Accessibility levels of Portuguese enterprise websites: equal opportunities for all?

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Web accessibility is growing in importance. We may also find an increasing need for access to web resources by those with some sort of disability. The Web is very important for spreading information and for promoting interaction between the various elements in society. Given this, it is essential that the Web presents itself as a totally accessible resource, so that it can help citizens with disabilities and their integration in society. This obligation should be even greater for enterprises as primarily the Web is used as a marketing and business platform. With this document, we present indicators regarding the [lack of] accessibility levels of Portuguese enterprise websites. This article contains theoretical and background considerations as well as the results of two different studies that the research team undertook. First of all, the research team made a comparison between the 1000 largest Portuguese enterprises (annual sales volume) and the 1000 best Portuguese small and medium enterprises (sales growth and profit) using a specialised software tool and according to Web Content Accessibility Guidelines (WCAG) 1.0; the research team then also considered WCAG 2.0 and its impact on enterprise Web accessibility. In the second study (qualitative in nature), focus group interactions led to a set of recommendations towards greater accessibility.

Keywords: accessibility; comparative study; websites

1. Introduction

The introduction of new technologies and methods for the treatment and utilisation of information makes our society more complete and able to evolve.

In the last two decades of the twentieth century, information and communication technologies (ICT) have contributed in a significant way to a profound change in economic and social activities. These changes include increases in quality of life, as well as in the competitiveness and productivity of enterprises (Sócrates 2007).

Through the use of ICTs those with functional diversity, people with a mental or physical disability, can be better integrated in society. However, for this to happen, it is necessary to increase efforts to adapt technologies so that they can be used by everyone, including those who have some sort of disability (Wenner 2008).

The information society is a society for all. ICTs bring a clear and an important influence to the various domains of daily life in society. Its applications cover the entire spectrum of social groups. Nevertheless, there are barriers to overcome, opportunities to explore and benefits to be taken advantage of. Therefore, it is not correct to create a brand new group of e-excluded people just by abandoning the unprotected. It is extremely important to promote universal access to e-literacy and e-competence (Gurstein 2000). In order to increase the amount of possible users for the existent websites, the application of the World Wide Web Consortium's (W3C's) Web content accessibility guidelines should be unanimous. This is especially important for those users who are people with disabilities as well as older adults (Curran *et al.* 2007).

The growing need for access to online information creates in turn the need for a guarantee of accessibility to this Web content. According to the 2001 communication of the European Commission (EU 2002a), there are 37 million European citizens with disabilities who need to be granted full access to Web content. Web accessibility means that people with disabilities can perceive, understand, navigate and interact with the Web. People with disabilities should be able to contribute to the Web, including older people with changing abilities due to ageing.

Given the social, technical and economic environment that exists, not only in Portugal but all over the world, a discussion of these present work goals was

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carried out. As a result of this discussion, the following set of goals was achieved:

- Present some high-level indicators and trends concerning the accessibility levels of a group of Portuguese enterprises websites;
- Present, through a focus group process, a set of recommendations that should help the creation of accessible websites.

This article is divided into six parts, including the introduction and subsequent theoretical and background considerations (Sections 1 to 3). Two different studies were undertaken by the research team. In the first study (Section 4), we present an accessibility evaluation performed in order to compare the 1000 largest Portuguese enterprises to the 1000 best Portuguese small and medium enterprises (SMEs) using a specialised software tool [considering Web Content Accessibility Guidelines (WCAG) 1.0 (W3C 1999)]. We do also, however, present an insight into the WCAG 2.0 (W3C 2008a) influence on existent accessibility levels as this newer version of the WCAG (still under public scrutiny and still in an early stage concerning availability of evaluation tools) presents, as we shall see, some differences from its predecessor. In the second study (Section 5), a group of recommendations towards accessibility are made; these recommendations were achieved through focus group interactions. Conclusions concerning our work are to be found in Section 6.

2. Web accessibility

In this section, we aim to present a contextual background to the (Web) accessibility theme. We start by presenting several perspectives on the definition of accessibility and its influence on citizens' quality of life, and we finish by presenting some other related works performed in other countries.

2.1. Concepts and concerns

Given the fact that ICT ('best characterized as being revolutionary' (Mansell *et al.* 2007, p.1), in particular, those ICT connected to the microprocessor, invented in the late 1960s) help to stimulate enterprise competitiveness and citizens' quality of life, the European Union should take advantage of all of the opportunities that these technologies have to offer (EU 2005).

ICT currently has a very high penetration rate in the Portuguese enterprise market. The Agency for the Society of Knowledge confirms this statement in the analysis made of the inquiry conducted by the Portuguese National Institute of Statistics, according to which 95% of the enterprises with 10 or more employees

use computers; furthermore, 84% of them use e-mail and 83% have Internet access. For medium-sized enterprises (50 to 249 employees), these three indicators have the value of 99%. For big enterprises (250 or more employees), all the three indicators have a value of 100% (INE 2007, UMIC 2007). Due to this, it is extremely important that ICTs become accessible to all, because if so, all those who work, or will work with them, can take advantage of the benefits that they bring (W3C 2005).

The Web is revolutionising the access to information and the opportunity for people who have disabilities to actively participate in society (Thatcher *et al.* 2006). If website accessibility levels are high (enabling the perception and understanding, and the navigation and interaction with websites) then all sectors of society including groups such as children, seniors and people with disabilities can be more independent and lead more fulfilling lives.

According to Nielsen (2002), accessibility and usability are very closely related, indeed the International Organization for Standardization (ISO 2002) definition of accessibility also highlights the relationship between accessibility and usability. Usability is related to 'effectiveness, efficiency and satisfaction in a specified context of use' (ISO 2008), including the Web and regardless of a person's disability (Thatcher *et al.* 2006), and

> Usability is associated not with the product in itself, but with the interaction between the user and the product. The emphasis on the quality of the interaction is regarded as also being fundamental to the goal of increasing the levels of accessibility achieved in software products
>
> (*ISO 2008*)

Increased accessibility for users with a disability of some degree inevitably leads to improved usability for all segments of society. Attention to simplicity, ease of use and to ease of (dynamic) learning in the design stage of websites is essential and will minimise user errors (Nielsen 2002).

So, the term accessibility can easily be defined as the possibility for people with disability to interact with a product, resource, service or activity in an equal way, just as someone without a disability would do. Concerning ICT, we can define accessibility as the creation of interfaces that are perceived, operable and easy to understand by those with a wide range of disabilities. This includes all disabilities, such as visual impairment, hearing problems and physical, cognitive or neurological limitations. Beyond this, accessibility features also make all products more available to those who do not have any kind of disability (W3C 2008a).

W3C also states that the accessibility of Web content is largely determined by the developer's

accessibility knowledge, skill and effort, by the authoring tools support for creating accessible content, and by the evaluation tools that will allow a validation of the accessibility levels presented by the created Web content (Brewer 2006). In fact, the issue of accessibility has two main components (Chisholm and Henry 2005), the technical components (related to the tools and the content that we are working with) and the human component, involving content producers, end-users and tool developers. This means that, 'to realise the dreams of people with disabilities', tools have to enable the creation and modification of the content in Web pages that must be made accessible. Accessibility has therefore to be looked upon from the two perspectives and, to this end, the Web Accessibility Initiative (WAI) of the W3C was launched as an organised effort to tackle this issue. In this context, we would like to highlight the following guidelines:

> Authoring Tool Accessibility Guidelines (ATAG)
> User Agent Accessibility Guidelines (UAAG)
> Web Content Accessibility Guidelines (WCAG)

Whereas the ATAG define how authoring tools should help Web developers produce Web content that is accessible and conforms to WCAG, UAAG outlines how to make user agents accessible to people with disabilities in order to raise the level of accessibility of Web content. Technology improvements and break-throughs are prone to occur if Web designers would make an effort in order to understand the differences between all Web users (Shneiderman and Hochheiser 2001).

