QUALITY CRITERIA OF CONTENT-DRIVEN WEBSITES AND THEIR INFLUENCE ON CUSTOMER SATISFACTION AND LOYALTY: AN EMPIRICAL TEST OF AN INFORMATION QUALITY FRAMEWORK

(Full Paper)

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Abstract: This paper shows how a conceptual framework of information quality has been tested and refined empirically in the context of content-driven Internet websites (such as news portals). Although there are already several similar models, these approaches do not offer management-relevant categories that allow to allocate responsibilities for the various web quality dimensions. The model presented in this paper, by contrast, tries to achieve both, empirically validated categories and relevant dimensions for management. The results of a survey (based on four prior focus groups) conducted among 673 Swiss Internet users are presented and discussed. The findings highlight crucial correlations between the quality of a website (in terms of its relevance, soundness, processes and infrastructure) and user satisfaction, as well as user loyalty. The results show a high perceived information quality contributes significantly to customer satisfaction and customer loyalty.

Key Words: Information quality framework, content quality, media quality, website quality, information quality survey, information quality criteria, customer loyalty

GOAL AND CONTEXT OF THE STUDY

Amidst the increasing quantity of information that is available on the Internet, the quality of information becomes a crucial challenge, not only for Internet users, but also for managers, content providers, webmasters, and IT-staff who need to assure the quality of published content [2]. The information quality domain can contribute towards meeting this challenge by providing adequate management frameworks. The main goal of the survey that is discussed in this paper is thus to empirically test the conceptual management framework that was presented in [18] and see how well it matches the perceptions of real-life information consumers. Specifically, the survey results presented in this paper should reveal which information quality criteria are seen as crucial by information consumers in a certain setting (namely, the Internet) and how well they correlate with the overall customer satisfaction with a website. Through the survey, we should be able to compute how strongly the sixteen information quality attributes (see Figure 1) we proposed in [18] influence perceived information quality. The tested framework depicted in Figure 1 is based on four dimensions of information quality: the community or *relevance* dimension (designating whether the right kind of information is provided to a community of users), the *soundness* or intrinsic dimension (consisting of criteria that describe value-added and error-free information), the *process*

dimension (containing criteria relating to how the information is provided), and the *infrastructure* dimension (outlining characteristics of a reliable website infrastructure). The first two views are summarized as content quality, while the latter two are labeled as the quality of the medium or media quality.

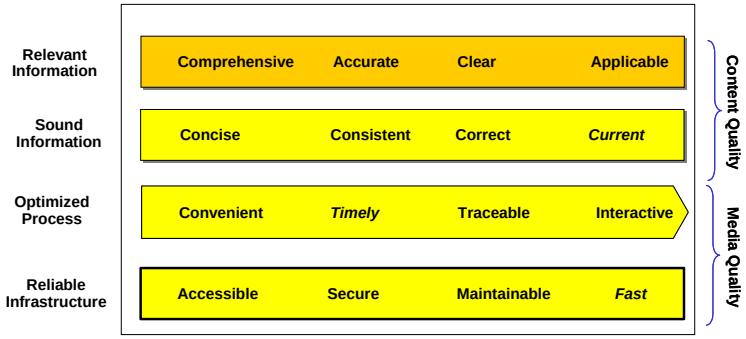

Figure 1: A conceptual framework for information quality management

Although there is already a plethora of information quality models for the Internet context (see 1,2, 4, 5, 7, 10, 12, 15, 25, 27, 28, 30, 31, 33, 36, 37, 38, 42, 43), or for general quality measures in the information domain (see for example 3, 16, 22, 26, 34, 35, 39, 41) some of which have already been tested empirically, the majority, if not all, of these frameworks do not take into account that a model of information quality should not only describe what constitutes information quality, but also how the *responsibility* for it can be divided. Consequently, our approach consists of testing a model that achieves this task. The model depicted in figure 1 distinguishes between four dimensions of information quality for which four different professional groups within a company are responsible: the relevance of the provided information is the responsibility of line managers who needs to assure that the content producers align their information to the information needs of the information consumers. The *authors* or information providers or authors themselves need to assure that they provide sound or valid information. The *webmasters* are responsible for the efficiency of the content management process, both for information producers and for information consumers. *IT managers*, finally, are responsible for the functioning of a reliable information technology infrastructure [20].

