

# Engineering accessibility through corporate policies

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## Abstract

Web sites of official organizations should be accessible to reduce the digital divide and improve the ability of *any* citizen to participate to the social and political life of a country. However the current status of web sites is far from satisfying. Despite the existence of standards and regulations, many organizations still host web sites that are not accessible.

To support this claim the paper presents a survey of some of the major accessibility defects present in web sites of official governmental agencies (Italian regions, Austrian and German Bundesländer).

The paper discusses then the role of corporate accessibility policies (and associated concepts of accessibility levels, corporate guidelines, and implementation plan) and suggests that they could be used to bridge the gap between what is currently done and what should be done in order to improve the accessibility of web sites.

## 1 Introduction

For governmental agencies the final reason for hosting a web site should be to reduce the digital divide and to improve citizens' ability to participate to the social and political life of a country. In particular, for *any* citizen, regardless his/her own disabilities. Not accessible web sites prevent a portion of citizens from visiting and using them.

While there are signs that we are moving in the right direction, a lot still needs to be done. In fact, on the one hand web accessibility awareness

has increased dramatically over the last few years (a Google search of “web accessibility” yields about 1,150,000 hits). The major driver behind accessibility awareness are the official regulations that many nations have adopted. In many cases these regulations specifically mention technical requirements that web sites should adhere to in order to be accessible, and oftentimes these requirements in turn refer to the W3C/WAI web content accessibility guidelines.

But although awareness has increased dramatically, and despite availability of technical guidelines, the level of accessibility being achieved has not improved in the same way. Factors working against proper implementation of accessibility include limits of the guidelines [9]: their theoretical nature, their dependency on other guidelines, ambiguity, complexity, their closed nature and some logical flaws.

Another factor is the difficulty in understanding the concepts of accessibility and usability (*e.g.* see the different definitions of accessibility discussed in [1]) and of the guidelines. Furthermore guidelines are intentionally defined in terms that are independent from the technology used in implementing a web site and from the technology used to visit the web site. As a consequence, however, the guidelines are often too abstract to be directly applicable to a web site, and they create a large gap to be filled.

An additional factor is a lack of knowledge about how accessibility has to be achieved and verified. For example, not all violations of the guidelines have the same impact on disabled users (*e.g.* few images — besides clickable images — require a non-null textual alternative, since they are very often only visual decorations, used with the purpose of achieving emotional effects on users through visual stimuli; yet, by the guidelines, all images missing a textual alternative have the same weight in terms of importance of the violation). In addition, available accessibility testing methods are not well studied in terms of their reliability, the extent to which they can produce comparable and repeatable results, and validity, the extent to which the method captures the desired properties [1]. And accessibility management practices are too little discussed and implemented.

A final factor that may affect the practicality of accessibility implementation is the implicit assumption that to achieve an accessible web site one has to follow the universal design approach [6]. As claimed in [3; 9] and partially demonstrated in [2] this is not necessarily true. However such an approach might pose unjustified heavy burdens on web developers.

These factors may explain why truly accessible web sites are difficult to achieve and to maintain. The solution requires that accessibility be conceived as a process, rather than a target, and that appropriate corporate policies, corporate guidelines and corporate implementation plans are explicitly de-

fined in order to establish effective work processes. In short, accessibility requires solid engineering practices.

The goal of the paper is to present a survey of the accessibility status of web sites of several Italian, German and Austrian governmental agencies. In the second part, the paper discusses the concepts of accessibility policies and implementation plans, and how these concepts could be deployed in order to engineer accessibility.

## 2 Current status of web accessibility for governmental web sites

I present a survey of accessibility of several Italian, German and Austrian local governmental agencies. The purpose is to highlight some of the most typical accessibility issues that are present on those web sites.

These kinds of analyzes of web sites, that might be repeated over time, and applied to a potentially large number of web sites and pages, have to be based on automated means. Research on this topic is underway [4], and until reliable data are available it is difficult to use tools to get accurate surveys.