As concerns accessibility in computing, specific examples include having textual equivalents for images, thus enabling blind users with text-to-speech software or text-to-Braille hardware to access desired information; furthermore, large/enlargeable text and images make access to users with poor vision easier; and clickable links which are large in size make it easier for all to access content especially those who cannot exert precise control over a mouse or those using wide structures (web content concentrated in two layers) to facilitate deaf users' frequent navigation in websites (Fajardo *et al.* 2009).

In this context, the focus of this article is the human component and, namely, the end-user perspective of the consumer interacting with existing Web content and applications and, therefore, in the WCAG (version. 1.0).

The ISO, which is 'probably the most well-known and highest profile standards making organisation in the world', published in 2002 the ISO TS 16071 technical specification for software accessibility, 'a collection of empirically derived guidelines' (ISO 2002). The focus of accessibility therein (please refer to the ISO accessibility definition above) is not on the user but on a computing

agent's usability, this usability thus representing the problem that needs to be solved. Although the complexity and innovation brought up by ISOs TS 16071 is indeed significant, new specifications were created and published – ISO 9241-110 (ISO 2006) and ISO 9241-171 (ISO 2008). These new specifications introduced new definitions for existing concepts and new concepts and concerns. Accessibility is seen to be a desired path to promote 'increased effectiveness, efficiency and satisfaction for people having a wide variety of capabilities and prefer-ences' and, furthermore, 'the accessibility planned for a product can be defined, documented and verified (e.g. as part of a quality plan)' (ISO 2008). According to ISO 9241-110, there are seven dialogue principles (ISO 2006):

- Suitability for the task;
- Self-descriptiveness;
- Conformity with user expectations;
- Suitability for learning;
- Controllability;
- Error tolerance;
- Suitability for individualisation.

The ISO guidance on software accessibility (ISO 9241-171) provides guidance 'on the design of the software of interactive systems so that those systems achieve as high a level of accessibility as possible' (ISO 2008), and to increase the compatibility with assistive technologies. It refers to three major principles for designing accessible software that must be used in conjunction with the seven dialogue principles of ISO 9241-110 (ISO 2006). Table 1 lists those three major principles.

A website's accessibility level is largely based on three factors, according to the World Wide Web Consortium:

- Web Content - the information presented by the website, including text, images, forms, sounds, etc.;
- User Agents - Web browsers, media players and assistive technologies such as screen readers, alternative keyboards and scanning software;
- The user's knowledge, experiences and in some cases, adaptive strategies.

Although the combination of these three factors determines the accessibility level presented by a website, we also need to understand which of these factors can be better controlled and easily improved upon.

In many countries, the law mandates Web accessi-bility and consequently policies exist to that end, for example in the European Union, with the eGov Action Plan (EU 2006) or in Portugal with the new law for the public procurement procedure based on Electronic Web Platforms (Silva 2008). Despite these policies, studies have found however that websites, when used by people

Table 1. Major principles for designing accessible software.

Principles	Description
Equitable use	'Provide the same [identical or equivalent] means of use for all users' (ISO 2008)
Suitability for the widest range of use	Solutions should be designed so that they 'will be useful, acceptable and available to the widest range of users within the intended user population, taking account of their special abilities, variations in their capabilities, the diversity of their tasks, and their differing environmental, economic and social circumstances' (ISO 2008)
Robustness (WCAG 2.0 Principle No. 4) (WAI 2005)	'Software should be designed to be as *robust* as possible to allow it to work with current and future assistive technologies [as the need to use add-on assistive technologies – hardware or software, such as a Braille display or a screen reader, which is added to a system or incorporated within it to satisfy the need of an individual to increase his or her accessibility (ISO, 2008) – is at times inevitable]... The software can promote integration of assistive technologies by providing information that can be read by assistive technologies, and by communicating through standard application-to-application communication protocols' (ISO 2008)

Note: Adapted from ISO (2008).

with disabilities, can be 'three times harder to use' as compared to the use by people without disabilities (Nielsen 2002). Our article in particular focuses upon corporate website accessibility levels and we seek to emphasise how there is a flagrant disregard for people with disabilities in some countries, even within the European Union. The case we focus upon is that of Portugal and of the 1000 largest Portuguese enterprise websites as well as the 1000 best Portuguese SME websites.

2.2. Web accessibility – related studies in other countries

There is a very comprehensive study published by the European Commission (Cullen *et al.* 2009) about Web accessibility levels. Much as with our study, Cullen *et al.* (2009) aimed to help Web accessibility levels while at the same time reporting on the transition to WCAG 2.0 guidelines from the earlier WCAG 1.0 guidelines. While our study focused on Portugal alone,

Cullen *et al.* (2009) focused on a number of countries. Some of its main conclusions are that:

- Web accessibility compliance (mainly WCAG 1.0 based) is still very low across the EU;
- Government websites show some progress despite the 'pass/fail' logic not detecting this progress ('legal/regulatory obligations seem primarily to be directed towards Web sites of public administration at the upper governance levels');
- Over time Web accessibility compliance varies – websites might pass at one stage and then fail later on – meaning that longitudinal studies are necessary to capture this variability over time;
- The new guidelines WCAG 2.0, while being positive, pose new challenges.

Significantly:

> None of the sample of websites that were surveyed achieved WCAG 2.0 compliance in accordance with the (manual) method used in this study, but then none of them achieved full WCAG 1.0 compliance either (by passing both automatic and manual testing).

Cullen *et al.* (2009) reveal (they tested less websites than in our study – just over 100 per year – however, testing was not limited to an automatic tool but included manual testing as well) that from 2007 to 2009 WCAG 1.0 compliance levels have a negative trend. Indeed, in 2009, zero websites passed automatic and manual testing versus 2.9% and 3.6% in 2008 and 2007, respectively. Furthermore, consistently over half of the sample failed to comply more than marginally in the 2007–2009 period. This alerts us to a problem – we believe that there is an absence of a sense of urgency to address website accessibility levels in the EU – and for this urgency to be achieved a solid and credible business case, describing why it makes sound business (as well as social) sense to be accessible needs to be developed and communicated.

Pernice and Nielsen (2001) report that, in their evaluation of several different websites in Japan and the USA, 104 people (from Japan and the USA) participated in total, including 84 users with disabilities. Users with disabilities had visual impairments (low vision and no vision), motor skill impairments, but users with audio impairments were not included in the study as the Web's audio use is at present very limited. Pernice and Nielsen (2001) indicate 'that Web usability is about three times better for sighted users than for users with visual impairments' and that 'most of the usability problems are not quite as severe for users with motor skill challenges'. Finally, the research revealed very similar usability problems both in the USA and in Japan, and as

a result of the usability tests, 75 design guidelines are given for accessible Web design.

Kurniawan *et al.* (2001) also studied websites and their accessibility and usability. They used two automatic evaluation tools for this purpose: Bobby and LIFT. Among the sample, which included different domain extensions such as '.com', '.edu', '.org' and '.gov', the governmental website group performed the best relative to desired accessibility levels. This confirms, to some extent, what Cullen *et al.* (2009) also found in terms of progress in government websites. However, Kurniawan *et al.* (2001) found that among the government websites, only just over half (52%) passed their website accessibility approval test (compliance with the Website Content Accessibility Guide). These researchers also found that for all groups studied accessibility correlated significantly with usability ratings (this was not the case for commercial websites however, the only exception).

Other related studies about website accessibility include Becker (2008), which researched online access to electronic government namely Web accessibility barriers that need to be overcome and ongoing concerns. Drews (2008) adopts a different perspective and discusses 'tourism for all' and interestingly states, much as we have done, that the market for people with disabilities and older persons is significant and should not be neglected.

3. Regulations and the world perspective

In this section, we present a brief summary of what the situation is (as concerns Web accessibility) all over the world. We try to show some of the most 'important' regulations and at the same time show a little bit of what some World level organisations are doing in order to improve the existing situation.