FRAMEWORK-INDUCED HYPOTHESES

Based on the framework described in the previous section, we can propose a series of hypotheses that help to explain the perception of information quality on the Internet and its effect on loyalty. Our first structural hypothesis relates to the question of whether information quality as a whole can lead to customer loyalty or not:

H1: Perceived information quality has a positive influence on declared customer loyalty.

The other hypotheses should test the framework's dimension. They are as follows:

H2: The perceived relevance of the website content positively influences the perceived quality of the website.
H3: The perceived soundness of the website content positively influences the perceived quality (operationalized as user satisfaction) of the website.

H4: The perceived process performance of the website positively influences the perceived quality of the website.

H5: The perceived reliability of the website infrastructure positively influences the perceived quality of the website.

These five hypotheses can be represented in the following structural model:

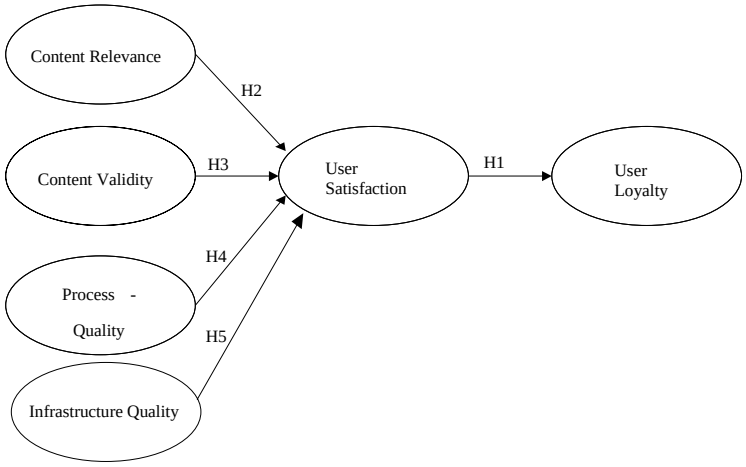

Figure 2: The Proposed Structural Model

Having described the main hypotheses that are based on the framework and are tested, we can now briefly summarize the employed methodology.

EMPIRICAL STUDY

Participants and Procedure

The context that has been chosen for this test of our framework are content-driven websites (such as news or information portals, company homepages or tourism websites in contrast to more transaction-oriented websites, such as auction websites, see question 1 in the appendix). From September to October 2001 we have questioned over 1200 Internet users in Switzerland via an online survey (see [44]) on what they consider to be information quality in the context of websites that they regularly use. In total, we were able to use 673 completed questionnaires (response rate of 56 percent) which were then analyzed with the help of the statistical software package SPSS. Our population is thus 673 Internet users between the age of 15 and 75 years mainly from the German speaking regions of Switzerland (a very small amount is from Liechtenstein or the French and Italian parts of Switzerland). Because of this, the questionnaire was written in German. The distribution of the respondents revealed that 31.5 percent (or 212 people) were female, while 68.5 percent (or 461 people) were men. In terms of the represented professional groups, more than half of all the respondents are managers, employees, or entrepreneurs.

Measures

The questionnaire we used for the survey is based on prior work documented in [10] and [19] and on three online focus groups we conducted. These focus group results have generated the multiple answer choices that were given in the subsequent questionnaire. The online focus groups, each ninety minutes long and made up of six to seven participants (managers, students, or senior citizens), also helped to focus on critical quality issues that were then addressed in the survey. The survey itself consisted of ten major questions, nine of which were multiple choice. Most of them relied on a scale of one (I don't agree at all) to five (I fully agree), except the questions that asked for the single most important issue in a list of

choices.

