The relationship between Web content and Web Accessibility at university: the influence of social and cultural factors

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Abstract

This research aims to assess if the universities from varied cultures rank significantly different with respect to the quality of their web contents and with regard to their Web accessibility (WA) level. Moreover, this paper tests whether universities, which make stronger efforts to improve the quality of their Web contents, also take into account WA issues to ease the access to such contents. We use a database containing 399 universities from 16 countries. Main results suggest that universities in Anglo-Saxon countries pay more attention to WA issues, and that those in Germanic countries rank significantly higher with regard to Web quality contents. On a global basis there is a significant relationship between the level of accessibility at university Web pages and the quality of the Web contents. However, if countries are grouped results are different. While in Germanic, Nordic and Anglo-Saxon countries there is no relation between the level of accessibility of university Web pages and the quality of the Web contents, in Latin countries this relation is direct and significant.

Keywords

Universities; Web Accessibility; Social factors; Cultural factors; Web quality content.

1. Introduction

The Web has become one of the most important tools for disseminating information about organizations among owners and the different groups of stakeholders (Pérez, Hernández, & Bolívar, 2005). In the case of business organizations, for firms above a certain size limit it is almost compulsory to have a Web site for the disclosure of both commercial and financial information. In fact, it is compulsory for certain kinds of firms (i.e. quoted companies, financial institutions) (Bonsón, & Escobar, 2006; Serrano-Cinca, Rueda-Tomás, & Portillo-Tarragona, 2009). For the case of educational institutions, it is also an important tool for communicating with the various groups involved in the educational process (actual and prospective students, teaching and administrative staff, and managers). Moreover, higher education institutions have the generation and dissemination of knowledge as their principal mission (Kidwell, Linde, & Johnson, 2000). So, for this reason, it is even more important, due to the fact that one of the usual missions of universities is research. Many activities related to research can be enhanced by an adequate diffusion of research processes and results through Web sites (fund raising, improving research impact on the scientific community, etc.).

In this context, the quality of the contents disclosed through Web sites is of key importance. A number of metrics has been proposed to monitor and evaluate such quality (Orehovacki, Granic, & Kermek, 2013). For the specific case of the universities, a relevant metric is the one used for the elaboration of the Webometrics ranking (Aguillo, Granadino, Ortega, & Prieto, 2006). However, the efforts of universities to increase the quality of their Web contents should be accompanied by an effort to improve the presentation of such contents.

The presentation of the contents can be understood as a multi-dimensional concept difficult to formalize and measure, but in this research work we focus on one of the issues of the presentation of Web contents, which is their Accessibility. Web Accesibility (WA) ensures that Web contents are available to people with disabilities or in certain situations (Clark, 2002; Paciello, 2000; Peters & Bradbard, 2010; Thatcher et al., 2003; Thatcher et al., 2006). WA can be assessed using a number of metrics (Vigo, Arrue, Brajnik, Lomuscio, & Abascal, 2007), which yield a score that allows the comparison of different sites.

The main objective of this research is to test whether universities, which make stronger efforts to improve the quality of their Web contents, also take into account WA issues to ease the access to such contents. WA issue is important because over a billion people in the world are estimated to live with some form of disability. This corresponds to about 15% of the world's population. Between 110 million (2.2%) and 190 million (3.8%) people of 15 years and older have significant difficulties in functioning (WHO, 2011). Barron, Fleetwood, and Barron (2004) argue that having a disability should not prevent a person from benefiting from the cutting edge e-learning opportunities that exist in today´s world. Thus, WA can be considered an aspect of the Corporate Social Responsibility (CSR) strategy of the organizations (Peters & Bradbard, 2007).

It is also remarkable that, although research on the accessibility of higher education institutions Web sites is limited, the research to date suggests that, as is the case of business organizations, many universities lack accessible Web sites (Bradbard, Peters, & Caneva, 2010).

Moreover, in many cases papers are focused on an individual country (Buenadicha, Chamorro, Miranda, & González, 2001; Hackett & Parmanto, 2005). So,

in this research data from a representative sample of European universities were gathered. Quality of Web contents was measured through the Webometrics ranking, and the level of Web accessibility was assessed through a quantitative metric, the Web Accessibility Barrier (WAB) (Parmanto & Zeng, 2005), developed at the University of Pittsburgh.

Since European countries have not yet faced lawsuits for lack of Web accessibility, European universities that decide to increase the WA level are not probably motivated by the threat of future lawsuits but by the social, cultural, legal and political contexts. Consequently, there are strong motives for our research. Our research design took into account that some cultural environments are more prone to transparency and disclosure of information. According to Boymal, Martin and Lam (2007), socio-legal systems can influence Internet innovation adoption patterns and diffusion rates. Miranda, Sanguino, and Bañegil (2009) found significant differences between European countries in the quantitative assessment of European municipal Web sites. So, we included national culture variables in our analysis. In this regard, and as additional goals, we tested the hypotheses of whether universities from different cultural environments rank significantly higher/lower with regard to, respectively, Web contents and WA.

The remainder of the paper is structured as follows: section 2 explains WA and the way it is measured. Section 3 discusses the methodology we used to measure the quality of the Web contents. Section 4 further elaborates on the reasons why WA should be taken into account in Web engineering. In section 5 we formulate the hypotheses of our work, which are about the relation between social/cultural factors, Web content and Web accessibility. Section 6 details the methodology of this research, including data

gathering and empirical methods. Section 7 discusses the results and, finally, section 8 is devoted to the exposure of the summary and conclusions.