3.1. The European situation

The first time Web accessibility became a matter of concern in the European Union was in September 2001 through a communication made by the European Commission to the European Council, to the European Parliament, to the Economic and Social Committee and to the Regions Committee. This communication was a result of the wide scope of the 'eEurope 2002' action-plan that was approved in the Feira's European Council (EU 2002b). After 2001, and as Web accessibility importance was growing, the European Commission launched the 'eEurope 2005' action plan. This plan's goal was the creation of modern public websites and the creation of a dynamic environment for e-business through an enormous offering of broadband access

with competitive prices and through a secure infrastructure for information (EU 2003).

i2010 is a recent initiative and the successor of eEurope 2005. i2010 aimed for 'a European information society for growth and employment'. ICT is seen to be a means to achieve improved personal quality of life as well as being a positive contributor to an improved economy and society and i2010 was the EU framework to promote this during the period 2005–2009.

Presently, there is another European project being executed. This project, called 'Digital Agenda for Europe', aims to deliver sustainable, economic and social benefits from a digital single market based on fast and ultra fast internet and interoperable applications. In order to achieve its goals, this new project will take action in eight areas (EU 2010):

- A vibrant digital single market;
- Interoperability and standards;
- Trust and security;
- Fast and ultra fast internet access;
- Research and innovation;
- Enhancing digital literacy, skills and inclusion;
- ICT – enabled benefits for an EU Society;
- International aspects of the Digital Agenda.

3.2. The Portuguese situation

In 2001, a demographic study named 'Censos 2002 – População residente com deficiência segundo o grau de incapacidade e sexo' was performed by the Portuguese National Institute of Statistics – INE. According to the results of the study, there were 634,000 Portuguese citizens with some kind of disability (INE 2002).

Worldwide awareness of the Web content accessibility issue is growing every day. This same awareness is evolving globally to enterprise markets because people with disabilities are using ICT on a more regular basis, and their economic influence is also growing. As a consequence of these global 'movements', the Portuguese enterprise market should also adapt to this new reality.

In Portugal, there is a serious lack of accessibility reports (UMIC 2005, Vector21 2007). During the research process that led to this study, only five reports on Web accessibility were found; four that were directed at Portuguese public administration websites and a fifth that was presented by Vector21 (2007), where it is possible to view the results of an accessibility evaluation of 16 Portuguese enterprise websites. Contrary to what happens in many other countries, the Web content accessibility issue has not been studied with the precision and depth that it deserves. As odd that it may seem, our work in this area is the first and most complex ever done having in consideration the 'Portuguese Web'.

3.3. The situation in the United States of America

In 1998, Congress amended the United States Rehabilitation Act of 1973 in order to require Federal agencies to make their entire Electronic and Information Technologies accessible to all people, including those with some sort of disability. This action resulted in the creation of Section 508 regulation. This regulation was enacted to eliminate barriers in information technology, open new opportunities for people with disabilities, and encourage the development of technologies that will help achieve these goals. The law applies to all Federal agencies when they develop, procure, maintain or use electronic and information technology. One of Section 508's rules claims that agencies must give employees and members of the public with disabilities access to information that is comparable to access available to others (ITAW 2010).

Although Section 508 is still the current USA law as concerns e-accessibility issues, its creator, the US Access Board, is working on an update of this document. According to the referred agency, they are aiming to update the regulations that concern accessibility to information technology for those with some sort of disability. This update will involve technologies such as mobile phones, computer software and hardware, websites, mobile devices and electronic documents, among others. An additional effort is being made in order to include Point-of-Sale machines and self-service kiosks in the range of technologies that are being included in the new Section 508 version (USAB 2010).

3.4. W3C perspective and regulation

Web content accessibility has been a priority for various world entities, such as the W3C which in 1997 created the Web Accessibility Initiative – WAI. This initiative was created with the aim of being a parallel organisation to the W3C and its mission was to develop guidelines that would be understood as the international standards for Web accessibility; as well as to develop support materials for a better understanding and development of Web accessibility, and to develop new resources through international co-operation (W3C 2008b).

Since the year 1997, WAI has been aiming for an increase in Web content accessibility by creating several tools that facilitate this. An example of those tools is the WCAG 1.0. These guidelines are an explicative document of how to create Web content so that it can be accessed by anyone, including those who have some sort of disability. According to the first version of these same guidelines, Web content is all the information within a Web page or Web application. The accessibility guidelines were characterised by three main aspects, the

guideline checkpoints, the priority levels (level 1, level 2 and level 3) and the conformance levels (level A, level AA and level AAA) (W3C 1999). The priority level 1 checkpoints are those that, according to the W3C, must be implemented so that a website can be accessible to the majority of users. Priority level 2 checkpoints are those that should be implemented because they bring a great improvement to the overall accessibility and usability of a given website. The priority level 3 checkpoints are those that may be implemented so that the entire website can be accessible by all users (W3C 1999). The conformance levels could be characterised as the 'level of accessibility' presented by a website. If a website implemented all priority level 1 accessibility checkpoints then it would have the conformance level A. If a given website presented all the priority level 1 and 2 accessibility checkpoints covered then it would have the conformance level AA. By implementing all the priority levels 1, 2 and 3 accessibility checkpoints, a website would have the conformance level AAA (W3C 1999). As a follow-up of the technology evolution, W3C also found the need to create a newer and updated version of the Web Content Accessibility Guides. The new version of the WCAG, named 'Web Content Accessibility Guidelines 2.0 – WCAG 2.0', presents some differences from its predecessor. According to WAI, WCAG 2.0 covers a wide range of recommendations for making Web content more accessible and following these guidelines will make content accessible to a wider range of people. Following these guidelines will also often make your Web content more usable for users in general (W3C 2008a).

WCAG 2.0 also made use of the functional concept of principles used in some other works, such as ISO Dialogue Principles (ISO 2006) and Nielsen's Usability Principles (Preece *et al*. 2002). The new version of the W3C guidelines was divided according to the following principles (W3C 2008a):

- *Be Perceivable* – Information and user interface components must be presentable to users in ways that they can perceive;
- *Be Operable* – User interface components and navigation must be operable. This means that users must be able to operate the interface (the interface cannot require interaction that a user cannot perform);
- *Be Understandable* – Information and the operation of user interfaces must be understandable. This means that users must be able to understand the information as well as the operation of the user interface;
- *Be Robust* – Content must be robust enough so that it can be interpreted reliably by a wide variety of user agents, including assistive technologies.

3.5. *World Health Organization perspective and regulations*

According to the World Health Organization (WHO), 10% of the world's population suffers from some form of disability. This number clearly shows the existing need for health and rehabilitation services. As a way to disseminate and create awareness of this reality, the WHO created an action plan called 'Disability and Rehabilitation Action-Plan 2006-2010' (WHO 2006).

4. Web accessibility evaluation using a specialised software tool

As we have seen above, 'Web accessibility is the practice of making websites accessible to all, particularly those with disabilities' (Bradbard and Peters 2010, p. 1). However, 'many websites are designed with visual aesthetics, rather than equal access, as the goal' (Bradbard and Peters 2010, p. 2).

4.1. *Evaluation methodology*

According to the W3C WAI, the accessibility evaluation is a process that should follow a given methodology. This same methodology 'defines' a process achieved by the following steps: definition of the scope of the evaluation, definition of the evaluation tools, definition of the proceedings for the manual evaluation and definition of which reports will result from the evaluation process (W3C 2006).

For the definition of the scope of the evaluation, we had to identify the criteria to be used for the accessibility evaluation and who would be part of the target group. In order to achieve good results, we decided to use the 'AAA' accessibility level announced by the W3C as the evaluation criteria (W3C 2008c).

For the evaluation tool, we chose the TAW3 tool (CTIC 2008). This was the Web accessibility evaluation tool we chose, because it is executed according to the following points:

- The evaluation is based on the W3C WCAG 1.0 [was replaced by WCAG 2.0 in December 2008. However, due to the newness of WCAG 2.0 many authoring tools as well as evaluation tools and legal mandates 'are still geared to WCAG 1.0' (Bradbard and Peters 2010, p. 14)];
- It is free to use by anyone;
- It automatically analyses all the pages of a website;
- It creates a report with all the accessibility failures encountered in a website;
- It is available in several languages, including Portuguese and English.