The opinions of this panel of 673 Internet users can give us further insights on what constitutes *perceived information quality*. In the questionnaire we asked the respondents to think about the website they have recently used intensively. The respondents needed to first identify the category to which their last used website belongs (such as an Internet portal, a newspaper-website, a company homepage, an online magazine, a travel-website, etc.). Then they needed to answer a number of questions on how they would rate this particular website on various issues, namely the sixteen information quality criteria described in our earlier work. They needed, for example, to indicate how much they agreed with the statement "I was able to quickly get to the information I wanted" or the statement "the information provided on the website was current and updated."

After these sixteen questions on quality attributes we asked four control questions. These questions were related to the overall satisfaction with the website (did it meet the respondent's expectations), the satisfaction with its content and design, and whether the respondent will use the website again or not. The final statement of this first set of questions asked the respondents to rate the following statement: "I would be willing to pay a small amount of money to use this website." With these four questions (numbered 17 through 21 in appendix) we were able to correlate the 16 criteria (individually or four at a time as one quality dimension) to the overall satisfaction (meeting overall expectations), the content and design quality, to loyalty (using the site again) or to the propensity to pay for website use (willingness to pay a small amount of money for website usage).

Test of Hypotheses

To test the quality and adequacy of measurements Cronbach's Alpha, item-to-total correlations, exploratory and confirmatory factor analyses were used. Cronbach's Alpha values indicate the internal consistency of each construct and offer clues for possible exclusion of indicators (see 11, 13). Cronbach's Alpha values range between zero and one, where a value of almost one indicates a high degree on reliability. Values equal or more than 0.7 are demanded. If Cronbach's Alpha values fall below 0.7, indicators have to be eliminated based on the lowest item-to-correlation value [11]. Exploratory factor analyses indicate discriminant and convergence validity. It is demanded that the factor structure in each measurement model explains more than 50% variance and no factor score is smaller or equal to 0.4. To verify the discriminant validity of the latent constructs in the structural equation model, confirmatory factor analysis (CFA) was used. To test the general framework of figure 2, structural equation modeling (SEM) was used. The LISREL 8.54 program [24] with maximum likelihood estimation was used for these analyses. Following the discussions of fit indices that can be found in [6], [9] and [29], the goodness-of-fit of the overall models was estimated with chi-square tests, the root mean square error of approximation (RMSEA), the standardized root mean squared residual (SRMR), the non-normed fit index (NNFI), and the comparative fit index (CFI). Model fits are regarded as satisfactory by having non-significant chi-square tests, the value of the ratio of chi-square divided by the degrees of freedom less or equal than 3, RMSEA values less or equal to 0.08, SRMR values less or equal than 0.05, and NNFI and CFI values greater or equal to 0.90. All analyses were performed on covariance matrices[14].

Results

The exploratory factor analysis and examination of the correlation matrix showed that the *correlations between the measures of process quality and infrastructure quality were very high*. Consequently, these two quality dimensions were treated as a *single construct* labeled 'media quality'. Cronbach's Alpha, item-to-total correlation, and exploratory factor analysis indicated the necessity to exclude the indicators 4, 8, 12, and 14 from the analysis. Table 1 summarizes the reliabilities afterwards that were adequate in all cases (see Table 1 in the appendix). The CFA models had five latent constructs (process and infrastructure quality were combined into media quality), and a total of thirteen indicators. *Results showed that the model fit the data well*. In sum, all test values of the parameters for local fit estimated were above the required threshold values. Thus, it is ensured that the operationalization of the