2. Web accessibility and its measurement

WA is the set of procedures to ensure that Web applications are accessible no matter the limitations of the user/device used for access (Bradbard & Peters, 2008, 2010; Chisholm & May, 2008; Lazar, Dudley-Sponaugle, & Greenidge, 2004). WA means overcoming all disabilities that prejudice Internet access: it means that people with disabilities can use it and perceive, understand, navigate, and interact with the Web, and they can contribute to the Web (Thorp & Henry, 2014). 'Disabilities' is a broad concept that affects web access, including visual, auditory, physical, speech, cognitive, and neurological disabilities. The success of the WWW essentially lies in its high availability and ease of access to information. However, many people with sensory restrictions (mainly visual and auditory), motor or cognitive, which can be permanent or as a result of a temporary situation, often encounter serious problems with access. In spite of this, one of the most widely accepted definitions of WA is that provided by Slatin and Rush (2003), which state that Web sites are accessible when individuals with disabilities can access and use them as effectively as people who don't have disabilities.

Although people with disabilities are a clear example of exclusion due to lack of accessibility, they are not the only ones who experience it. Similar restrictions apply to those who use equipment with small displays or low resolution, low bandwidth connection, special or older browsers, etc.

The standards-setting body for the Web, the World Wide Web Consortium (W3C), was launched in 1997 along with its most important initiative, the Web Accessibility Initiative (WAI, http://www.w3.org/WAI), with the aim of fomenting and

guaranteeing Web accessibility. WAI developed the Web Content Accessibility Guidelines (WCAG) to provide both general and specific guidance to Web content developers for assessing and ensuring the accessibility of their content. Its version 1 was published as W3C Recommendation on May of 1999 (Chisholm, Vanderheiden, & Jacobs, 1999) and the second version (Caldwell, Cooper, Guarino, & Vanderheiden, 2008) was published in December of 2008.

In the present research WCAG 1.0 is used. This is because although the transition to WCAG 2.0 is officially on the agenda of most countries much work remains to be done and nowadays a generally accepted practice for reporting WCAG 2.0 evaluation results does not exist (Nietzio, Eibegger, Goodwin, & Snaprud, 2011). Moreover, although the W3C recommends applying WCAG 2.0 it also recognizes (WAI, 2014), in line with other authors (Li, Yen, Lu, & Lin, 2012), that most websites conforming to WCAG 1.0 should not require significant changes in order to conform to WCAG 2.0. Moreover, some of them will not even need any changes at all.

In order to measure the accessibility level of a Web site several metrics have been proposed, so that features of Web sites are mapped to a value representing the accessibility level of the site. The most popular are qualitative metrics, such as the previously mentioned WCAG. Under this metric, Zero, A, AA or AAA qualification is assigned to a Web site depending on the satisfied checkpoints. However, these metrics are not sufficiently precise to determine the level of accessibility of a Web application. For example, an application that fulfills only the guidelines of priority 1 and another one that fulfills all the guidelines of priority 1 and all those of priority 2, except one, will receive the same qualification (A). Nevertheless, it is clear that the latter is more accessible than the former. So, this metric is not useful for the comparison of two applications or for the comparison of different versions of the same application. Metrics

yielding a quantitative estimation of Web accessibility are more suitable for these purposes (Vigo et al., 2007). So, in this research we used a quantitative metric.

3. Web content and its measurement

Nowadays the Web is a key for the future of all the university objectives, as it is already the most important academic communication tool, the future channel for the off-campus distance learning and the universal showcase for attracting talent, funding and resources (Schimmel, Motley, Racic, Marco, & Eschenfelder, 2010). Therefore, because Web sites are often entry points to an institution it is essential to develop quality websites. Moreover, university rankings put pressure on universities to find ways to best use and share their knowledge and improve outcomes for students and the institution (Howell & Annansingh, 2013). To assess the quality of Web sites many frameworks have been proposed by researchers. Thus, Huizingh (2000) proposed a framework focused on two aspects of Web quality: content and design. Ranganathan and Ganapathy (2002) proposed a model based on information content, design, security and privacy. The framework proposed by Aladwani and Palvia (2002) identified four dimensions of Web quality: specific content, content quality, appearance and technical adequacy. Hasan and Abuelrub (2011) proposed a model with four dimensions: content, design, organization and user-friendly. Other similar proposals are those by Fogli and Guida (2015), Rafique, Lew, Abbasi, and Li (2012), Sassano, Olsina, and Mich (2010), and Zhao and Zhu (2014). As can be seen, Web quality is a complex concept and although its measurement is multi-dimensional, all the authors consider that Web content is a critical part of it.

This paper is focused on an indicator of the quality of Web content: the Webometrics Ranking of World Universities (www.webometrics.info). The Web of Universities or Webometrics Ranking (WR) is the largest academic ranking of Higher

Education Institutions (Millot, 2015). It's been used since 2004 (Aguillo et al., 2006) by the Cybermetrics Lab, a research group of the Spanish National Research Council (CSIC). It is computed twice per year, and the results have been disclosed in January and July since 2006. It includes data from more than 21,000 universities from five continents, and after 2008 the portal also includes Webometrics Rankings for research centers, hospitals, repositories and business schools.

The ranking is built from publicly available Web data (indexed by search engines), combining the variables of activity and impact (Web visibility) into a composite indicator, and with a true global coverage. The Web Ranking uses a 1:1 ratio of activity indicators (publications and Web contents) and impact/visibility indicators (number of external links received). In practical terms this means each group represents 50% of the total weighting (Cybermetrics Lab, 2014).