According to Tawdis (www.tawdis.net), the TAW3 tool is capable of automatically evaluating an entire website. While doing this evaluation, this tool increases the total number of detected errors and presents them in an evaluation report. Although this fact can interfere with the final results of a website (there's a possibility of a bigger/more complex website presenting more errors and therefore a worse result than a smaller/less complex site), we believe that this fact is transparent throughout the entire range of Web accessibility evaluation tools. Despite this situation, we tried to decrease its importance by defining the total number of evaluated website pages. In the evaluation that led to this work, only 30 pages[1] of each website were evaluated (CTIC 2008).

When analysing a given website page, TAW3 assumes that each fault of a given WCAG1.0 checkpoint is an error. Therefore, the total number of errors that this tool presents in its evaluation report is in fact the total amount of faults that it encountered all across the website, grouped by the priority level. For example, if a given page has 100 images and 30 of them lack any alt text then TAW would account for 30 errors in that page. For this project, we decided that the manual evaluation of the websites of the entire target group was something that we would not be able to achieve in the period of time that we had for the resolution of this project. As a result of this situation, we decided not to manually evaluate the referred websites (e.g. a WCAG 1.0 guideline such as 'Provide equivalent alternatives to auditory and visual content' has five checkpoints; another WCAG 1.0 guideline 'Ensure that text and graphics are understandable when viewed without colour' has two checkpoints, still further, the WCAG 1.0 guideline 'Provide clear navigation mechanisms' has 10 checkpoints; a total of 14 guidelines are present in WCAG 1.0 to make possible the design and evaluation of accessible Internet websites; this in turn leads to a total of 65 checkpoints (Bradbard and Peters 2010) meaning that a manual evaluation of a significant number of websites, as is the case our study, was too cumbersome given our project timeline). Involving people with disabilities from the beginning of a project helps you to better understand accessibility issues and implement more effective accessibility solutions. It also broadens your perspective in a way that can lead you to discover new ways of thinking about your product that will make it work better for more people in more situations (W3C 2009). Web accessibility evaluations often focus on conformance to accessibility standards such as WCAG. While conformance is important, there are many benefits to evaluate with real people to learn how your website or Web tool really works for users and to better understand accessibility issues. Evaluating with users with disabilities and with older users identifies

usability issues that are not discovered by conformance evaluation alone (W3C 2010a), however due to the difficulty in accomplishing a standardised and stable environment in which to achieve this we opted not to do this with this study, albeit we leave this as a recommendation for future research.

Concerning the kind of reports that would result from the evaluation process, we decided to do a group of simple statistical studies (average, standard deviation, maximum and minimum) that would represent the reality of the Web accessibility level presented by the Portuguese enterprises.

4.2. Target evaluation group

For the definition of the target group, we realised that evaluating all of the Portuguese enterprise websites was extremely complicated, so as a way to solve this issue we decided to evaluate the 1000 largest Portuguese enterprises (according to annual sales volume) during the year of 2005 (INE 2007), and the 1000 best Portuguese SMEs[2] during the same year (Exame 2007).

Another reason for the choice of this target group was the fact that it contained enough importance and representative enterprises for the acknowledgement of indicators on the accessibility levels of the entirety of Portuguese enterprise websites.

Even though this was our initial target group, after researching the websites of the 1000 largest Portuguese companies, we reached the conclusion that only 777 of these companies have online websites, and 223 of this same group do not have a website or have one that is 'under construction' or even have one that is incompatible with the evaluation tool we have chosen. Research on the websites of the 1000 best SMEs led us to conclude that only 649 of the initial 1000 were online. From those 649, only 642 could be evaluated with the chosen evaluation tool.

For these reasons, the 'final' target group was only composed by 777 of the 1000 largest Portuguese enterprises and by 642 of the 1000 best Portuguese SMEs (Figure 1).

We believe that comparing the websites of these Portuguese enterprises is a good choice because ICT have a direct impact on citizens' quality of life, and because the enterprises are, as each day goes by, increasing the amount of online services that should be available for all, including those with some form of disability.

4.3. Evaluation results

After defining the target group, the website evaluation step was started. The available websites were tested against the W3C/WAI accessibility guidelines with the
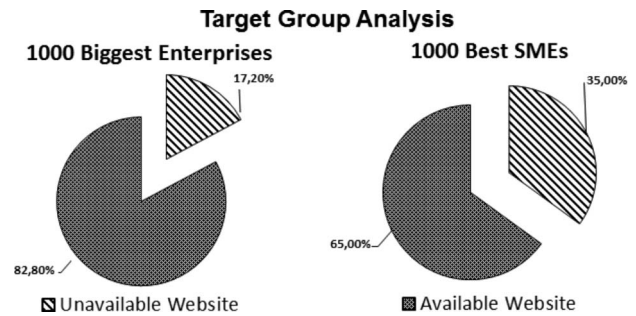

Figure 1. Comparison between the 1000 biggest Portuguese enterprises and the 1000 best Portuguese SMEs with/without an available website.

help of the TAW3 tool. This test was done manually by introducing each enterprise website in the TAW3 tool and also by manually treating the returned results in a way that they could be analysed and statistically treated.

The first element that was retrieved from this evaluation was the fact that 6% of the initial 82.8% largest Portuguese enterprise websites could not be evaluated. The same happened with 1% of the initial 65% best Portuguese SMEs. This occurred due to incompatibilities of the referred websites and the chosen evaluation tool.

Although the goal of this evaluation was to achieve indicators of the accessibility levels presented by the largest 1000 Portuguese enterprise websites, and by the best 1000 Portuguese SME websites, it is essential that the results that support those indicators are correct and reliable. In order to achieve this, a statistical analysis had to be performed of the evaluation results. The initial treatment/analysis consisted of applying the outlier definition to the referred results (Mendenhall and Sincich 2007). An outlier is an observation that being atypical and/or erroneous deviates decidedly from the general behaviour of experimental data with respect to the criteria that is being analysed (Muñoz-Garcia et al. 1990). According to Grubbs (1969), an outlier is one that appears to deviate markedly from other members of the sample in which it occurs. Before deciding what should be done to the outliers, it is important to know the causes that lead to their appearance. In many cases, the reason for their existence determines how they should be handled. The main causes that lead to the existence of outliers are measurement errors, execution errors and the variability inherent to the population elements (Figueira 2010).

In order to obtain the most accurate results, we have applied the outlier definition to each of the WCAG 1.0 priority level errors. With this we aimed to exclude from the final results of the evaluation, those websites that had 'invalid' priority X errors.

For example, if a website had an invalid number of priority 1 errors then it would be excluded from the statistical calculations that would be done for this type of errors. With this in mind, we achieved the numbers presented in Table 2.

Figure 2 presents a schema of what was applied to the results in this statistical treatment stage. After this treatment had been performed on the results, we achieved a new sample of results that can be seen in Figure 3. As shown in Figure 3, the number of accessibility errors that was detected is extremely high.

When working on the evaluation results, we tried to reach a simple and an efficient way of showing these same results. With this in mind, we have had several discussions with the Portuguese governmental agency for Web accessibility – UMIC and concluded that the best way of giving some perception concerning the results was by dividing them according to qualitative measures for website accessibility. So with this in mind, we have defined four intervals that would allow a qualitative assumption of an accessibility level of a website:

- [0–60] – This interval should contain the websites that could be considered compliant with WCAG 1.0 checkpoints. These websites would present an average of two errors for each of the 30 evaluated pages, which according to UMIC can be

assumed to be an excellent indicator of Web accessibility accomplishment;
- [60–300] – This interval should contain the websites that would present a very high number of compliances to WCAG 1.0 checkpoints and that could almost be considered accessible;
- [300–1500] – This interval should contain the websites that presented some compliances with WCAG 1.0 checkpoints, but that also present a significant number of accessibility faults;
- [>1500] – This interval should contain the websites that present an insignificant number of compliances with WCAG 1.0 and a very significant number of faults.