hypothetical constructs meets the requirements given in the relevant literature [6]. Table 2 summarizes the tests for local fit (see table 2 in the appendix). Apart from testing each interaction hypothesis, it is required to evaluate the overall quality of the causal model. The goodness-of-fit statistics for the model were as follows: $\chi^2 / df = 2.9$, RMSEA = 0.055, SRMR = 0.029, NNFI = 0.98, CFI = 0.99. All correlations between pairs of latent constructs were significantly less than one. This provides adequate evidence of discriminant validity of all the latent constructs in the model. In this case, all minimum values required are exceeded as table 3 shows (see table 3 in the appendix). The results of the local and global fit measures of the model allow us to proceed with confidence to the SEM analysis. *Of the three quality perception constructs, maintaining content relevance ($\gamma = 0.64$, SE = 0.13), and media quality ($\gamma = 0.29$, SE = 0.11) were significant predictors of satisfaction. However, content validity ($\gamma = 0.10$, SE = 0.35) did not predict satisfaction significantly.* These antecedents explained ninety one percent of the variance in satisfaction. Further, and as expected, satisfaction in turn predicted loyalty significantly ($\gamma = 0.89$, SE = 0.05). Forty nine percent of the variance in loyalty was explained. Figure 3 illustrates the results. Table 4 summarizes the results in testing the hypotheses (see the appendix for table 4).

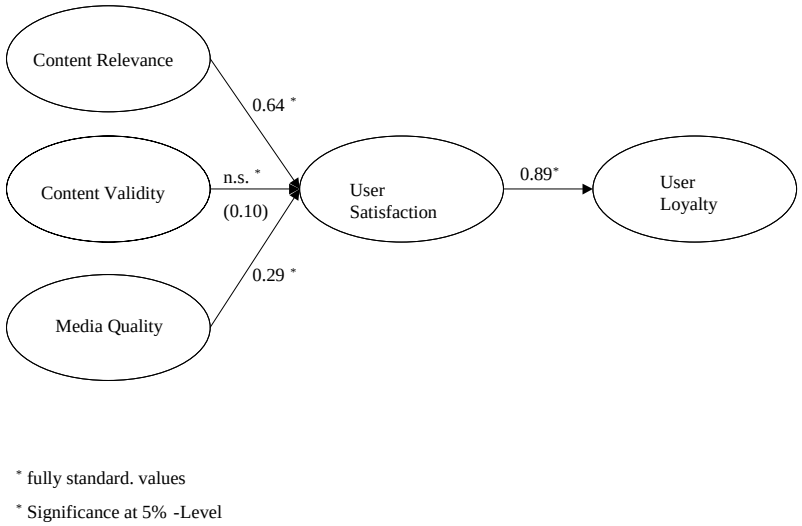

Figure 3: Results for the tested model

Discussion

In general, the results of the tested model suggest (with regard to content driven websites) that content relevance (providing the right kind of information) and media quality (providing it in the right manner) significantly influence consumers' satisfaction, which in turn significantly drives consumer loyalty. A significant influence of the content's validity on consumer's satisfaction could not be confirmed. There are several possible explanations for this finding: One explanation could reside in the limited sample size. Further tests could demonstrate whether the same pattern is replicated or not in other, perhaps larger samples. Another possible explanation is that consumers believe that Internet content is mostly valid and that validity is consequently not a critical issue. A third possible explanation is that consumers view Internet-based content as more unreliable and take content validity as something like a luxury that cannot be expected anyway. Further research should test which of these explanations is the correct one with regard to content validity (which may also vary according to the type of website used). Furthermore, several individual criteria could not be included in the final model, for example interactivity (in the sense of personalization) which was consistently reported as not very important.

As an implication for practice managers of website content must focus (among other things) on providing the right kind of information (relevance dimension) on the right kind of medium (infrastructure and process-dimension). Investments into market research (finding out what the true information needs are) and into IT-infrastructure seem critical activities. To assure this dual quality further, clear accountability of managers (in terms of content quality) and IT-staff (in terms of media quality) is a key prerequisite for

customer satisfaction and thus loyalty on the web.

