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QUATIC 2012

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Women vs. Men: Perceptions of Data Quality in Web Portals

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Abstract—The need to compete for user preference has arisen on the Internet. One competition-based strategy is to provide an adequate quality of service, and one of the key factors in this is the quality of the data provided. Web portals have been consolidated as an appropriate means to organize and facilitate access to data on the Internet. Many organizations and businesses also use them to provide either an alternative to the traditional manner of doing business, or complimentary services. It is thus interesting for Web portals developers to know how users value Data Quality. In this paper we show the results of a study that inquires into users' opinions of the Intrinsic Data Quality in Web portals in order to discover whether there are any differences in data quality preferences depending on the user's gender. This has been done by defining the hypothesis that men and women place different importance on quality characteristics. However, as a result we have discovered that, in general, they have the same opinion of the majority of the quality characteristics. In fact, we only found differences in the Objectivity and Understandability characteristics.

Keywords—component; Data Quality, Web portal, Statistical Method

I. INTRODUCTION

A Web portal is a Website or service that offers a broad array of resources and services to customers and business partners [1].

An increasingly amount of companies is deciding to use Web portals to sell their products or as an access point for the tools/services that their employees need to perform their jobs. Web portals have gradually undergone an evolution, and currently provide a variety of services [2].

Every day, new Web portals are being created to provide better services, and new businesses are managing their products through this kind of applications.

In this scenario, the quality of the data obtained via Web portals is becoming continually more important since the use and application of data are increasing in everyday life, and it is important that it is correct. Data Quality (hereafter DQ) or Information Quality is often defined as “fitness for use”, i.e.,

the ability of a data collection to meet user requirements [3, 4]. This signifies that the quality of a set of data should be determined by the people that use it in the context of a particular use.

In this respect, the DQ in Web portals is important to increase user reliability, since users can clearly see its usefulness. When the degree of satisfaction increases, the number of customers that access the portal also increases. The area of Web portal data quality has consequently begun to emerge [5].

Since we are aware of the importance of data quality in the context of Web portals we have, in a previous work, developed the SPDQM model (SQuaRE-Aligned Portal Data Quality Model) [6]. This model is composed of 42 DQ characteristics which are organised into four categories: Intrinsic, Operational, Contextual and Representational. In this paper we concentrate on studying the DQ characteristics in the Intrinsic category. More specifically, we show the results of a survey that we used to study the importance that Web portal users place on the aforementioned Intrinsic data quality characteristics. We were especially interested in determining whether there was any difference between the level of importance that men and women place on these DQ characteristics.

The remainder of this paper is organized as follows: Section II presents a background to the SPDQM model, which is focused on the Intrinsic category. In Section III, related works are briefly introduced. Section IV shows our research questions and hypotheses. The statistical method used is presented in Section V. The analysis and results are shown in Section VI and finally, Section VII presents our conclusions and lines for future work.

II. BACKGROUND

SPDQM will be used as a starting point for our work. SPDQM is a data quality model specifically for Web portals, which has already been defined by the authors of this paper. This model was defined on the basis of a previous model denominated as PDQM (Portal Data Quality Model) which was

completed with DQ characteristics obtained from a Systematic Literature Review and then aligned with the ISO/IEC 25012 standard [7] belonging to SQuaRE (Software product Quality Requirements and Evaluation).

Bearing in mind that a data user has no direct control over the DQ available [6], SPDQM was defined by taking into account that:

- The main goal of data users is to find useful information that meets their personal needs, rather than to provide information that satisfies the needs of others.
- The SPDQM model needs to be flexible and easy-to-use, so that it can be used by Web portal data users and also employed in different types of Web portals.
- Likewise, it should also be useful for producers and data designers/developers to know, when evaluating the DQ, what the users' criteria are and to determine if the level of DQ of the web portal is adjusted to their needs.
- Finally, SPDQM, like PDQM, will adapt itself to the user's perspective.

The model is composed of a set of characteristics and sub-characteristics which are grouped according to four categories:

- Intrinsic: denotes that data have quality in their own right.
- Operational: emphasizes the importance of the role of systems; that is, the system must be accessible but secure.
- Contextual: highlights the requirement which states that data quality must be considered within the context of the task at hand.
- Representational: denotes that the system must present data in such a way that they are interpretable, easy to understand and concisely and consistently represented.

In this paper, we focus on the Intrinsic category. Further information on SPDQM and the definition of the DQ characteristics can be found in [6].