These results indicate that the priority 1 errors (that according to the W3C should not exist in a website) are indeed present in the Portuguese enterprises' websites. Another aspect that can be perceived from Figure 3 is the fact that more than 70% of the biggest Portuguese enterprises' websites have >300 priority 2 errors. Also in Figure 3, it is possible to see that the number of websites with a number of priority 1 errors between 300 and 1500 is much bigger in the largest Portuguese enterprises. Of interest also is the finding that the number of websites with a number of errors that fitted the interval between 0 and 60 is relatively larger in the SMEs than in the largest enterprises.

Although the number of priority 2 errors is more dispersed, we can perceive that the number of websites with more than 1500 of these errors is, by far, bigger in the largest Portuguese enterprises' websites. Another aspect that is also visible is that almost half of the SME websites evaluated have <60 priority 3 errors. On the other hand, almost 40% of the websites belonging to the largest Portuguese enterprises have a number of errors between 300 and 1500.

All the work behind the results presented above was carried out according to all the W3C recommendations for these kind of studies and was performed by a team of specialists in evaluating website accessibility and who have several other similar research efforts in their background. Given the fact that this same team, while performing the evaluation of the target group websites, had not found a significant difference in the size and complexity between the websites of the best 1000 Portuguese SMEs and the largest 1000 Portuguese enterprises (possibly against what happens in other countries where these factors are very different), no correction measure – related to size or complexity of a website (UAB 2007) – was applied to the achieved results.

The results obtained by the two studies presented above must be seen with some moderation since they were obtained using an automated testing tool. Any accessibility testing must be viewed as a process that

Table 2. Number of enterprises that were taken into consideration at each round of the presented work.

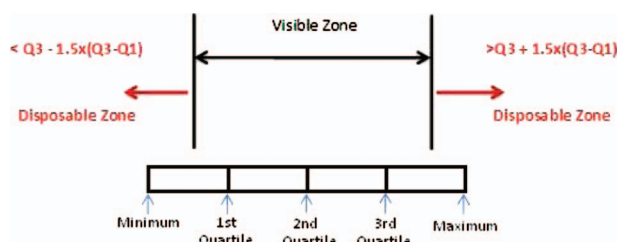|	Initial enterprises	Enterprises after evaluation	Enterprises after outlier treatment
Portuguese biggest enterprises			
WCAG 1.0 Priority 1	1000	777	747
WCAG 1.0 Priority 2	1000	777	744
WCAG 1.0 Priority 3	1000	777	742
Best Portuguese SMEs			
WCAG 1.0 Priority 1	1000	642	557
WCAG 1.0 Priority 2	1000	642	596
WCAG 1.0 Priority 3	1000	642	591

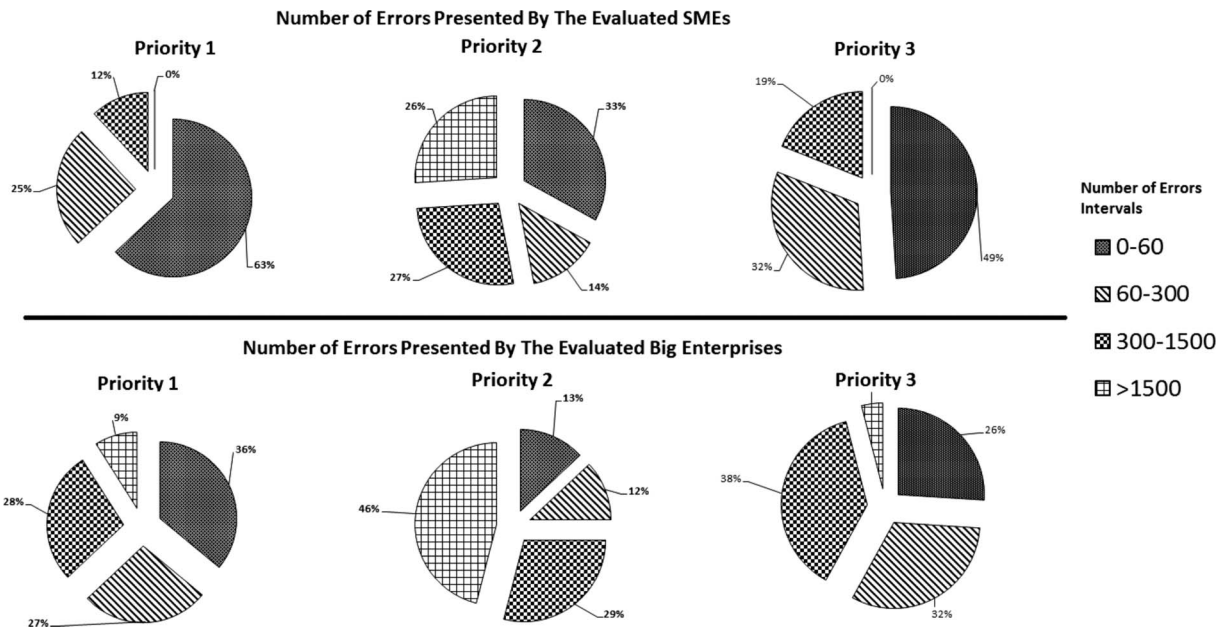Figure 2. Treatment schema of outliers.

Figure 3.   Comparison between the number of errors presented by the websites of the evaluated enterprises.
Note: We decided to group the results according to intervals of numbers of errors because the interpretation of the results is thus easier and helps in the gaining of an awareness on the websites "position" as concerns number of errors.

combines automated software tools with human judgement. No tool exists that you can run against your website (or Web page for that matter) in order to assert that it is accessible and/or complies with the WCAG. When a website claims WCAG Conformance from some tool or other, the most it can mean is that the site (or page) passed all of the automatic WCAG tests. Having said that, software-testing tools can help you find out if a website is not accessible or does not comply with WCAG, by testing for the absence of valid required elements and/or attributes (Thatcher 2010).

4.4.   Examples of detected errors

During the accessibility evaluation associated with the present project, a very significant variety of errors was found. To illustrate this variety, we show below some examples of these failures.

(I) Lack of equivalent alternatives to auditory and visual content – WCAG 1.0 Priority 1 Checkpoint:
  (a) The Web content creator should provide a text equivalent to every non-text element (e.g. via 'alt', 'longdesc' or in element content);
  (b) Redundant text links should also exist for each active region of a server-side image map.

(II) Incorrect use of markup and style sheets – WCAG 1.0 Priority 2 Checkpoint:
  (a) Style sheets should be used to control the Web content layout and presentation. These style sheets should also be compliant with the W3C regulations; the use of the 'absolute' unit instead of a 'relative' unit is clearly a flaw according to the W3C. This Consortium states that the Web content creator should use relative rather than absolute units in markup language attribute values and style sheet property values.

4.5.   Current and future research efforts – WCAG2.0

The W3C WAI has created the second version of WCAG – WCAG 2.0. Although the present study gives a rather clear perspective on what the accessibility levels of Portuguese websites are, we also believe that the next step to be taken is the use of the 2.0 version of the W3C WCAG (W3C 2008a). The use of these new guidelines would help not only to make possible some assumptions between the accessibility evaluation results achieved with the 1.0 version and with the 2.0 version but also to present a new and more up-to-date characterisation of Portuguese Web accessibility. Despite this, at the time of the evaluation that is the foundation of our article, the WCAG 1.0 was the only valid regulation. When WAI published the present 2.0 version of the guidelines, we then decided to undertake a new evaluation task, aiming to achieve

a complete accessibility evaluation against these new guidelines.