The four dimensions considered in the Webometrics Rankings are:

- **Impact.** External inlinks (not only academics) that the university Web domain receives from third parties. The link visibility data is collected from the two most important providers of this information (Majestic SEO and ahrefs) using their own crawlers. The indicator is the product of the square root of the number of backlinks and the number of domains originating from those back links, so it is not only the link popularity that is of importance but even more so the link diversity. The maximum of the normalized results is the impact indicator.

- **Presence.** Total number of Web pages hosted in the main Web domain of the university (including all the subdomains and directories) indexed by the largest commercial search engine (Google). It counts every Web page, including all the formats recognized individually by Google, both static and dynamic pages and other rich files.

- **Openness.** Number of rich files (pdf, doc, docx, ppt) published in dedicated websites according to the academic search engine Google Scholar. Only recent publications and files whose names are properly formed are considered. This indicator represents the effort to set up institutional research repositories.

- **Excellence.** Number of excellent publications. The academic papers published in high impact international journals are playing a very important role in the ranking of universities. This ranking considers only excellent publications, i.e. the university scientific output being part of the 10% most cited papers in their respective scientific fields.

Therefore, the objective of Webometrics Ranking is not to evaluate websites according to their design, usability or the popularity of their contents considering the number of visits or visitors, but to assess the quality of their content. Actually, Web activity and impact/visibility indicators can be an important and objective mechanism for the evaluation of university activities, of the services it offers, of the quality of its teaching and research, of its management and governance and of the relevance and impact of scientific, technological, cultural or economic results, both local and international. Accordingly, the Ranking reflects the commitment of the institution with the publication on its website.

4. Why web accessibility should be part of the Web policy?

WA entails overcoming all disabilities that prejudice Internet access: it means that people with disabilities can use it and perceive, understand, navigate, and interact with the Web, and they can contribute to the Web. Therefore, WA expands opportunities for communication, interaction and employment for people with disabilities. Moreover, WA helps reduce the digital divide (Mahmud & Ramakrishnan, 2012), benefits older

people with diminishing abilities (Becker, 2004), provides easier access to the Internet for people with low literacy (Capra, Leal, Silveira, & Ferreira, 2012) and/or not fluent in the language, as well as for people with low bandwidth connections and/or older technologies.

WA is a technological innovation capable of improving the relationship between the organization and all their stakeholders, not only those with disabilities, becoming a source of competitive advantage for businesses (Thatcher et al., 2006). It can affect an organization's employees, stockholders and board members, suppliers and vendors, partners and collaborators, customers and other stakeholders. Moreover, due to the social issues, WA can be understood not only as a technological innovation but also as a Corporate Social Responsibility (CSR) initiative (Oh & Chen, 2015; Peters & Bradbard, 2007). CSR is regarded as voluntary corporate commitment to exceed the explicit and implicit obligations imposed on a company by society's expectations of conventional corporate behavior (Falck & Heblich, 2007). Therefore, CSR is part of the expected repertoire of every university wanting to be perceived as modern and legitimate. Thus, WA is an integral part of CSR in demonstrating an organization's commitment to providing equal opportunities (Henry, 2014) and effective online information for all users. WA policies are a way for universities to provide a general guide to action for faculty and staff that serve as Web site developers for the organization (Bradbard et al., 2010). Therefore, WA can create strategic benefits for CSR-committed universities. In this regard, we must bear in mind that one of the dimensions of the CSR strategy of an organization is visibility. In other words, if CSR efforts are not adequately communicated, they are less likely to be perceived by the university community and the general population. An accessible Web site can be a valuable tool for this purpose.

Furthermore, WA has also an impact on another key area of CSR benefits. It has a positive effect in order to favour employee motivation, retention and recruitment. WA can be offered as evidence of the efforts of the organizations to be attractive for potential employees with disabilities. In addition, it can also directly influence current employees as they are more motivated to work in a better environment, and WA contributes to show that the organization cares.

For the specific case of universities, the importance of WA as a complement to their CSR strategy is even higher than for other organizations. This is because education has lower direct environmental impact than other industries such as for example mining or chemicals. Furthermore, in most countries universities receive funds from governmental bodies and other donors of funds. These entities may eventually take into account that, apart from their educational and research missions, the university receiving funds is committed with the development of society. Surprisingly, to the extent we know no prior studies have tackled the issue of determining the reasons universities may have to adopt practices to improve their WA levels.

Another issue that must be considered is that pressures on Web designers to make their Web sites fully accessible are increasing due to legal rulings. In recent years, most European countries have either enacted legislation, or taken other measures on WA. Table 1 shows the regulations approved in the different European Union (EU) countries.

[INSERT TABLE 1 ABOUT HERE]

It can be observed that there is a widespread interest in national legislation in achieving minimum levels of web accessibility. Nevertheless, a common issue of most regulations is that no direct enforcement mechanism seems to be in place. Moreover, in most cases, regulation does not seem to envisage any sanctions for non-compliance.

This situation contrasts with that of the USA, where there is a large number of lawsuits and settlements directly related to WA.

With the aim of harmonizing regulation in European countries, on December 3, 2012 the European Commission adopted a Proposal for a directive on the accessibility of the public sector bodies' Websites. Nevertheless, since European countries have not yet faced lawsuits because of lack of Web accessibility, European universities that decide to increase the WA level are not probably motivated by the threat of future lawsuits but rather by the social, cultural, legal and political contexts. So, there are strong motives for our research and social, cultural, legal and political contexts should be considered as factors having an influence on the level of WA.