III. RELATED WORK

We have found various studies that concentrate on the different ways in which men and women use the Internet. For example, the authors of [8] indicate that the two genders' use of the Internet tends to be different as regards likes, preferences and use, in that men are more analytical and objective than women, who are more subjective and intuitive [9]. What is more, men view surfing the Net as entertainment, while women perceive the Internet as an interpersonal navigation tool [9], [10]. This gender difference also influences the use of Web portals, as is shown, for example, in [11] in which the authors state that "gender differences show up in information and search services use".

Bearing all of the above in mind, it is possible to appreciate that there are differences between men and women as regards their Internet use. This situation leads to the question of whether these differences signify that each gender has different

data quality needs in the context of Web portals. The motivation of this work is, therefore, to determine whether these differences actually exist.

IV. RESEARCH QUESTIONS AND HYPOTHESES

In this paper our work concentrates on answering two research questions:

- Do Web portal users consider all the DQ characteristics that SPDQM defines for the Intrinsic DQ category to be equally important?
- Does the Web portal users' gender influence the importance that they place on the various DQ characteristics that SPDQM defines for the Intrinsic category?

With the first question we wish to define whether any of the DQ characteristics in the set related to the Intrinsic category are more relevant to users, thus enabling developers to pay special attention to them when creating a Web portal.

The second question has been raised by following certain beliefs that users' profiles may influence their perception of quality. In this case, we distinguish two roles: masculine and feminine, in accordance with [12], such that we focus on the traditional idea that assigns masculine roles to assertiveness, competition, and toughness and feminine roles to the capacity to deal with people.

By following the idea presented in [12] which considers that men focus more on material things, whereas women are more concerned with emotions, we shall determine whether this can affect the users' determination of some particular DQ characteristics or others depending on their gender.

We have also considered the ideas presented in [13], which state that the use of the Internet to obtain information according to gender is such that men pursue and consume information online more aggressively than women. Moreover, men use the internet more than women as a destination for recreation. Men are additionally more interested in technology than women, and they are also more tech savvy. Men value the Internet for the breadth of experience it offers; women value it for enriching their relationships, but they're more concerned about its risks.

Bearing the aforementioned issues in mind, and concentrating on Web portal users' gender characteristics, we shall therefore attempt to respond to our second research questions by verifying the following hypotheses:

- H0. Men and women do not place the same importance on the Intrinsic DQ characteristics.
- H1. Women place more importance than men upon the Reputation and Understandability characteristics, which are defined as [6]:
 - a. Reputation: The degree to which the data in a Web portal are true or of high reliability according to their source or content.
 - b. Understandability: The degree to which the data in a Web portal are clear, unambiguous, easy to understand and interpret by users and they are

expressed in language, along with the appropriate symbols and units.

- H2. Men place more importance than women upon the Precision and Completeness characteristics, which are defined as [6]:
 - a. Precision: The degree to which the data in a Web portal are exact and have DQ characteristics that help users to find relevant results and avoid irrelevant results.
 - b. Completeness: The degree to which the data in a Web portal satisfy the users' information needs, implicitly satisfying other criteria such as easy comprehension, which serve as an indicator of relevance.

The study carried out to answer our research questions is shown in the following section.

V. METHOD

In order to respond to our research questions and to test the proposed hypotheses, an unsupervised survey was conducted [14], which was generated to ask users to give their opinion of each DQ characteristics and sub-characteristics in the Intrinsic category.

A. Setting up the survey

This questionnaire in this survey was made up of a total of 17 questions, 16 related to the DQ characteristics in the Intrinsic DQ category (including a question concerning the definition of the term 'Intrinsic') (see Table I), and the last one, which was a demographic aspect (see Table II). We used closed questions, and the Likert scale of 1 to 5 was used to answer the questions, ranging from strongly disagree (value 1) to strongly agree (value 5). The questionnaire was distributed among a great variety of Web portal users of different ages, genders, occupations and knowledge of computing.

B. Sample selected

The questionnaire was given to a heterogeneous group of Web portal users, of a varied demography, such that there would be diverse participation.

C. Means of distribution

The survey was sent out by e-mail and/or on paper. In both cases, users were asked to read the instructions slowly and carefully.

D. Recovery of the survey data

The data was collected by e-mail and/or on paper, depending on the particular means of distribution used to deliver it in the first place. The survey distribution process was long and laborious since the distribution took place over a fortnight in order to obtain the greatest possible variety of user profiles. What is more, the submission of the surveys took a month since there was a 15 day period in which they could be submitted.

E. Review of Replies to the Survey

All the surveys sent out were answered, with a total of 137 surveys collected. One of these was rejected, since not all the questions had been answered. A total of 136 questionnaires were therefore processed and analysed.