As we searched for a tool that was capable of evaluating a website against WCAG 2.0, we found that the majority of these tools were not capable of evaluating a webpage against this new version of the accessibility guidelines. As a result of this, we talked to the company that produced TAW3 with the goal of acquiring a version that allowed an automatic evaluation of an entire website against WCAG 2.0. However, the version of this tool that can evaluate Web pages against WCAG 2.0 is still in a Beta version and thus only allows an evaluation of a single webpage at a time. Despite all the referred limitations, we still considered an analysis of the first page (homepage) of each website to be relevant, against the new version of the accessibility guidelines. We assume this relevancy due to the fact that, in the majority of cases, this first page presents itself as an indicator of the accessibility level of its website.

As we took into consideration the limitations of the evaluation tool that we were using, we decided to only evaluate a part of our target group (the 1000 largest Portuguese enterprises) and thus achieve results that could indicate some sort of tendency.

Figure 4 presents the results obtained with the accessibility evaluations against the WCAG 2.0. As shown in Figure 4, the results gathered from the referred evaluation indicate that the majority of the evaluated websites present between 0 and 60 priority 1 errors, an improvement therefore on the results in Figure 3 for the largest Portuguese enterprises. As concerns the priority 2 errors, the obtained results are less 'distinct', the amount of websites presenting between 0 and 60 errors and the number of websites presenting between 60 and 300 errors being almost the same. For the priority 3 errors, the situation is very similar to the one presented by the priority 2 errors. We do also see in these two cases however a tendency

for a smaller number of errors to occur – the interval with 0–60 errors has grown in all the three cases relative to the data presented in Figure 3 for the largest Portuguese enterprises.

We cannot, following this exploratory study, yet be led to agree that with WCAG 2.0 W3C has brought 'a new standard that will help Web designers and developers create sites that better meet the needs of users with disabilities and older users' (WAI 2011). However, against WCAG 2.0 and if the websites analysed will reflect the reality of each website homepage, we might conclude that the 2.0 version of the W3C WCAG is more close to reality than its predecessor, as the number of detected errors has decreased. In addition to this certain WAI documents such as *Techniques for WCAG 2.0* (W3C 2010b) do exist, providing valuable information so that Web developers may successfully meet the criteria of WCAG 2.0. We do thus believe that the foundation does exist for Web accessibility levels to increase worldwide.

5. Data collection and analysis via a focus group

All the results that were found that concern Portugal or other countries, present, in their majority, and without a clear reason, low levels of accessibility. Aiming to understand the reasons for such results and in order to achieve a way of erasing the problems detected, we decided to start a focus group process, in which several specialists were involved.

5.1. Methodology followed

In order to gain further insights relating to the Web accessibility of major enterprises (largest enterprises and best SMEs) in Portugal, and namely into how accessibility levels could be improved, we conducted focus group research, a qualitative research method
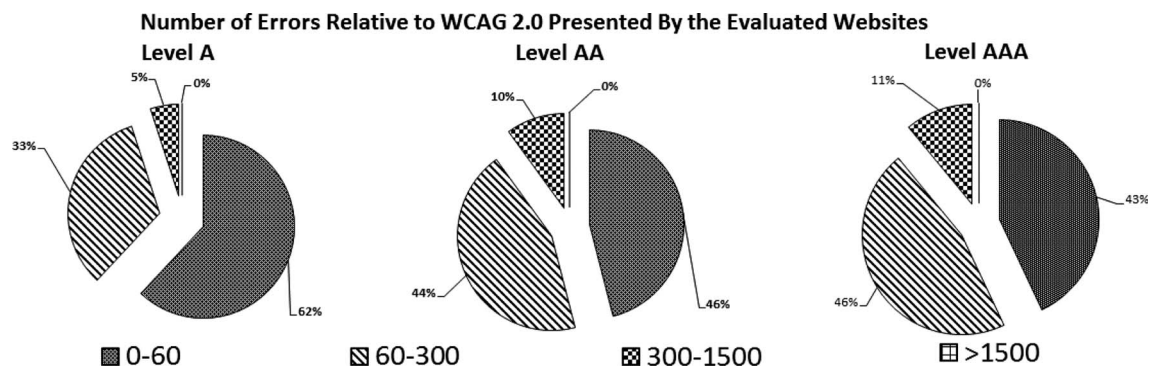

Figure 4. Distribution of the accessibility errors relative to the WCAG 2.0.

(Ghauri and Gronhaug 2005) popular for being able to provide detail (Bernard 2006). This second study and what it revealed is also described in this article.

So, in performing focus group qualitative research, we thus combined it with our previous quantitative method, a practice advocated as being beneficial by many researchers (Bernard 2006). Focus group research involves gathering a group of carefully selected individuals (i.e. not randomly selected) 'brought together to discuss various topics of interest at length' (Kotler and Keller 2009, p. 133). According to Fern (1982), focus groups are interactive discussion groups used to generate knowledge and hypotheses, as well as to explore opinions, attitudes and attributes. Parent *et al.* (2000) advances further that focus groups seek to maximise search time and to take advantage of the synergies that arise from group effort. In our case, seven individuals were selected (following an analysis of their Curriculum Vitae, which we requested), the group thus having an appropriate size within what is deemed fitting – namely 6 to 10 members (Ghauri and Gronhaug 2005, Kotler and Keller 2009). Bernard (2006) specifically states that 'seven or eight people is a popular size' for focus groups, a guideline that we followed. The individuals were selected based on their technical expertise in the area of Web accessibility. Note that no sum was paid to them for their participation and thus this method did prove to be cost-effective, as is mentioned in the literature (Ghauri and Gronhaug 2005). The members of our group, who were gathered together on three separate occasions (approximately 2 h each session), did so in a room in the official building of the Portuguese Order of Engineers, in Lisbon, which suitably provided some privacy as was required by our endeavour (a consideration suggested by Bernard 2006). Although they wish to remain anonymous, we can share however that they included two academics and five practitioners (an information systems director in the largest privately owned Portuguese bank, listed on the Lisbon Stock Exchange; an information systems director for a major multinational pharmaceutical company; a Microsoft Universities director; a managing director for a company specialised in informatics outsourcing and finally a lawyer specialised in informatics law). Due to the diverse composition of the group, the discussion and interaction were very rich in its content, these will occur as suggested by Ghauri and Gronhaug (2005). The main guiding objective being to help us interpret and reap practical results concerning the consequences and implications of what we had found in our first study meant that we had to present our results to these specialised individuals. 'Interpreting

previously obtained quantitative data' (Ghauri and Gronhaug 2005) using focus groups is particularly useful (Stewart and Shamdasani 1990). We intended at the outset to also set down a roadmap for future activities concerning Web accessibility in Portugal. As advocated by Kotler and Keller (2009), a professional research moderator (a seasoned researcher and academic) provided questions and guided the discussion based on a previously developed agenda (a tool consisting of a list of subjects to cover focused on accessibility levels of Portuguese Enterprise websites and involving a sequence of questions and sentences for comment and which was arrived at following fine-tuning and revision in order to reach the defined goals). The discussion was thus kept on track 'focused' (Ghauri and Gronhaug 2005) by the moderator who nevertheless purposefully avoided knowingly biasing the group. The sessions were recorded (audio – with the explicit agreement of the participants) and transcribed and the material used to deepen our research into the Web accessibility of Portuguese enterprises. The resulting document was sent to participants for revision and acceptance. Confidentiality was assured at all times.

Before analysis of content, verbatim documents and notes were organised. This material was processed through content analysis based on emergent thematic categories. Data analysis, in qualitative research, is a phase of the research process that occurs every time the researcher collects new data. During the analysis, the researcher must continually use what has already emerged (Deslauriers 1991). One of the key elements in qualitative data analysis is the systematic coding of text (Strauss and Corbin 1990, Miles and Huberman 1994). Codes are the building blocks for model building and the foundation on which the analyst's arguments rest. Codes embody the assumptions underlying the analysis.