However tools can be used to produce an *upper bound* on the accessibility status of a web site: by using only some of the results produced by the tools, and by focusing on those that are deemed to be more reliable (*i.e.* that have a significant probability of being true), one could get an estimation of the defects of the web sites.

I believe that this kind of results is sufficient for the purpose of comparing different web sites, or for monitoring the evolution of a web site over time, or during a competitive analysis to discover strengths and weaknesses of competitors or similar agencies. Clearly these results cannot be used (in isolation, and as sole results) for diagnostic purposes or for assessing the level of accessibility.

### 2.1 Survey method

The adopted method is based on an automatic tool (LIFT Machine v. 1.7.1). As shown in [4], when used only with so-called automatic tests, this tool's effectiveness is characterized by less than 7% of false positives (warnings being raised incorrectly) and less than 17% false negatives (issues that are missed by the tool<sup>1</sup>).

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<sup>1</sup>With respect to the checkpoint the test refers to, and with respect to what other tools were able to identify as true problems for the same checkpoint; see [4] for more details.

Selected web sites were crawled (on May 18–19) by downloading about 50 pages for each of them, starting from the home page and following a breadth–first strategy. The same criteria were used for all the web sites (*e.g.* same timeout, same URL filters, ...).

The evaluation of these pages was based on the same kind of tests, which are a subset of the tests that can be used to assess conformance with respect to WCAG 1.0 level AA. No specific customization was performed on the adopted tests (*i.e.* the default built–in preferences were adopted for all the web site).

## 2.2 Results of the survey

Results are shown separately for each nation (see tables 1, 2 and 3 and figure 1) together with arithmetic means within each nation and overall. The numbers represent the percentages of instances of specific features (like number of link images, or number of navigation bars) that resulted in a violation of a checkpoint (absolute numbers ranged from 26 to 1592). Results are grouped into comprehension, operability or flexibility barriers in order to provide an easy way to estimate the kind of effect that they can have on visitors.

In terms of potential *comprehension* barriers<sup>2</sup>, in all the tested web sites there are lots of images (not decorations nor spacers) that lack a proper ALT attribute (at least 42% for Sachsen in Germany). Proper use of TITLE for frames is more sparsely distributed, probably because frames are seldom used. In general non sighted users are likely to miss the content of those images and are disoriented in navigating through frames.

In terms of *operability*, there are several web sites with few properly implemented *skiplinks* links around navigation bars. There are some AREAs and many image links with no proper ALT. Non sighted users will have a very hard time navigating these web sites. Forms are seldom properly labeled (with the LABEL tag): 1 out of two.

Finally, in terms of flexibility, very often (63%) web sites implement some interaction feature with JavaScript events in such a way that interaction through keyboard alone may be impeded. There is also a wide variation in the number of these defects. Popup windows appear to be not so frequent, while the adoption of absolute units (in CSS dimensions) is extremely frequent, making it difficult for users to enlarge the text or to resize the browser window.

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<sup>2</sup>To assess the existence of barriers a manual inspection, even if only based on a sample, is needed. We therefore speak only of potential barriers.

Region	Compr.		Operability				Flexibility		
	img	frm	skipl	areas	imglnk	lbl	evnt	pop	unt
1. liguria	100	0	0	0	0	98	100	0	100
2. piemonte	100	0	1	0	1	0	5	7	97
3. lombardia	87	0	0	0	90	78	1	0	91
4. basilicata	64	0	39	31	67	69	95	0	97
5. calabria (5)	54	5	22	40	49	23	2	5	69
6. campania (6)	97	0	0	0	100	96	96	0	98
7. emilia	70	0	0	1	38	3	18	0	95
8. fvg	46	0	7	55	53	12	81	0	80
9. lazio	95	0	0	1	98	1	1	1	96
10. marche	100	94	0	20	100	98	18	0	100
11. molise	97	0	0	0	3	0	0	73	96
12. puglia	96	85	0	3	98	85	85	0	91
13. sardegna	100	0	0	0	52	1	0	0	100
14. sicilia	67	0	6	30	46	6	68	0	82
15. taa	60	0	0	37	47	13	2	0	92
16. toscana	79	0	42	1	37	1	44	0	87
17. umbria	98	0	0	93	91	46	62	0	94
18. vda	100	0	9	96	98	98	27	5	100
19. veneto	98	0	0	0	38	5	3	0	100
20. abruzzo	90	1	32	66	68	32	95	0	90
means it	85	9	8	24	59	38	40	4	93
means de	92	8	18	40	51	66	83	11	91
means at	82	19	3	38	66	67	79	10	92
overall	87	11	10	32	57	54	63	8	92