F. Data analysis tool

The SPSS statistical analysis tool [15] was used to process the data obtained from the surveys. The starting point for this was the calculation of the Cronbach's alpha to estimate the reliability of the results, with which a highest value of 0.6 was considered to be adequate. In our case, a value of 0.856 was obtained as a result of this, which indicated that the results had good internal consistence. The information obtained in this research is therefore reliable.

TABLE I. QUESTIONS CONCERNING THE INTRINSIC CATEGORY

	Question	Characteristic
1	The data in a Web portal are defined in a standardized manner, such that all their users can understand them, and not therefore leading to doubts and different interpretations of them.	Compliance
2	A Web portal should provide information about its author or the source from which the data came.	Traceability
3	The data in a Web portal should come from known and reliable sources.	Reputation
4	The data in a Web portal should be impartial, i.e., they should be as objective as possible, and should lead to correct conclusions.	Objectivity
5	The data in Web portals should, in general, be correct and true. (This characteristic is related to those shown in questions 3 and 4).	Credibility
6	The data in a Web portal should be error-free and not be duplicated.	Accuracy
7	The data in a Web portal should be free from contradictions.	Consistency
8	A Web portal should provide data which are accessible to any user, including those with disabilities.	Accessibility
9	In some Web portals it should be necessary for users to provide identification if they wish to access certain data, which should be protected.	Confidentiality
10	The data in a Web portal should be updated the moment it is used.	Currentness
11	It should be possible to know the last date on which the data in a Web portal were updated.	Expiration
12	The data in a Web portal should be clear and easy to understand.	Understandability
13	It is important that there should be little interaction time when using the Web portal (the number of links that must be accessed) in order to obtain the necessary data.	Efficiency
14	The data in a Web portal should satisfy the users' information needs.	Completeness
15	The data in a Web portal should be exact, and relevant to the task that one wishes to carry out.	Precision
16	In a generic manner, indicate how important you believe it to be that the data provided by a Web portal are of high quality, i.e., up-to-date, exact, consistent, complete, credible, etc.	Intrinsic

TABLE II. QUESTIONS CONCERNING DEMOGRAPHIC ASPECT

<p>Indicate your gender: Male: _____ / Female: _____</p>
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VI. ANALYSIS AND RESULTS

Of the 136 sample subjects, 35% were women and 65% were men. This accords with the fact that men go online more frequently than women, as is stated in [13], which also indicates that 44% of men go online at least several times a day, compared with 39% of women. Moreover, this is owing to the fact that many of the surveys were distributed in the university spheres of Computer Science and Engineering, in which there are a higher proportion of male students, as is shown in [16].

Upon carrying out the descriptive analysis of the sample, we obtained the maximum, minimum and mean of all the DQ characteristics for the total sample (N = 136), see Table III.

The results obtained in this first analysis allow us to conclude that the first research question has been answered. In effect, it is possible to see that the means of the evaluations submitted are very similar for all the characteristics, and are in the majority of cases above 4. Only one (Traceability) is below 4, with a mean of 3.96.

We can therefore respond to our first research question that Web portal users do consider all the DQ characteristics that SPDQM defines for the Intrinsic DQ category to be important.

In order to respond to the second research question, we concentrated the remainder of our study on determining the influence of the gender of the subjects surveyed in the evaluations that they gave for the different DQ characteristics. This was done by carrying out another type of descriptive statistical analysis (bivariables and multivariables). More specifically, we carried out a variance analysis (Anova), a factorial analysis for the DQ characteristics that represented the Intrinsic category, and we finally carried out a cluster analysis by considering the results obtained in the factorial analysis.

The variance analysis (ANOVA) was carried out in order to determine the significant differences between the DQ characteristics obtained according to gender. Table IV shows the principal results obtained.

To carry out this analysis, we consider the relevance of the differences of means in the DQ characteristics where there is a significance level (Sig) less than or equal to 0.1. The results indicate that the principal significant differences in means as regards the evaluation of the various DQ characteristics only occur for the Objectivity and Understandability characteristics (which are highlighted in Table IV). These DQ characteristics are more highly valued by woman than by men, i.e., there is a significant difference between the means, and the significance level is less than 0.1. There are no significant differences in the other DQ characteristics.

The factorial analysis consisted of creating homogeneous groups of DQ characteristics. These groups are formed of those DQ characteristics which have a considerable amount of correlation with each other, and each group is independent of the others.