The first coding step consisted of organising all of the contents into major topics. As they had been identified, these new topics were also considered in the organisation of the information. The second step was to iteratively look for similarities, differences, common denominators, models and other relevant aspects. Through this process, the different categories began to emerge.

Several memos and diagrams were built alongside this procedure with the analysis based either on the verbatim descriptions or on the notes registered during the focus group. Memos and diagrams help put on paper the preliminary products of the iterative analysis (Fortin 1999).

In general, the findings were both informative and innovative and were not simply limited to announcing what we already know (a criticism of focus groups advanced in (Kotler and Keller 2009)).

5.2. Discussion of the focus group findings and recommendations

5.2.1. Focus group considerations

In this section, we proceed to systematise several issues that were consistently brought up by the focus group and that are behind the results presented in this article. The following is a consequence of the systematic analysis made by the focus group of e-business, as well as of several interactions of this group with the private and academic sectors. The recommendations made by this focus group aim to contribute to the improvement of the present situation that involves poor Web accessibility levels for the sample analysed, as seen above. A general question put forth was 'How can one improve enterprise accessibility levels?' and the following six higher-level considerations were a direct result of the focus group interactions:

(1) First and foremost, according to the focus group participants, a major problem leading to poor enterprise Web accessibility levels is a lack of adequate financial support. An enterprise presence on the Web is not seen to be strategic enough, in most cases, to warrant a strong and credible commitment leading to adequate accessibility levels.

(2) Even if an adequate financial commitment by enterprises did exist, concerning their presence on the Web, general knowledge about accessibility issues is very low, including among companies that supply Web services. It follows that the accessibility problem would still exist even if adequate funding were a reality. Thus, more attention needs to be drawn to the problem of Web accessibility in order for it to be solved. Thus, a strategic communication plan addressing the Web accessibility problem must be developed and implemented in the Portuguese case and this should be the responsibility of a specialised association geared to this purpose, of overseeing enterprise Web accessibility levels. This has been accomplished already, to a degree, as the APDSI (www.apd-si.pt) has been involved by the co-authors and was given a report concerning this research.

(3) Following on from an inadequate financial commitment to a strong enterprise Web presence, several solutions are implemented by companies and consultants that are low-cost and based on typified websites. So, although saving enterprises financial resources, Web solutions are in fact deficient in terms of ergonomics and accessibility.

(4) Software applications in general and websites in particular are oftentimes built by experts, for other experts, resulting in difficult access for people with low technology or Internet knowledge.

(5) In Portugal's case, in particular, there is a lack of legislation that does not consider the totality of Portuguese websites. Thus, only public administration websites and public services websites are under legal appliance. A global, more structured legislation, applicable to both private and public sectors and aligned with the best international practices, is necessary.

(6) Worldwide there are several accessibility tools; however, they are not used in Portugal in a consistent way in the development phase of web applications or after a go-live. We consider that this happens because of a lack of knowledge about the existence of these tools and also about the way that they work. Furthermore, companies are probably wary of larger project durations if they must comply with accessibility standards.

In addition to the above, detailed recommendations were also advanced by the focus group as follows.

5.2.2. General recommendations and expected results following the focus group analysis

The focus group sessions resulted in a good number of recommendations. These recommendations were also further developed after the group had dispersed as contact with the moderator was maintained by the focus group participants, and certain issues researched. For example, what the literature had to say concerning certain items brought up during the sessions was seen to be essential, and the more relevant references are listed below. The objective has always been to contribute to the improvement of enterprise Web accessibility levels in Portugal. It follows that:

(1) The adoption of concrete measures is necessary, with bigger impact and with lower cost, improving efficiency.

(2) Information should be documented regarding standards and best practices of Web accessibility for organisations, so that they may implement them in their Web platforms. The available technologies to create more accessible Web applications should be documented.

(3) If there is an improvement in sector knowledge, to support better business strategies in corporations, more efficient solutions will result, with better support for the development of

accessible websites, and decision making will be far more easy and efficient (Henry 2005).

(4) A standardisation of the offering in the sector is necessary and a levelling according to the upper limit, concerning accessibility rules; the harmonisation of accessibility standards is extremely important and very much needed, because it will allow the creation of a unified market for authoring tools that will produce conformant content. This unified market, in turn, will drive the more rapid development of accessible Web content mostly due to the fact that with these standard compliant authoring tools, developers would only have to learn one consistent set of guidelines and implementation techniques, rather than having to learn many different guidelines. This would allow developers to create accessible websites in a more efficient and cost-saving manner (Brewer 2006).

5.2.2.1. Assisting technologies. As concerns Web accessibility assisting technologies, the research team recommends to:

(1) Build evaluation tools to test websites, and/or inform about existing ones, allowing non-technical people to evaluate their applications, to see if they fulfil the accessibility standards or not; facilitate the documentation of failure points for future correction. Furthermore,

(2) Allow better access to automatic test tools, at low cost:
   (a) To allow small- and medium-sized companies to know their compliance level and how to improve it.
   (b) To allow for a lower test duration cycle and the definition of specific measures to correct the identified failures.

(3) Web accessibility evaluation tools can reduce the time and effort required to carry out evaluations. When used carefully throughout the design, implementation and maintenance phases of Web development, these tools can assist their users in preventing accessibility barriers, repairing encountered barriers and improving the overall quality of websites (Abou-Zahra 2008).

5.2.2.2. Market concerns. Market concerns also exist, namely:

(1) A social and economic impact analysis about adoption of best accessibility practices should

be presented, for better evaluation by corporations, allowing new business decisions supported by better strategies. The reason to make the Web accessible is equal access for people with functional diversity, period. However, it is also useful to know the many additional benefits of Web accessibility. It is often easier for organisations to allocate more resources to accessibility when they learn that it can increase their potential market, decrease maintenance efforts, and result in many other benefits. While the primary focus of Web accessibility is access by people with disabilities, for a broader business perspective, you can say that accessibility is about designing your website so that more people can use it effectively in more situations (Thatcher *et al.* 2006). According to the study *W3C Hungary Office – Web Accessibility Day* (W3C 2008d), the evolution predicted for the ageing of the European population will be of 17% for the population older than 65 years in 2010 and 30% for the population older than 65 years in 2050, meaning that a significant global ageing in society will occur. This older population will have additional difficulties in utilising Web platforms including the services made available by them (public and private), resulting in a sector growing quite significantly, which will imply for sure more attention and more investment, so as to solve this inclusion problem.

(2) People access the Web using a growing variety of technologies, customised with a growing variety of possible preferences and configurations. People with disabilities are included in this mix, but people without disabilities are included as well. By recognising that this technological diversity exists and by developing Web content that complies with standards, Web authors can ensure that their websites are accessible to the broadest possible audience (AccessIT 2009).

5.2.3. Recommendations for big corporations. Given the importance of big corporations and public administration and the demand for their products and services, the research team recommends that they:

(1) Follow, within reasonable limits, W3C rules, levels 1, 2 and 3 (which includes all of the existing rules) rather than just level 1, as this
   (a) Will allow a regulation of the sector, the defining of metrics and objectives, without

imposing impossible rules or rules that imply costs too high to fulfil them;

(b) Will allow the identification and recommendation of more assertive measures, needed to correct more common difficulties;

(c) Will 'point the way', leading by example.

(2) Improve ergonomics and usability globally, as this will

(a) Allow a simplification of website usage;

(b) Allow the achievement of a higher usage level of electronic services;

(c) Allow those who are info-excluded the access to tools that may be of great importance to their day-to-day activity.

5.2.4. Recommendations for Web platform suppliers and manufacturers. Surprisingly, Web platform suppliers and manufacturers are not as well informed as one might expect. Thus, it is necessary to:

(1) Educate suppliers to use/implement business accessibility standards, as this will

(a) Help companies to improve their accessibility levels, at lower costs;

(b) Help companies to gain additional commercial success;

(c) Aid companies in their Web presence and subsequently the whole economy.