Table 1: For each Italian Region, the percentage of features that lead to a checkpoint violation is given. Means (*it*, *at*, *de* stand for Italy, Austria and Germany) are also given as a reference value. *Img* represents tests on images that are not decorative nor links/buttons and that do not have appropriate ALT; *frm* represents frames without appropriate TITLE; *skipl* represents navigation bars without hidden links for skipping around them; *areas* represents hot-spots with no proper ALT; *imglnk* represents images used as links or buttons without ALT; *lbl* represents forms with no explicit labeling; *evnt* represents events handlers that cannot be activated by keyboard; *pop* represents the use of JavaScript for opening new windows; *unt* represents CSS dimensions specified with absolute units rather than relative ones.

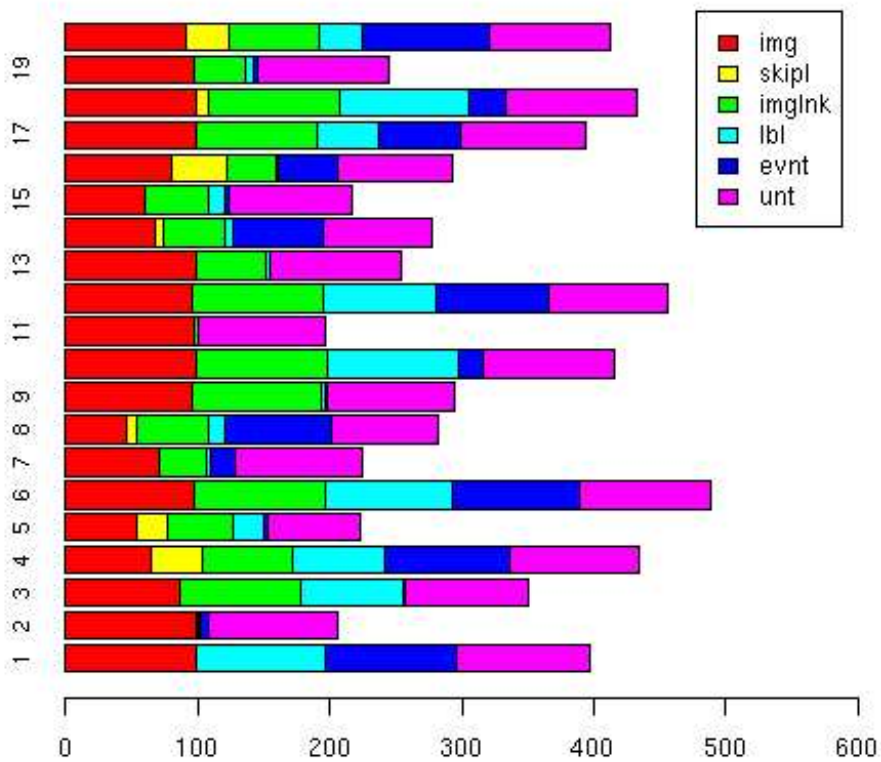


Figure 1: Barplot for some of the features shown in table 1. Each bar refers to an Italian region (according to the rows of that table) and shows percentages of violations (each color refers to a different feature).