TABLE III. RESULT OF DESCRIPTIVE STATISTICAL

Characteristic	Min	Max	Mean
Compliance	1	5	4.24
Traceability	2	5	3.96
Reputation	2	5	4.42
Objetivity	1	5	4.13
Credibility	2	5	4.48
Accuracy	2	5	4.22
Consistency	2	5	4.36
Accessibility	2	5	4.44
Confidentiality	1	5	4.10
Currentness	2	5	4.32
Expiration	1	5	4.01
Understandability	2	5	4.18
Efficiency	2	5	4.07
Completeness	1	5	4.26
Precision	2	5	4.26
Inherent	3	5	4.51

TABLE IV. ANOVA RESULTS WHEN CONSIDERING THE GENDER VARIABLE

Characteristic	Variable	Mean	Typical Deviation	Sig
Compliance	Women	4.25	0.758	0.940
	Men	4.24	0.871	
Traceability	Women	3.94	0.954	0.820
	Men	3.98	0.982	
Reputation	Women	4.52	0.618	0.242
	Men	4.36	0.805	
Objectivity	Women	4.31	0.719	0.091
	Men	4.03	0.999	
Credibility	Women	4.56	0.712	0.292
	Men	4.43	0.675	
Accuracy	Women	4.29	0.771	0.473
	Men	4.18	0.891	
Consistency	Women	4.35	0.758	0.945
	Men	4.36	0.761	
Accessibility	Women	4.42	0.739	0.767
	Men	4.45	0.693	
Confidentiality	Women	3.92	1.182	0.152
	Men	4.19	1.004	
Currentness	Women	4.33	0.834	0.914
	Men	4.32	0.751	
Expiration	Women	4.08	1.069	0.521
	Men	3.97	0.988	
Understandability	Women	4.33	0.781	0.086
	Men	4.09	0.783	
Efficiency	Women	4.10	0.881	0.735
	Men	4.06	0.717	
Completeness	Women	4.42	0.739	0.106
	Men	4.18	0.838	
Precision	Women	4.38	0.703	0.196
	Men	4.20	0.745	

This factorial analysis is a data reduction technique in the sense that it allows us to search for the minimum number of DQ characteristics that are capable of explaining the maximum amount of information contained in the data.

In our case, we restrict the number of groups to 3, for each category, and we determined a minimum correlation value of 0.5.

The results reveal the existence of three factors which, when combined, represent 52.9% of the total variability, which can be interpreted as an acceptable percentage. Factor 1 represents 35.1% of the total variance and is made up of the DQ Compliance, Confidentiality, Currentness, Understandability, Efficiency, Completeness and Precision DQ characteristics. Factor 2 represents 10.4% of the total variance and is made up of the DQ Reputation, Objectivity, Credibility, Accuracy and Consistency DQ characteristics. Finally, Factor 3 represents 7.4% of the total variance and is made up of the DQ Traceability, Accessibility and Expiration characteristics. The Cronbach's alpha was calculated for each of the factors obtained in order to estimate the reliability of the results. Factor 1 obtained a Cronbach's alpha value of 0.763, Factor 2 obtained a Cronbach's alpha value of 0.790 and Factor 3 obtained a Cronbach's alpha of 0.671. This signifies that the values obtained are acceptable, and that the results are therefore reliable. The results of the factorial analysis are shown in Table V, together with the average score and the standard deviation for each item (the last two columns on the right).

If we interpret Table V on the basis of the definitions of the DQ characteristics we obtain that in Factor 1 the data must be defined according to regulations and standards (compliance), only interpreted by authorized users (confidentiality), considered up-to-date and not obsolete (currentness), clear, unambiguous and easy to understand and interpret (understandability), relevant (precision) and data also should satisfy information needs of the users (completeness) using an appropriate quantity of resources (efficiency). For Factor 2, the data should be true or of high reliability according to their source or content (reputation), impartial and unbiased (objectivity), correct (credibility), free of errors (accuracy) and coherent (consistency). In Factor 3, the data must be well-documented (traceability), accessible particularly for disabled people (accessibility) and the time until which the data remain up-to-date, should be known (expiration).

The scores obtained from the factorial analysis were used to construct groups of factors (denominated as cluster) using a cluster analysis. These clusters determine the importance placed on the DQ characteristics of each factor. This analysis considers the definition of 2 clusters, whose results are shown in Table VI.

As will be observed, the first cluster gathers those subjects who positively evaluated Factors 1 and 2, and the second cluster gathers those who gave a positive value to Factor 3. The clusters obtained were then used to generate a contingency table to discover how these two groups conformed to the gender variable, thus obtaining the results shown in Table VII.