LIMITATIONS

The exploratory survey presented in this paper clearly has several limitations. First of all, it is not representative because the distributions of the drawn sample does not correspond to that of the entire Internet population. Furthermore, there is always the problem of self-selection in online-surveys [44] which may also influence the sample's representativeness [8] und [21]. Nevertheless, Moser argues that while testing causal relations representativeness is less important than testing the parameters of a population [32]. Waldmann justifies this by arguing that a validation of a theory has to be tested on different samples, on which the theory very time has to be proven as correct [40]. Thus, it is not necessary to have representativeness on all parameter's of a population. A further limitation regarding the factors that were tested is their initial conceptual development. The dimensions and their attributes were not developed empirically, but from a conceptual, theoretical base. Conceptually, these factors strive for generic applicability. Because of this, their application to the website context may lead to certain areas of focus and to certain neglects. Future research should show if in fact the conceptual framework presented in the first section of this paper can be used for a variety of application contexts, of which websites is one sub-set.

CONCLUSION

The results presented in this paper can give first indications for the perceived quality of information in the website context and for the adequacy of our conceptual framework. Two main insights should be highlighted from this study.

First, there is clear evidence that information quality matters for the satisfaction and loyalty of website users. Specifically, the relevance of the content and the reliability of the website-infrastructure and processes contribute significantly to a repeated use of a website. In addition, all of our framework's four *dimensions* are correlated with the overall satisfaction with a website as measured by meeting the users' expectations.

Second, the *information quality criteria* that were chosen to be included in our framework mostly influence the overall user satisfaction with a website. They should be and can be categorized in dimensions that allow to allocate responsibility within organizations (e.g., among business managers who are responsible for content quality, and IT managers who are accountable for the media quality).

This paper has shown that information quality is not only an issue of crucial importance for the context of data bases (see [41]) or data warehouses [17], but also and especially for website content. Previous approaches (such as [2]) have begun significant work in this area, but they were neither connected to the information quality discourse, nor did they try to combine empirical validation with managerial relevance (in terms of allocating responsibilities). For the scientific community active in the domain of information quality the Internet offers a fruitful field of exploration and application. The survey presented in this paper is one step in this direction.

Construct	*Indicators*	*Cronbach's Alpha*
Relevant Content	Completeness of the information provided on the website	
	Accuracy of the information provided on the website	0.75
	Clarity and Comprehensibility of the information provided on the website	
Valid Content	Conciseness of the information provided on the website	
	Consistency of the information provided on the website.	0.72
	Error-free website content	
Media Quality	ease of use / easy navigation	
	The final information can be reached easily.	0.73
	The website is easily accessible.	
Satisfaction	The website has met my expectations.	
	The quality of the website design is high.	0.74
	The quality of the website content is high.	
Loyalty	I intend to use this website again.	-

Table 1: Cronbach's Alphas

Construct	*Indicators*	*Completely Standardized Solution*	*t-values*	*Standardized Errors*	*Squared Multiple Correlation*	*Factor Reliability*	*Average Variance Extracted*
Relevant Content	Completeness of the information provided on the website	0.68	16.73	0.051	0.46		
	Accuracy of the information provided on the website	0.79	-	-	0.63	0.72	0.53
	Clarity and Comprehensibility of the information provided on the website	0.45	5.78	0.098	0.51		
Valid Content	Conciseness of the information provided on the website	0.66	14.67	0.065	0.44		
	Consistency of the information provided on the website.	0.70	-	-	0.49	0.72	0.47
	Error-free website content	0.68	14.89	0.066	0.47		
Media Quality	ease of use / easy navigation	0.71	15.5	0.059	0.50		
	The final information can be reached easily.	0.76	-	-	0.58	0.72	0.46
	The website is easily accessible.	0.57	12.75	0.058	0.32		
Satisfaction	The website has met my expectations.	0.74	19.63	0.048	0.54		
	The quality of the website design is high.	0.54	16.05	0.043	0.29	0.72	0.48
	The quality of the website content is high.	0.78	-	-	0.62		
Loyalty	I intend to use this website again.	-	-	-	-	-	-

Table 2: Selected parameters for measuring the constructs and local goodness of fit statistics

	Chi Square/df	*RMSEA*	*SRMR*	*NNFI*	*CFI*
Overall model	2.9	0.055	0.029	0.98	0.99
Requirements	< 3	< 0.6	< 0.05	> 0.9	> 0.9
Conformance	✓	✓	✓	✓	✓