(2) Create alternative pages to all pages or functionalities that are not W3C compliant, allowing access to all people who need them, as this

(a) Will allow the info-excluded access to very important tools in their day-to-day activity;

(b) Will allow all users the access to all functionality, even to the websites that are not triple 'A' compliant. This way we guarantee unconditional access to all information and functionality, without eliminating the benefits of newer design and ergonomics, very useful to other user groups;

(3) Include test phases in the development process, by people with disabilities, in a way so as to prevent future difficulties and adapt the applications in a more practical way.

(a) This will allow the achievement of goals with lower risk and lower cost, and faster too;

(b) This will also allow the identification of new accessibility needs, that were unknown until the tests were run, and the possibility to accommodate them;

(4) Build alternative interfaces, bringing them closer to natural language (voice, chat, speech). This

(a) Reduces barriers for users with basic difficulties (of knowledge in informatics usage or with disabilities – info-excluded);

(b) Allows the use of and access via new channels, such as telephones, personal digital assistants or other equipment;

(c) Simplifies buying processes in the Web environment, or the search for information, improving the efficiency of Web platforms;

(5) Consider the impact of Web 2.0 on accessibility. Ensure the communication of accessibility rules and availability of Web services between entities, as this

(a) Better prepares for evolution, ensuring the success of the strategy to follow;

(b) Optimises business and support processes inside organisations, or between organisations, ensuring business continuity;

(c) Allows innovation, the building of new kinds of user interfaces, resulting in new and better functionality and ensuring accessibility rule compliance.

5.2.5. Recommendations for public administration, regulatory entities and universities. Public administration and regulatory entities have a major role in defining and auditing the adequate rules and laws, helping the market to perform better. Universities are the perfect vehicle to propagate those initiatives.

(1) Create new legal mechanisms that apply to public websites and also to private entities, as this

(a) Allow the regulation and levelling of both sectors;

(b) Allow the standardisation of accessibility levels for end users;

(2) Create auditing institutes that guarantee accessibility levels, applying severe penalties to companies that do not apply accessibility improvements in their Web platforms, which

(a) Allow the achievement of global accessibility goals;

(b) Allow penalties to be applied to incompetent entities;

(c) Allow penalties to be applied to entities with a dishonest market approach;

(d) Allow the protection of the investment of more credible companies that invest according to the law, and makes public recommendations to achieve compliance levels.

(3) Include accessibility and usability issues in academic programmes of higher colleges,

referring to information technologies and communication. There are a significant amount of barriers slowing down the creation of accessible Web content. However, there are ways to break down these barriers. One of these ways is by including accessibility subjects in education programmes (Yu 2002). This would

(a) Allow the improvement of the global knowledge level, permitting a more complete definition of future strategies and

(b) Allow the reduction of average market costs for the bringing of competent consultants in this field of expertise;

(4) Support projects with the goal of building more accessible solutions for all citizens (e.g. acessibilidade.gov.pt, CERTIC-UTAD), which

(a) Demonstrate that the standards and rules are able to be implemented and are viable;

(b) Allow the giving of examples and the defining of best practices.

(5) Evaluate the more well-known Web platforms every year regarding their accessibility compliance, in such a way so as to guarantee a consistent level in accessibility standards. This in turn will

(a) Guarantee the future maintenance of goals already achieved, avoiding a regression;

(b) Guarantee continuous improvement.

5.2.6.   Relevance of the recommendations. As we were able to see, the problem of Web accessibility is a transversal ethical, social and economic issue, in which diverse actors may intervene, at different times and with different types of responsibility.

It was possible to identify via our focus group a set of possible reasons that explain the low level of Web accessibility and to propose a broad set of recommendations for improvements. The reasons identified are of diverse types however some of them are based essentially on the lack of information and training of the people and companies involved in the management, teaching, software development and regulation and control processes. We believe that the recommendations presented and the exhaustive and persistent communication to the diverse set of actors involved, as well as the communication of best practices in society could lead to sustained improvements over time.

6.   Conclusions

With the first study we undertook, we managed to achieve our initial goal that was to deliver indicators on the actual accessibility levels presented both by the 1000 best Portuguese SMEs and by the 1000 largest Portuguese enterprises.

As the results presented demonstrate, a considerable number of accessibility errors were detected on all of the websites belonging to the target group, without exception. This fact indicates that the accessibility levels presented both by the websites of the 1000 best Portuguese SMEs and by the websites of the 1000 largest Portuguese enterprises are indeed relatively low according to the W3C WCAG1.0 standards because, for the majority, they are not even conformant with the lower accessibility conformance level.

By analysing the results achieved, we believe that the 'non-implementation' of accessibility features, in a website, could be more related to website complexity – results/tendencies must be seen with a certain degree of abstraction (and not with stated certainties) due to certain issues such as website content complexity differences between both types of enterprises – SMEs could be responsible for less-complex websites as their value proposition, to be communicated using the Web medium, may present itself as being a simpler task. If this is the case then *keeping it simple* might be good advice towards greater enterprise Web accessibility levels. More importantly, as the greater financial capability of larger enterprises does not present itself as being a solution to website accessibility levels, we see that a greater awareness of the accessibility problem needs to be developed, via concerted specialised communication efforts, which need to be undertaken especially in more marginal economies such as Portugal. Improved Web accessibility levels will then in future be a result of more informed decision-making, which is, after all, the objective of enterprises, both large and small.

Analysing the results of the evaluation of the 1000 largest Portuguese enterprises against WCAG 2.0, we can perceive that there are still several issues and problems as concerns Web accessibility. Although the tool used to evaluate the websites against WCAG 2.0 is still in a Beta version, we believe that the issues referred to are indeed present. It is important to clarify that this could be the result of several 'foreign' aspects, such as the tool version and the difficulty to correctly evaluate a website against WCAG 2.0 (that present a new and different structure and rationale) and get results from this evaluation.

A major contribution of the article is the series of recommendations and suggestions for improvements we put forth, considering the typical user's needs and the main difficulties we identified, both in the quantitative research study and in the Focus Group discussions. Those recommendations are referred to with importance and priority, alongside the expected impact and result of each measure. The recommendations are presented and grouped according to their background. We present a set of focus group

recommendations with a more generic focus that introduces themes such as assistive technologies and market concerns. Big corporations were also considered in the focus group and this resulted in a set of recommendations directly related to them. Web suppliers and manufacturers were also a theme of our focus group discussion. This led to a group of recommendations related to these same Web suppliers and manufacturers. Finally, a group of recommendations related to the Public Administration sector, regulatory entities and universities was created in order to try to help this group of 'organisations' improve their accessibility levels.

Unfortunately, in EU Member States, one finds that 'results from nationally available data are not comparable across countries due to variable samples and methods applied' (Cullen *et al.* 2009). Furthermore, 'in all the countries covered, there is considerable variation in terms of the types of legislative/regulative approaches that are adopted [including for implementation timeframes] and in the types of websites that are addressed' (Cullen *et al.* 2009). We consider this to be a serious shortcoming at the European level and thus greater interoperability between systems and organisations, to make communication seamless (Mertins *et al.* 2008), for Web accessibility purposes, needs to be a focus in future – so as to make the effort to make websites accessible to all a more concerted one. By making data across countries comparable and by taking these data into the public arena, there will naturally exist added pressure for lagging Member States to improve their Web accessibility levels. Costs might also be saved by doing this as if companies are convinced of the need to make their websites accessible from the start, retrofitting accessibility into websites, generally seen to be more expensive could be avoided.

Notes

1. When evaluating the target group websites, we limited the TAW3 tool to only evaluate 30 pages per website. It follows that the first 30 pages of each website that TAW3 analysed were the ones contemplated in our work.
2. SMEs defined as employing < 500 employees, as having annual sales volume not > 12 million Euros and that do not have a majority ownership (> 50%) by a company not considered to be an SME (source: INE and IAPMEI, as quoted by *PME Líder 2010*). Best SMEs are classified according to sales growth and profit growth and return on assets and return on equity (Exame 2007).

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