As we can see, men predominate in both groups, although percentage-wise there is a majority of men in cluster 2. In this way, we conclude that women give more importance to the DQ characteristics of the factors 1 and 2, however, the DQ

characteristics in the factor 3 are more relevant to men. In order to discover whether there are any significant differences between the DQ characteristics analysed, we carried out a Chi square test which showed that, in effect, there was a significant difference of 10%.

Therefore, and on the basis of the results obtained, we can affirm the following. Hypothesis H0 is not fulfilled since, in general, both men and women evaluate the Intrinsic DQ characteristics in a similar way. Hypothesis H1 is partially fulfilled, since it can be shown that women give a higher value to the Understandability characteristic than men, although no difference can be established between men and women as regards the Reputation characteristic. Finally, hypothesis H2 is not fulfilled since no differences can be established between men and women as regards their evaluations of the Precision and Completeness characteristics. In response to our second research question, we can therefore state that gender does not appear to affect the importance that Web portal users place on the various SPDQM characteristics defined for the Intrinsic category.

TABLE V. FACTORIAL ANALYSIS OF THE DQ CHARACTERISTICS

Characteristic	Factors			Mean Score	Typical Deviation
	Factor 1	Factor 2	Factor 3		
Compliance	0.586			4.24	0.83
Traceability			0.684	3.96	0.97
Reputation		0.605		4.42	0.75
Objectivity		0.816		4.13	0.92
Credibility		0.828		4.48	0.69
Accuracy		0.548		4.22	0.85
Consistency		0.603		4.36	0.76
Accessibility			0.586	4.44	0.71
Confidentiality	0.513			4.10	1.07
Currentness	0.687			4.32	0.78
Expiration			0.872	4.01	1.02
Understandability	0.605			4.18	0.79
Efficiency	0.521			4.07	0.78
Completeness	0.579			4.26	0.81
Precision	0.611			4.26	0.73

TABLE VI. CLUSTER ANALYSIS OF FACTORS

	Cluster	
	1	2
Factor 1	0.372	-0.564
Factor 2	0.488	-0.742
Factor 3	-0.213	0.324

TABLE VII. CONTINGENCY TABLE

Demographic aspect	Variable	Cluster (%)	
		1	2
Gender	Women	40%	28%
	Men	60%	72%
Total	Amount (N)	82	54

Finally, we should add that in spite of there being no significant differences between the evaluations of men and women, upon generating the cluster concerning factors, we observed a certain tendency in men to give a higher value to the Traceability, Accessibility and Expiration characteristics than women.

These results will assist Web portal designers and developers to discover which DQ characteristics are most important to users according to their gender. Therefore, if designers and developers wish to create a Web portal related to information about racing cars which is principally oriented towards men, they should pay more attention to the DQ characteristics in factor 3, which is to say that the data must be well-documented (traceability), accessible, particularly for disabled people (accessibility), and the time until which the data remain up-to-date should be known (expiration).

VII. CONCLUSIONS AND FUTURE WORKS

This paper presents a study whose intention is, on the one hand to establish the importance that Web portal users place on a group of DQ characteristics and, on the other to determine whether the users' gender influences this evaluation.

This was based on SPDQM, a DQ model for Web portals which is made up of 42 DQ characteristics that are organised in four categories: Intrinsic, Operational, Contextual and Representational and in two points of view: Inherent and System Dependent. The study presented considers only one part of SPDQM – that which defines the DQ characteristics for the Intrinsic DQ category.

Our study attempts to answer two research questions: (a) Do Web portal users consider all the DQ characteristics that SPDQM defines for the Intrinsic DQ category to be equally important?, and (b) Does the Web portal users' gender influence the importance that they place on the various characteristics that SPDQM defines for the Intrinsic DQ category?.

Having obtained our results, we were able to establish that users place equal importance on all the Intrinsic DQ characteristics, and that the difference in gender does not have any significant influence on how they evaluate the various characteristics.

However, upon attempting to reduce the number of DQ characteristics with a factorial analysis, we discovered that one of the factors is more highly evaluated by men than by women.

These results have nevertheless encouraged us to continue exploring this theme in greater depth via the inclusion of other demographic variables which will permit a better characterisation of the groups of users associated with the factors obtained. We thus hope to establish, per groups of users, the DQ characteristics to which Web portal owners and developers should pay more attention if they wish to attain user preference.

Finally, as future work we intend to continue carrying out statistical studies for the other categories in the model. More specifically, we shall soon be carrying out a new survey for the Contextual category. The experience acquired in this work has made us aware that we must make some major improvements,

such as using a wider scale to evaluate the characteristics, which will thus enable us to establish greater differences between the results and obtain a greater number of responses that cover different objective groups in the Web (for example: in work areas, in Web use, in professional training, etc.).

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