5. Hypotheses formulation: the relation between social and cultural factors, Web content and Web accessibility

With regard to the arguments exposed above, it is remarkable that many prior research efforts (Matten & Moon, 2008; among others) suggest that CSR is applied differently across different social, economic, cultural, legal and political contexts. So, as WA can be understood as a CSR initiative, national culture and legal systems are important issues in the WA adoption. For the case of universities Howell and Annansingh (2013) recognize the role of culture in determining different perspectives of knowledge. The most common definition of culture is from Hofstede (2001), who defines national culture as the collective mental programming of people of a particular nationality. This mental programming shapes the values, attitudes, competence, behaviour, and perceptions of priority of that nationality. Hofstede (1980) initially identified four dimensions within national culture: power distance index (PDI), individualism index (IDV), uncertainty avoidance index (UAI) and masculinity index

(MAS). Later on more dimensions were added to this framework (Hofstede, Hofstede, & Minkov, 2010), although they have been scarcely considered in the literature.

Power distance is the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally (Hofstede, 1980). Cultures that are high in power distance are illustrated by decisions being made by superiors without consultation with subordinates, whereas cultures that are low in power distance will have a more participative and egalitarian relationship between superiors and subordinates. In high power distance nations, it is believed that the powerful should have special privileges and it is expected that not everyone will have an equal opportunity to reach the highest level of advancement (Hofstede et al., 2010). Countries whose national culture has a low PDI are more system-fixing oriented and only if something is wrong, either relative to products or processes, investments are made in new technologies in order to fix the system. Previous literature found that the cultural dimension of power distance is strongly and negatively related to innovation (Rinne, Steel, & Fairweather, 2012).

Hofstede (1980) defines individualism based on the extent to which people are integrated into groups; it reflects the degree to which people focus on their own internal attributes to differentiate themselves from others. Individualism index describes the relation between the group and the individual. An individualist culture is one in which individual interests prevail over collective interests. On the other hand, in a collectivist society relationship prevails over task. Cultures high in individualism will value personal time and personal accomplishments, whereas cultures high in collectivism will value the group's well-being more than individual desires. Higher innovation capacity has been commonly associated with more individualistic cultures because that type of society implies autonomy, independence and freedom, because these values are related

to higher inventive and useful ideas and have a positive effect on economic creativity. Zhao (2011) found a positive relationship between individualism and e-government development.

Uncertainty is a fact of life in any society. Where societies differ is in the extent to which they seek to avoid uncertainty (Perry, 2002). Uncertainty avoidance is the degree to which the members of a society feel uncomfortable with uncertainty or unknown situations and try to avoid such situations. In cultures with low uncertainty, citizens are comfortable in ambiguous situations and with unfamiliar risks. Organizations in countries with low uncertainty avoidance generally show characteristics such as promotion of innovations (Waarts & Van Everdingen, 2005), little formalized management and the application of innovation by rules (Hofstede, 2001). Strong uncertainty avoidance cultures are risk averse, and this hampers the emergence of new ideas and even more the implementation of innovations (Gaspay, Dardan, & Legorreta, 2008).

Finally Hofstede (1980) considers the distribution of emotional roles between the genders. In masculine societies, social gender rules are clearly distinct, while in feminine societies social gender rules overlap. A masculine society places greater value on success, money, and personal accomplishments, whereas a feminine society places greater emphasis on caring for others and quality of life. In a masculine society individuals are more aggressive, ambitious, and competitive; whereas individuals in feminine societies are more modest, humble, and nurturing (Blodgett, Bakir, & Rose, 2008). In a low masculine society, managers generally use intuition as much as logical thinking to solve problems, and internal conflicts could be resolved by negotiation and compromise.

Many researches find a linkage between cultural values and legal systems (Arminjon, Nolde, & Wolff, 1950; Gray, 1988; Hope, 2003; La Porta & Lopez-de Silanes, 1998, among others). Although each nation has its own legal system, there are similarities in certain critical aspects of the legal systems of some countries. According to the Zweigert and Kötz (1998) taxonomy, it is possible to identify in Western European countries, the following legal families: the Romanistic legal family, the Germanic legal family, the Anglo family and the Nordic legal family. In the same way La Porta, Lopez de Silanes, and Shleifer (2006) classified Western European countries into four legal families: English (common) law, French civil law, German civil law, and Scandinavian law. England developed a common law tradition, characterized by independent judges and juries, relatively weaker reliance on statutes, and the preference for contracts and private litigation as a means of dealing with social harm. France, in contrast, developed a civil law tradition, characterized by state-employed judges, great reliance on legal and procedural codes, and a preference for state regulation over private litigation. Much like its French counterpart, the German civil law is based on Roman civil law and was subsequently exported to other countries. By contrast, the Scandinavian legal tradition is usually viewed as part of the civil-law tradition, although its law is less derivative of Roman law than the French and German families. Zweigert and Kötz (1998) highlight the less intensive influence of Roman law upon Nordic law, as well as the lack in Nordic law of large, systematically constructed private law codifications (there are no general civil codes in the Nordic countries).