Region	Compr.		Operability				Flexibility		
	img	frm	skipl	areas	imglnk	lbl	evnt	pop	unt
baden	100	0	0	0	1	5	100	0	98
bayern	92	1	97	97	31	73	100	0	95
berlin	95	18	35	11	50	86	96	78	93
brandenburg	98	0	0	1	15	23	100	0	98
bremen	100	0	17	100	86	26	100	0	100
hamburg	97	0	98	10	78	97	0	0	98
hessen	100	98	0	0	18	98	100	96	100
m-v	98	0	0	98	100	100	100	0	100
niedersachsen	89	0	0	5	1	95	100	0	68
nrw	98	0	30	7	94	94	96	0	100
rlp	94	0	0	1	65	3	0	0	88
saarland	96	0	0	0	62	96	97	0	96
sachsen-anhalt	100	3	0	98	11	94	100	0	91
sachsen	42	1	12	44	26	19	57	0	75
schleswig-holstein	100	7	0	87	94	98	100	1	100
thueringen	79	1	0	84	81	52	97	1	59
means de	92	8	18	40	51	66	83	11	91
means it	85	9	8	24	59	38	40	4	93
means at	82	19	3	38	66	67	79	10	92
overall	87	11	10	32	57	54	63	8	92

Table 2: Percentages for each German Bundesland

Region	Compr.		Operability				Flexibility		
	img	frm	skipl	areas	imglnk	lbl	evnt	pop	unt
burgenland	59	0	0	0	22	5	100	94	100
ktn	47	5	3	78	86	16	79	0	50
magwien	72	0	0	0	68	37	1	0	98
noel	100	0	0	0	77	94	100	0	97
oberösterreich	98	0	0	1	7	95	37	0	98
sbg	100	96	0	96	100	98	100	1	100
steiermark	93	74	27	95	82	81	97	0	100
tirol	91	0	0	7	59	88	100	0	100
voralberg	84	0	1	66	97	90	96	0	94
means at	82	19	3	38	66	67	79	10	92
means de	92	8	18	40	51	66	83	11	91
means it	85	9	8	24	59	38	40	4	93
overall	87	11	10	32	57	54	63	8	92

Table 3: Percentages for each Austrian Bundesland

There is a remarkably similar distribution of these potential defects across the 3 nations.

## 2.3 Discussion of results

The adopted evaluation method, being based solely on automatic tools, is not totally accurate. For false positives we could consider an error margin on the numbers shown in previous tables (like 20% on false positives – *i.e.* even assuming that the reported numbers are smaller than the true numbers for a 0.2 factor – much higher than the estimated error for the adopted tool). Even with such a margin the values that we obtain are still very high.

Consider also that the adopted method provides only an upper bound on accessibility, since many other barriers were not analyzed at all, nor was their impact on user experience.

These two arguments lead to the conclusion that in none of the mentioned usability factors (comprehension, operability, flexibility) those web sites do a good job in supporting their disabled users.

## 3 Accessibility policies for corporate web sites

One reason why these web sites are not accessible, despite being required by law to be or become accessible, may be the lack of practical and effective engineering approaches.

Any of such approach has, in my opinion, to start from the definition of the accessibility policy, which is a statement describing what has to be achieved and how.

The purpose of an accessibility policy is to provide a framework where all the important decisions about accessibility can be answered. These include the definition of accessibility<sup>3</sup>, definition of accessibility levels, how these levels should spread over time, how specific coding conventions adopted in the web site can be considered in formulating specific guidelines, which accessibility levels are required for which areas of the web site, which processes need to be implemented for eliciting, classifying, prioritizing, and solving problems, and how to validate solutions.

Users of an accessibility policy include *web developers*, who need to learn how to avoid problems, which practices are to be promoted and which are to be avoided, and how to solve already existing problems; *copy-editors*, who need to learn which problems to avoid, which practices are to be promoted and which are to be avoided; *quality-assurance people*, who need to know

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<sup>3</sup>This is not trivial, as in [1] at least 6 different definitions are reviewed and compared.



what to test, how to test it, and what to consider as a true problem; *project managers*, who have to know how to track progress of development, editing or QA teams; and *external partners* of the company, who might be interested or required to follow the same levels of accessibility as the organization who owns the web site.

### 3.1 Ingredients of an accessibility policy

A policy has to specify a number of items.

The *purpose* of the accessibility initiative, outlining the organization mission, the main accessibility drivers [7] within the organization (*e.g.* as an opportunity to innovate the product, to improve the brand, to reduce customers' dissatisfaction, to cope with competitors' products, etc.) and expected results).

