation process. The information found on a website may be outdated. It is often unclear when an entry was created, e.g. there is no date of generating the information in the news section for students, or there is no date of posting the improved timetable. It may also happen that there is no access to current information due to posting it on a website with large delay. Moreover, the process of creating information may negatively influence accuracy, cohesion, and comprehensibility of content within a website. In addition, the information within a website may be deformed or false, e.g. the information a student finds may be outdated, therefore misleading.

It should be noted that publishing extended pieces of information or those with unnecessary elements influences their conciseness. Information presented clearly and understandably significantly limits information quality problems. Transparency of the presented content may be realized via showing information legibly. For instance, too complex sentences in the description of a recruitment process to a university or in a study regulation cause misunderstanding of the text. It cannot be forgotten that there is a need to use language that is clear and concise, that is without any unnecessary formal expressions and that the average user can clearly understand – the intent is to inform, not to impress.

The third category of information quality problems regards processes of content management within a WWW. Even though such information does not contain any mistakes and is useful for the customers, the method of delivering or presenting it may be inappropriate. An adequate form of presenting information, the best layout of content within a website, a map of a website, are exemplary remedies which may remove the information quality problems on a website. Using boldface, providing clear titling of particular sections in the text, improving the colors within a website, aggregating the content (placing a table instead of a text) are common methods of improving information presentation. The proper service structure, as well as an interactive interface of the website, significantly influences utility of the website as well. Furthermore, the inserted information requires verification of its source and origin, as well as presentation without needless delays.

The last category of problems may be the infrastructure used to transmit/receive information. Using the safe communication protocol HTTPS on the website enables to supply confidentiality and integrity of data transmission which influences the safety of accessing information. Flexibility of the process of adjusting optimal interface for website users in the case of entering the service from mobile devices (so-called responsively) is one of the very important parts of the infrastructure. Using the appropriate techniques allowing recognition of mobile devices, such as tablets or smartphones increases the accessibility to the service. Whereas, lack of optimization of the website's speed of loading has negative influence on the usage of a particular website by its users (optimization of graphics, site code, style sheets CSS, JavaScript scripts).

The manager with the IT team should also pay attention to the ability to service a website. The following factors may indicate lack of accuracy: absence of movement analyzer on the website (e.g. *Google Analytics*), absence of tag *meta title* (contains the title of a WWW), absence of *meta description* (describes the content of a website), or absence of the *sitemap.xml* file in the website's domain.

5.1. Responsibilities for the incurred problems

The problems mentioned above are closely connected with the area of responsibility for their occurrence. There are three groups of people who handle solving these problems and who should be mentioned here. They are:

- Administrators (e.g. owners of websites, managers);
- Information creators (e.g. authors of publications, Website content writers, Webmasters);
- IT workers (e.g. Web Server Administrators, Database Administrators, Web developers, Webmasters).

When deciding who is responsible for the problems, the type of a WWW may be crucial (e.g. *Weblog*, *e-commerce site*), its information content (e.g. the kind of presented content), or size (e.g. the amount of subpages in a service). In practice, it is common that one person serves several functions/roles, e.g. the function of an owner, information creator and its administrator, just as in the case of the websites based on the Wordpress templates. The people belonging to three of the above-mentioned groups hold the responsibility of removing the occurred problems. For instance, incompleteness of the delivered information will force the website managers to select information adjusted to the requirements of the users. Uploading outdated content will influence the necessity of updating information by its authors. The limited access to some content relates to the efforts of IT workers in improving the utility of a website.

6. The information quality problems from the information user's perspective

The information quality problems from the information consumer's perspective may be analyzed in the categories of consequences of using the incorrect piece of information. The results arising under lack of information quality are following: information overload, incorrect assessment, incorrect interpretation, incorrect use of information (Table 3). Information overload causes lack of possibility to find and access information. In situations when the information that needs be uploaded is in the part of a website that is hard to reach, the resulting frustration causes discomfort or even limits access to it. In contrast, too extended information generates negative impact on the user's ability of finding the necessary information. In addition, the information within a WWW may be incomplete and fulfills the user's needs insufficiently. One method that enables removal of such problems is connecting information deriving from various sources. The role of information aggregates may be taken by inbuilt internal search engines that find information according to the key words or expressions given by the user. Summaries of documents or short forms of visualization (e.g. highlighting some parts of the text, schemes) belong to the group of quite simple methods of aggregating content. Another example is information filtering - which is used by multiple services of different themes (e.g. in internet shops, on websites with access to databases). A website may also have the mechanisms of information personalization when its content or the way of displaying it depends on the user (a website adjusts to the user's requirements). In order to

identify the user, logging-in mechanisms or cookie files are used. Furthermore, the increase of information availability can be realized by information categorization, e.g.: using schemes (graphs, graphics), tables, highlighting, headings, tag clouds, website maps.

Table 3.