Hofstede (1980) used hierarchical cluster analysis to divide countries into culture groups. This yielded the following culture regions in Europe: Anglo, Germanic, Nordic, and Developed Latin. La Porta legal system families and Hofstede's regions are practically the same in Western European countries. In this regard, we must underline

that the scope of coverage of existing WA legislation/regulations varies across the Member States: in most countries, central government Websites are covered but there is a lot more variability as regards coverage of other levels of governance; also coverage of Websites of non-governmental services of "public interest" is a lot more limited, this means that sites of services of public interest are addressed to a much lesser extent and, where they are, it tends to be more a general reference rather than precise specification of the particular services that fall within the scope of the legislation (Cullen, Kubitschke, Boussios, Dolphin, & Meyer, 2009).

According to Laporta & Lopez de Silanes (1998) in common law countries there is a higher demand for publicly disclosed information. Because WA allows disseminating information to a large number of users, it is more likely that firms in common law countries implement WA. In countries with common law, high individualism, low power distance, low uncertainty avoidance and high masculinity there are more incentives to innovations, especially those that ease the dissemination of information. As English common law countries have such characteristics we formulate the following hypothesis:

H_1: In Anglo countries (with high IND, low PDI, high MAS, and low UAI) universities are better positioned in Webometrics Ranking.

The academic web is a global source of expertise and is also a means to communicate scientific and cultural achievements (Aguillo, Granadino, Ortega, & Prieto, 2005). Hence, the number of publications available through the Websites of universities has increased during the last years. As previously noted, the Webometrics ranking is a powerful tool to rank universities according to the volume and quality of the contents they disclose through the Web (Aguillo, Ortega, & Fernández, 2008).

In their discussion of the Webometrics Ranking, Aguillo et al. (2005) found evidence of a wide digital divide among developed countries. The presence of different cultural and legal systems among the European countries can partially explain the differences. In countries with high uncertainty avoidance, the volume and quality of academic Web publications may be higher as a means to reduce uncertainty and ambiguity. High power distance is an obstacle to open communication, whereas low power distance stimulates more participation. Masculine cultures have a preference for achievement, assertiveness and material recognition for success, so there is an incentive to increase quality publications and the disclosure of quality contents through the Web. As German countries have low PDI, high MAS and high UAI we formulate the following hypothesis:

H_2: In German countries (with low PDI, high MAS, and high UAI) universities are better positioned in Webometrics Ranking.

Finally, the relationship between Webometrics Ranking and accessibility is studied. In this regard it should be noted that having quality content is more useful if the number of users is large. In this sense WA is a useful tool to expand the number of users by overcoming the barriers in the access to Web pages. Given that Webometrics Ranking takes into account impact indicators (number of external links received) greater accessibility of Web pages improves the impact. So, it is possible to argue that universities concerned about content quality are also concerned about more accessible Webs, because with more accessible Web sites the number of citations can be improved. Then, we hypothesized:

H_3: Universities best positioned in Webometrics Ranking are more accessible.

6. Research methodology

6.1. Data base

In this paper the Webometrics ranking *Top 500 Universities in Europe* was used. It includes 500 universities in 34 countries ordered by the ranking provided by Webometrics. The ranking was elaborated in July 2011. Countries were grouped into four sets according to La Porta legal system families and Hofstede's regions (Anglo, Germanic, Nordic and Developed Latin). Some countries were excluded because they could not be included in any of the four cultural/legal groups. In addition, countries with a reduced number of universities were excluded. The final database contains 399 universities (re-ranked from 1 to 399) from 16 countries (Table 2).

[INSERT TABLE 2 ABOUT HERE]

The countries and number of universities in each culture/legal groups are detailed in Table 3.

[INSERT TABLE 3 ABOUT HERE]

The four dimensions of national culture identified by Hofstede are quantified using the Value Survey Module (VSM2008). Each country in this model is characterized by a score on each dimension. Table 4 shows the Hofstede's scores (available at http://www.geert-hofstede.com/countries.html) for the countries in the sample.

[INSERT TABLE 4 ABOUT HERE]

6.2. WA Indicators

As mentioned in Section 2, in this research we used WAB (Parmanto & Zeng, 2005) for the measurement of the accessibility level of Web sites. WAB is a well-accepted quantitative metric (Freire, Fortes, Turine, & Paiva, 2008; Vigo & Brajnik, 2011). It has been applied in numerous studies (Hackett & Parmanto, 2005, 2009; McMillan & Lin, 2009; Yu & Parmanto, 2011).

WAB looks at 25 checkpoints based on WCAG 1.0 (5 of Priority 1, 13 of Priority 2 and 7 of Priority 3) that can be automatically evaluated. In this regard, it must be taken into account that apart from the automated procedures a manual evaluation is necessary for a complete diagnosis of the accessibility of a Web site. However, the automated procedures provide a continuous range of values, which can be used as a proxy of the level of accessibility (Hackett, Parmanto, & Zeng, 2004). The number of violations of the checkpoints is the basis for the score:

$$WAB\,score = \frac{\sum_{p}\sum_{v}\left(\frac{n_v}{N_v} \times W_v\right)}{N_p}$$

With *p* = Total pages of a Web site, *v* = Total violations of a Web page, *nv* = Number of violations, *Nv* = Number of potential violations, *Wv* = Weight of violations in inverse proportion to WCAG priority level, and *Np* = Total number of pages checked.

Higher WAB scores mean that more accessibility barriers exist, and low scores mean better conformance with WCAG guidelines. A score of zero denotes that the Web site does not violate any Web accessibility guideline and should not present any accessibility barrier.