Table 3: Fit-Indices of the overall model

Hypo-theses	*Sign of Influence*	*Constructs*	***Results***
H2	+	Relevant Content → Satisfaction	✓*
H3	+	Valid Content → Satisfaction	n.s.
H4/H5	+	Media Quality → Satisfaction	✓*
H1	+	Satisfaction → Loyalty	✓*

Table 4: Results of hypotheses tests

✓* = Accepted with a tolerated probability error of $\alpha = 5\%$

n.s. = not significant

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APPENDIX: THE ONLINE INFORMATION QUALITY QUESTIONNAIRE

The following questionnaire was sent to a panel of approximately 3000 Swiss Internet users in September of 2001. More than one thousand users filled out the questions below. This resulted in 673 completed questionnaires. The format of the survey was an online questionnaire (see [44] for some of the advantages of online surveys) open during September and October 2001. The scale for the multiple choice questions was a likert scale of one to five, one meaning "I do not agree at all", five meaning "I fully agree" (or alternatively: 1= this is not the case at all; 5= this is very much the case). Italic statements in the questionnaire below are added as explanations. They were not part of the original questionnaire.

Information Quality on the Internet

Question I Which one of the following Website-types have you used intensively recently?

a) Company Homepage
b) Online Newspaper
c) Online Magazine
d) Banking-Website
e) Shopping-Website
f) Travel-Website (vacation, transport/aviation)
g) Public Website (federal state or community homepages)
h) Entertainment- and Event-Website (cinema, concerts, parties)
i) Wellness- and Health-Website
j) Job- or educational Website
k) Internet Content Portal (such as Yahoo, MSN, Bluewin etc.)

Question II Please answer all of the following twenty-one questions based on your choice in question I (the website you used most recently). *[All of these questions had to be answered on a scale of 1="I don't agree at all" to 5="I fully agree" or with "I don't know"]*

1. The information on the website were comprehensive.
2. The information provided on the website were accurate and precise.
3. The information was clear and comprehensible.
4. The information provided was useful to me.
5. The information was generally concise and to the point.
6. The information and its format was consistent and without contradictions.
7. The information provided on the website was correct and free of errors.
8. The information was current and updated.
9. The navigation on the website was convenient and user-friendly.
10. I was able to quickly get to the information I wanted.
11. The sources (e.g., authors, institutions) of the provided information were clearly indicated.
12. The Website was very interactive in the sense that I could adapt it to my personal needs (it was 'personalizable')
13. The website was easily accessible.
14. The website seemed very secure and well protected against mis-manipulations or unauthorized intruders.
15. The website seemed well maintained.
16. The website infrastructure was fast in terms of response times and access times.
17. The website has met my expectations.
18. The website 's layout and design were of high quality.
19. The website's content was of high quality.
20. I will use this website again.
21. I would be willing to pay a small amount of money to use this website.

Question III Please rate the following website quality criteria or elements according to their importance for you:

- Convenience or user-friendliness of the website design and navigation
- Currency of the provided information
- Comprehensiveness of the provided information, scope
- Interactivity in terms of personalization (can the website be adapted to one's needs)

- Conciseness, Brevity of the provided texts
- Personal touch of the website, humane look & feel
- Clarity in terms of the website category (you see immediately what kind of website it is)
- Simplicity in structure and information organization (i.e., few hierarchical levels)
- Objectivity, Independence
- Ability to contact the website manages and authors easily
- Speed (quick access to all pages, rapid query results)
- Correct information (no or very few errors)
- Consistent website-design over time (few design changes in a given period)
- Exclusivity, exclusive information
- Entertainment value, fun factor
- Artful design, aesthetic rendering of the information

Background of these Criteria *[These factors were all gathered in the three online focus groups that preceded the design of the questionnaire]*

Question IV Which of the above factors is the most important one to you in a website?

Question V For which of the above issues do you see the greatest improvement needs?