A second component is the specification of the *levels of accessibility* that are to be achieved, based on some definition of accessibility, and formulated so that they can be verified. Possible levels include:

1. degree of conformance/compliance with an official standard (like WCAG 1.0 AA); alternatively or in addition, conformance to internal guidelines
2. degree of effectiveness to be achieved by disabled users (for example, by stating that certain goals should be achievable by 95% of blind users with less than 5 errors, within 10 minutes and reaching at least a 75% successful completion)
3. like the previous level, but defined in terms of usability rather than just effectiveness
4. degree of usability with respect to disabled users, of web sites of other companies that partner with the organization whose policy is being defined. One example could be a large web portal (offering email, finance, directory services, among others) where some of the services are offered by a partner company (*e.g.*, stock quotes, profiles and charts): the policy should integrate and harmonize accessibility requirements in such a way that users would experience the same levels of accessibility.

A third element is the specification of the *categories of users* that should benefit most from the implementation of the policy. Rather than stating that all types of disabilities will be fully addressed (statement too general to be viable), a policy could consider specific types of disabilities, assistive and browsing technologies. For example DRC [8, p. 6] describes in this way the impairment groups represented in a study:

- blind people who use screen readers with synthetic speech or Braille output
- partially sighted people who may use screen magnification
- people who are profoundly deaf and hard of hearing
- physically impaired people whose use of the web may be affected by their lack of control of arms and hands, by tremor and by lack of dexterity in hands and fingers.

A fourth element are *specific guidelines* referring to actual features of the web site or specific guidelines and techniques. The policy could list for example relevant WCAG 2.0 criteria together with how each criterion should be interpreted and adapted to specific coding conventions. For example, by stating that the search button that appears in the header of each page should have `alt="Search"`, or when and how *skip-links* should be implemented.

A fifth element is the *implementation plan* that specifies how the required level of accessibility has to be achieved. Of course the plan should consider practical constraints, like available resources (time, budget, people and their skills, infrastructure), already planned roadmaps for the web site, and it should optimize the resources with respect to expected benefits.

Besides specifying how accessibility awareness, knowledge and policy should spread within the teams in charge of the web site, the plan should also define *defect management processes*, specifying how defects should be identified, classified, validated, prioritized and solved. This part of the policy implements a feedback loop that is essential in every quality-assurance program. The rationale is that, no matter how well the web site has been developed and engineered, a number of defects will always creep into it [5] and only appropriate test methods are capable of catching (part of) them after the web site is running.

Particularly important are criteria and methods for defect identification and for *triage*, the process of determining if observed defects have been already managed in the past, which defects should be removed and how to schedule their removal<sup>4</sup>. In particular, methods for identifying defects should be valid and reliable [1].

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<sup>4</sup>Criticality of a defect depends on several factors that the policy should make explicit: *violation of required standards* (like not being compliant to Section 508 accessibility requirements), *individual impact* (the hindrance caused by the defect to some kind of users), *likelihood* (this in turn depends on how frequently the page is used by visitors and the proportion of visitors that will be affected by the defect), *symbolic impact* (if the defect is an embarrassing bug that damages the public image), *removal costs* (removing a defect requires diagnosis, identification of solutions, planning, implementing and verifying one of

## 4 Conclusions

The lack of appropriate engineering approaches towards web accessibility is probably the major barrier to achieve a higher level of accessibility. This is true also for web sites that are required by law to be accessible.

The (approximated) current accessibility status of several official web sites of local government web sites in Italy, Germany, and Austria appear to confirm this claim.

The adoption of local accessibility policies, and associated management and engineering activities and processes, is probably the only way out from the current situation, that witnesses a high level of awareness for web accessibility and a widespread diffusion of (some) technical knowledge regarding how accessibility defects should be resolved.

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the solutions), *instability of the web site* (removal of the defect, like any other change to the web site, is likely to perturb the web site in ways that cannot always be predicted, leading to instability and possibly generation of other failures).

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