In order to get a more accurate value of the level of accessibility (Hackett & Parmanto, 2009), we performed the evaluation over the main page or each URL plus all pages in the second and third navigation level. That is, we evaluated the home page, the pages that are linked by the main page, and the pages that are linked from these. Measurements were realized using a Web tool named Atenea (http://www.atenea-accessibility.es), which allows access to Web pages at remote Web sites and the calculation of accessibility scores according to the selected metrics.

6.3. Empirical methods

First, we computed descriptive statistics for the variables in the study (WAB score and Webometrics ranking). We provide means, standard deviations, and minimum and maximum values for the universities grouped by countries and cultural groups. These statistics give us a first approach of the level achieved by the aggregations we defined in this study.

For the assessment of H_1 and H_2, which postulate that universities from certain cultural/legal groups achieve higher levels of Web accessibility and quality of Web content, we assessed the significance of the differences in the mean levels between each pair of groups by using the *t* test for the difference of means (independent samples). As a robustness check we repeated the analysis replacing the *t* test by the nonparametrical Mann-Whitney test.

For the assessment of H_3, which postulates that there is a direct relationship between the level of Web accessibility of the Web sites of universities and the quality of the contents measured through the Webometrics ranking we formulated the following regression equation:

$$WAB\,score = \hat{a} + \hat{b} \times Ranking$$

This equation was estimated both for the total sample and for each one of the cultural/legal groups. In order to approximate regression residuals to normality, WAB was transformed using natural logarithms prior to the estimation of the equations. In addition, as the White test for heteroskedasticity revealed that in all cases the hypothesis of constant variance was rejected, we used robust regression procedures.

7. Findings and discussion

7.1. Descriptive statistics

The summary statistics for the WAB scores by countries and by cultural groups are shown in Tables 5 and 6.

[INSERT TABLES 5 AND 6 ABOUT HERE]

Considering that, under the WAB evaluation framework, 5.5 is defined by some researchers (i.e., Hackett et al., 2004) as the threshold value for an acceptable level of accessibility, the Nordic group is the only one that really may have serious problems of accessibility. In contrast, the best performing group is that of the Anglo countries.

Descriptive statistics for the ranking positions, by countries and cultural groups are displayed in Tables 7 and 8.

[INSERT TABLES 7 AND 8 ABOUT HERE]

It is noticeable that Germanic universities achieve on average the highest positions in the ranking and Developed Latin universities are usually low-ranked. By countries, Switzerland is the best positioned and France is the worst country on average.

7.2. Assessment of H_1

As indicated above, assessment of H_1 was done by performing a series of pairwise *t* and Mann-Whitney tests. Results are exposed in Table 9. Cells in the triangle above the main diagonal display the results of the *t* tests. The figure in the upper part is the *t* statistic, and below in parentheses the sign of the differences used for the test is indicated. The cells below the main diagonal contain the results of the Mann-Whitney tests. The figure in the upper part is the *z* statistic and below we show the sign of the differences.

[INSERT TABLE 9 ABOUT HERE]

First of all, it is noticeable that Web sites of universities from Anglo-Saxon countries are clearly more accessible than the others. Nordic universities seem to have lower levels of WA than those from Latin and Germanic countries. Finally, results

provide evidence that no significant differences arise between Germanic and Latin universities with regard to WA.

So, we can conclude that our data support H_1. In this regard, we must comment that the interest of UK universities in removing barriers is old. As early as in 1999 a committee was appointed to carry out accessibility audits of Web sites in the UK Higher Education Web sites (Sloan, Gregor, Booth, & Gibson, 2002).

7.3. Assessment of H_2

The results of the assessment of H_2 are displayed in table 10. The structure of this table follows the same pattern as that of table 9. Cells above the main diagonal contain the results of parametric *t* tests while cells below display those of its nonparametric Mann-Whitney counterpart.

[INSERT TABLE 10 ABOUT HERE]

An examination of data in table 10 reveals that Germanic universities perform higher in the ranking than Anglo-Saxon and Latin universities. However, no significant differences are found with regard to Nordic universities. So, our data lend partial support to H_2. Nordic universities perform better than Latin and Germanic. Furthermore, tests do not show evidence of significant differences between the Germanic and the Latin environment.

7.4. Assessment of H_3

As settled above, H_3 postulates that there is a direct relationship between the level of Web accessibility of the Web sites of universities and the quality of the Web contents. The results of the regression models estimated for the assessment are detailed in table 11. This table contains the estimation results for the subsamples by cultural groups and the results of the model estimated for the total sample.

[INSERT TABLE 11 ABOUT HERE]

First of all, our analysis shows that on a global basis there exists a significant relationship between the level of accessibility and the quality of the Web contents. So, we can assert that H_3 holds. An examination of the results detailed by cultural groups reveals that this relation is significant only for the Latin environment. For the other cultural groups (Germanic, Nordic and Anglo-Saxon), no relationship is found between the level of Web accessibility and the quality of the Web contents. In other words, in the Latin environment the universities which take care of the quality of their Web contents have also taken into account the quality of the presentation of such contents through an adequate level of Web accessibility. The case of Anglo-Saxon universities is especially noticeable. As seen in the assessment of H_2, they achieve higher levels of Web accessibility than all other universities, and not only the universities that rank high with regard to the contents quality show a commitment to Web accessibility.

8. Summary and conclusions

Web sites of organizations are key tools for the fulfillment of their missions. For the specific case of universities this is especially important as many groups of interest gather information about universities in a continuous manner. So, universities make remarkable efforts to increase the quality of the contents they disclose through their websites. A number of metrics have been proposed, and this makes possible the elaboration of rankings.