Information quality problems from the information user's perspective

Problem category	Problem solution	Exemplary remedies	Exemplary information quality problems
Information cannot be found	Integrate all sources of information	Information aggregation Information categorization Information customization Information personalization	Inconvenience Incompleteness Inaccessibility Too large volume
Information cannot be trusted	Validate the correctness of information	Verifying the reliability of the source of information Providing safety in accessing data Using popularity ranks	Inaccuracy No security Inconsistency (incompatibility) Slowness
Information cannot be understood	Provide the context of the information	Improving information with meta information Determining the customer group for which the information is relevant	Redundancy Falseness Ambiguity Anonymity
Information cannot be used	Adjust information for use	Flexible forms of presenting information Providing examples, ready-made schemes of solving problems Using the "push" mechanism	Rigidity Obsolescence Slowness No possibility of use

Source: adapted and extended based on Eppler, 2006, p. 43.

Another category of problems is lack of trust towards the discovered information. When a user finds information, there must be possibility of verifying it. Information described with unambiguous source of origin (the place of generating it), along with permissions of people to publish it, influence its credibility (author's qualifications). The provision of references or qualifications of the author of information, as well as publishing dates, readily allows the ranking of the information. Another mechanism, which may be automatized, especially on the Internet, is the measurement of resource use. Although it is not a guarantee of the measured resources, it may be a precious indicator regarding highly rated parts of content by other users. Based on the collected information rankings are created which regard, e.g. the most popular articles, the most frequently downloaded files, or ranks given by users. Slowness of a website is a potential reason for complicating or even preventing from such evaluation. For instance, the website loading time and view rendering is one of the most important indicators for assessing the loading rate. Negligence linked with optimising the components displayed on the website (size of the graphics) influences the size of the website, which, in turn, decides loading speed. The infrastructure supplying information may be also evaluated. The current guidelines for creating websites encourage securing the connections between the user and the website independently from its content by using the HTTPS protocol, which influences safety and privacy. The HTTPS protocol became a normal part of creating a website not so long ago,

and now it is commonly used in the majority of websites requiring certification (e.g. banking websites).

Information that is found and assessed positively may be incorrectly understood by the user, which is another category of problems with quality. Recurring, false information that is unclear or anonymous has significant impact on the problem of interpreting information. This dilemma can be limited through the mechanisms creating information context. The context that is supplied should increase the transparency of information (i.e. determine what it is about), perceived correctness (when such information can be used and when it leads to wrong results), traceability, i.e. possibility of tracing its sources (where it comes from), and the possibility of maintenance (when, where and how it can be updated). From the perspective of information resources shared on the Internet, the most important issues are the techniques and tools that can be easily used in the Internet environment. Adding meta information significantly improves the context of using a piece of information. Supplying information about the kind of available information (e.g. text, graphics, sound, film), file format (e.g. doc, pdf), situation of use (e.g. official business), origins of the information (e.g. bibliography or references) also influence the user's decision whether or not to use such information. Placing information regarding time, i.e. the moment of creating such information and the moment of publishing it, is of similar importance. For instance, information published on the websites of public institutions (e.g. Bulletin of Public Information) should contain the date of creation, publishing and the last update of the piece of information, along with the data of people responsible for those activities. It is also important to determine who the published information is aimed at, with a description of the range of rights of access and/or use of information.

The last consequence resulting from poor-quality information is no possibility of its use by a user. Any proffered information should be adjusted to make it understandable and ready-to-use by any potential customer. For instance, the possibility of printing a website without earlier preparation. In the Internet services, creators can also use pushing mechanisms that prepare messages for the users, wherein the service user is notified automatically about, e.g. the news or prices of products.

The presentation of the ways of using information is through their demonstration, e.g. in a form of video films, tutorials, or instructions for users. Other ways are by following frequently asked questions (FAQ) and the interactivity of the form of presenting information with the use of messengers and software agents (assistants).

7. Summary

In this article, information quality problems within WWW were presented. As stated within the article, the problems which occurred and relate to quality may result from incompleteness or insignificance of information, respectively from incorrect information provided in an inadequate/ inconvenient way or shared via unsecured or unreliable website. From the website user's perspective, information quality problems concern finding information, trusting the identified information, wrong interpretation of the found and reliable information, as well as using information.

There are various remedies that can be used for improving information quality, among others: improving the usefulness of information and its timeliness, improving the utility of the website's interface, together with the content accessibility, adding meta information to particular pieces of information, aggregating and categorizing information and verifying the published sources of information.

The presented examples of remedies should facilitate all the interested parties (e.g. authors, website owners) in improving information quality in Internet services and, as a result, lead to information that should be: current, error-free, created objectively, with reference to its source and presented well (language, structure, layout). The limits of the research include a finite number of exemplary remedies. Further study in practice will allow identification of new methods and tools for improving information quality within WWW.

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