However, the effectiveness of Web sites as tools for the dissemination of information depends not only on the quality of the contents, but also on the way such contents are displayed. Presentation issues are important in order to allow users to gather and analyze the required information in an easier way.

The main objective of this paper is to assess whether the universities that are more committed to the quality of their Web contents are also interested in an improved presentation of such contents. In this regard, it is necessary to take into account that the quality of the presentation of Web contents is a multidimensional concept, which is not easy to measure in an objective way. So, we focused on an aspect of the presentation of the contents that can be measured using sound metrics, which is WA.

WA is an important issue with regard to the presentation of Web contents as it allows that information can reach an increased number of users that use a variety of access devices. Apart from the technical issues, WA has a social edge and it can be considered a part of the CSR strategy of organizations. As national culture has proven to have an influence both on the process of adoption of innovations and the CSR Commitment, we included the cultural ascription of universities in our analysis. This allowed us, as secondary objectives of our research, to assess if the universities from different cultures rank significantly different with respect to the quality of their web contents and with regard to their WA level.

For our research we gathered data from a relevant number of European universities and we assessed our hypotheses using both tests on the significance of the difference of means and regression analysis. Our main results indicate that on a global basis there exists a significant relationship between the level of accessibility and the quality of the Web contents. However, when the analysis is repeated for cultural groups this relationship is significant only for the Latin environment. In other words, in Germanic, Anglo-Saxon and Nordic countries, universities are committed with WA no matter the level of quality of their Web contents. As additional results of our effort, we also found that universities in Anglo-Saxon countries pay more attention to WA issues

and that those in Germanic countries rank significantly higher with regard to web quality contents.

The finding that universities are committed with WA in all environments except that of the Developed Latin countries suggests that in these countries the passing of regulations is not enough to ensure a proper access to Web contents to persons with disabilities. Enforcement measures, such as for example sanctions, should be implemented to prevent that only the entities that are more interested in improving the quality of their Web content are also more engaged in WA development. This sends a clear message to the disabled and other groups of interest which should put pressure on regulatory bodies to implement proper enforcement measures. In this regard, initiatives held at the European level could be of great help.

Finally, we can mention a number of future avenues of research, which extend the present paper. First, it could be of interest to extend the scope of this study to non-European cultural environments. Second, a feasible extension is the analysis of other aspects of the presentation of the Web contents, such as for example usability. Finally, other types of organizations can also be analyzed using the methodology proposed in this paper. Among these we must mention public and private companies and governmental bodies.

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Country	Legislation	Applies to
Austria	E-Government Act (February 2004)	All websites of public authorities must be set up to comply with the needs of challenged persons. By January 1, 2008 all government / public administration Web sites should be accessible
Belgium	Anti-Discrimination Law (2003)	Any lack of reasonable adjustments for people with disabilities will be considered as a form of discrimination
Denmark	No national law. Nevertheless by means of a formal agreement it is mandatory the use of WAI guidelines for the public sector	Public sector as of 1st January 2008
France	Law No 2005-102, art. 47	All French central government Web sites by May 2011. All other French public Web sites (public services, towns, public research, etc.) was required to comply by May 2012.
Germany	Federal Disabled Equalization Law (BGG) Federal Decree on Barrier-free Information Technology (BITV regulation)	All government Web sites by September 22, 2011
Ireland	The Disability Act 2005, art. 28	Public body Web sites by December 31, 2005
Italy	Law No. 4/2004 (Stanca Law) The *Digital Administration Code* (Legislative Decree No. 75, March 7, 2005)	All government Web sites by January 1, 2008
Netherlands	Act on equal treatment on the grounds of handicap or chronic illness (Stb. 2003, 206, December 2003)	All governmental Web sites by the end of 2010
Norway	LOV 2008-06-20 nr 42 Lov om forbud mot diskriminering på grunn av nedsatt funksjonsevne	The law requires all Web sites to be universally designed. From July 2013 onwards, new Web sites should follow WCAG 2 AA with some exceptions.
Portugal	Accessibility of Public Administration Web Sites for Citizens with Special Needs (RCM 97/99)	Requires government bodies and public corporates to implement accessible Web sites
Spain	Law 34/2002 Law 51/2003 Royal Decree 1494/2007 Law 30/2007	All public administration Web sites and all Web sites financed with public funds must be accessible before December 31, 2005
Sweden	National Disability Law (March 2000)	Requires Swedish government authorities to ensure that no later than 2005 their premises, activities, and information are accessible to people with disabilities
United Kingdom	Disability Discrimination Act (1995, updated 2005) Equality Act 2010	The GDS Service Manual requires WCAG 2 AA as a starting point for UK government Web sites. Other UK Web sites need to comply with the Equality Act and provide equal access, but this act does not specify technical standards.

TABLE 1. Regulations passed in different EU countries regarding Web accessibility.

	Number	Percentage (%)
Austria	8	2.0
Belgium	8	2.0
Denmark	8	2.0
Finland	7	1.8
France	56	14.0
Germany	64	16.0
Greece	9	2.3
Ireland	8	2.0
Italy	46	11.5
Netherlands	14	3.5
Norway	6	1.5
Portugal	11	2.8
Spain	50	12.5
Sweden	14	3.5
Switzerland	10	2.5
UnitedKingdom	80	20.1
Total	**399**	**100.0**

TABLE 2. Number of universities in the sample by country

	Number	Percentage (%)
Germanic	82	20.6
Developed Latin	194	48.6
Nordic	35	8.8
Anglo	88	22.1
Total	**399**	**100.0**

TABLE 3. Number of universities in the sample by culture/legal groups

		PDI	IDV	MAS	UAI	Main characteristics
Germanic	Austria	11	55	79	70	Low PDI / High MAS / High UAI
	Switzerland	34	68	70	58	
	Germany	35	67	66	65	
Developed Latin	Belgium	65	75	54	94	High PDI / Low MAS / High UAI
	Spain	57	51	42	86	
	France	68	71	43	86	
	Greece	60	35	57	112	
	Italy	50	76	70	75	
	Luxembourg	40	60	50	70	
	Netherlands	38	80	14	53	
	Portugal	63	27	31	104	
Nordic	Denmark	18	74	16	23	Low PDI / Low MAS / Low UAI
	Finland	33	63	26	59	
	Norway	31	69	8	50	
	Sweden	31	71	5	29	
Anglo	United Kingdom	35	89	66	35	Low PDI / High MAS / Low UAI/ High IDV
	Ireland	28	70	68	35	

TABLE 4. Hofstede's scores in selected countries

	Mean	Std Dev	Min	Max
Austria	5.304	2.527	0.941	9.772
Belgium	6.835	4.586	2.220	16.263
Denmark	6.891	2.264	4.020	10.523
Finland	5.845	4.207	2.000	13.061
France	5.730	2.627	1.131	12.005
Germany	4.924	2.390	0.988	11.312
Greece	8.151	3.724	3.269	13.545
Ireland	3.242	2.247	1.000	7.410
Italy	4.944	2.762	0.492	13.313
Netherlands	6.544	1.791	4.314	9.949
Norway	5.921	4.210	2.057	13.673
Portugal	5.496	2.324	2.000	10.786
Spain	3.622	2.623	0.186	10.846
Sweden	5.534	1.815	2.711	8.464
Switzerland	5.672	2.365	1.918	8.483
United Kingdom	3.830	2.043	0.027	9.616
Total	**4.925**	**2.729**	**0.027**	**16.263**

TABLE 5. WAB index by countries

	Mean	StdDev	Min	Max
Germanic	5.052	2.384	0.941	11.312
Developed Latin	5.204	2.953	0.186	16.263
Nordic	5.973	2.886	2.000	13.673
Anglo	3.777	2.055	0.027	9.616
Total	**4.925**	**2.729**	**0.027**	**16.263**

TABLE 6. WAB index by cultural/legal groups

	Mean	StdDev	Min	Max
Austria	163.38	108.519	10	290
Belgium	130.00	97.528	41	337
Denmark	169.88	115.579	22	330
Finland	169.00	110.910	9	355
France	280.14	74.793	51	399
Germany	151.19	100.186	12	396
Greece	254.89	102.451	122	381
Ireland	219.75	107.741	54	370
Italy	226.26	106.167	11	393
Netherlands	143.57	117.933	8	389
Norway	158.50	167.956	6	389
Portugal	242.09	137.223	47	378
Spain	187.92	109.014	20	390
Sweden	159.86	135.032	21	395
Switzerland	121.50	93.032	5	275
United Kingdom	207.68	120.577	1	398
Total	**200.00**	**115.325**	**1**	**399**

TABLE 7. Ranking of universities by countries according to Webometrics methodology

	Mean	StdDev	Min	Max
Germanic	148.76	99.517	5	396
Developed Latin	224.22	109.925	8	399
Nordic	163.74	126.755	6	395
Anglo	208.77	118.946	1	398
Total	**200.00**	**115.325**	**1**	**399**

TABLE 8. Ranking of universities by cultural/legal groups according to Webometrics methodology

	(1) Germanic	(2) Developed Latin	(3) Nordic	(4) Anglo
(1) Germanic	--	0.511 (1-2)	-1.848** (1-3)	3.462*** (1-4)
(2) Developed Latin	0.053 (1-2)	--	-2.381** (2-3)	3.190*** (2-4)
(3) Nordic	-1.411 (1-3)	-1.454 (2-3)	--	4.657*** (3-4)
(4) Anglo	3.402*** (1-4)	3.883*** (2-4)	3.991*** (2-4)	--

*** Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level

TABLE 9. Assessment of H_1

	(1) Germanic	(2) Developed Latin	(3) Nordic	(4) Anglo
(1) Germanic	--	-5.577*** (1-2)	-0.622 (1-3)	-3.576*** (1-4)
(2) Developed Latin	-5.116*** (1-2)	--	2.648*** (2-3)	1.034 (2-4)
(3) Nordic	-0.262 (1-3)	2.750*** (2-3)	--	-1.808** (3-4)
(4) Anglo	-3.299*** (1-4)	0.957 (2-4)	-1.799* (3-4)	--

*** Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level

TABLE 10. Assessment of H_2

	$\hat{a}$ (t stat.)	$\hat{b}$ (t stat.)	F stat.	R^2
Germanic	1.388 (11.83***)	0.001(1.17)	1.38	1.25%
Developed Latin	1.042 (8.13***)	0.002 (3.97***)	15.78***	6.90%
Nordic	1.621 (11.76***)	<0.001 (0.53)	0.28	0.72%
Anglo	0.941 (4.21***)	<0.001 (1.00)	1.00	1.31%
Total	1.204 (15.26***)	0.001 (3.17***)	10.06***	2.31%

*** Significant at the1% level ** Significant at the 5% level * Significant at the10% level

TABLE 11. Regression results for countries with more than 30 universities in the sample