

## Annex 3

### Literature review for statistical accessibility

### Report by the Statistics Commission

## INTRODUCTION AND BACKGROUND

1. This Annex reports a literature review carried out by the Statistics Commission Secretariat to identify the main accessibility issues. The purpose of the review was to inform the development of our initial pilot research, to assist in the interpretation of our research results and to inform our recommendations. The scope was government websites, mainly statistical websites, and mainly relating to UK statistics but also including relevant research carried out in New Zealand, Canada and the US, within the past decade.<sup>1</sup>
2. The literature reviewed falls into four broad areas, with varying quantities on each area:
  - government policies (about statistics, government websites in general, and the publication of information);
  - research studies into people's online behaviour;
  - research into finding official statistical information; and
  - information about the technology and conducting user testing of websites in general.
3. This report sets out the main themes from the literature review. It starts by presenting what the published **standards** are for accessibility by looking at the policies for statistical dissemination, government websites and for publication of information. This is followed by a look at the **methods used for evaluating** these standards, both qualitative and quantitative. From the research studies and commentary we present the main **barriers to accessibility** that have been identified. We also review the literature about **users** and user behaviour to provide some context for the barriers to accessibility. The final section presents a review of the information relating to **technological developments** and the impact this has on our expectations of online statistics. We conclude by reviewing what we have learnt from the literature review and what future research might focus on.
4. This review was carried out during 2006-07 and presents the themes from the literature published mainly in the previous ten years. It should be borne in mind that government departments are constantly updating and developing their websites and many recommendations made in these studies will have already been implemented, or the recommendations already superseded by technological advances. The Office for National Statistics (ONS), for example, is planning to launch its redesigned website in 2008 as part of its modernisation strategy.<sup>2</sup>

5. There are distinctions made between web accessibility and statistical accessibility. The former refers to the usability of websites, such as whether they are easy to navigate, or whether they have been adapted for people with disabilities, while we use the term statistical accessibility to refer to the availability of official statistics online, how easy they are to find, understand and use.

## WHAT ARE THE STANDARDS FOR ACCESSIBILITY?

6. Before reviewing the accessibility research, we look first at the criteria used for assessing accessibility. Standards for accessibility of statistics fall broadly into three types – those setting out statistical standards or codes of conduct; website standards and e-government strategies; and those setting out standards relating to official information generally.

### Statistical standards and accessibility

7. Statistical standards are set out for both policy and practice in the National Statistics Code of Practice and protocols (see Annex 1) and are reviewed in Ipsos MORI's research report (see Annex 2). This literature review does not attempt to cover the same material. The literature search identified some guidance from the United Nations on how to present and disseminate information including on the Internet<sup>3</sup> and tips for writing statistical stories for publication on the Web and evaluating their impact<sup>4</sup> such as using simple language, using graphs, table formats, using maps appropriately and including explanatory information.

### Website standards and accessibility

8. An important standard in the literature is for a user-centred approach to website design. There is a range of documentation from government – setting out website policy (the Transformational Government Strategy<sup>5</sup>), commenting on its progress (eg by APPSI), or standards for website design. For example, there are plans to rationalise the number of government websites, on the basis that users prefer to use a small number of “supersites” that bring a wide range of information together in one place.<sup>6</sup> In line with these trends, the Government recently announced its intention to make all online government services accessible via a central hub, such as DirectGov or Business Links<sup>7</sup>. Another recent proposal has been the development of a statistical publication hub that would separate the release of statistics from political comment on the data.<sup>8</sup>

9. Another standard is for transactional websites to cater for the shifting relationship between government and users. The Varney report on the opportunities for transforming the delivery of public services noted that “today’s consumer is no longer the passive recipient of government services” and that technological changes “create an increasing expectation that access to services on the Web will be comprehensive, joined-up and capable of delivering a service almost instantly”.<sup>9</sup>
10. Much of the website literature found relates to international and local technical standards for ensuring that websites are appropriate for all users including those with disabilities. Some of these standards are relevant to statistical accessibility, such as using the simplest language possible, or the need to identify row and column headers in data tables.<sup>10</sup>
11. In 2003, the Cabinet Office published its standards for good website design.<sup>11</sup> This included a definition of a good website, how to predict user satisfaction, and advice and guidance for designing websites (eg consistent navigation, a site map, and a good search facility) as well as advice to employ a professional agency to design the website. Aimed at government websites generally, the advice and guidance is also pertinent to statistical websites. The National Audit Office used these guidelines in carrying out an audit of government websites for their web accessibility.<sup>12</sup>
12. Website design guidance relating specifically to statistical websites includes advice to name the data appropriately, make sure data can be downloaded or copied into different formats, include metadata and have a good search facility. The author points out that “often the web presentation has not been developed by the paper publication team and has suffered from lost knowledge”.<sup>13</sup> The UN guidance (mentioned above) includes similar advice.

## Information standards and accessibility

13. The Freedom of Information Act (2000) is also helping to generate a culture of making government information publicly available, and is raising expectations about the type of information that should be made available. Government must be able to respond to these requests efficiently and has set up the Information Asset Register to hold information about what data is available. Users do not need to know which departments hold the information they seek, as a search is made across the whole of government.<sup>14</sup>

## HOW IS ACCESSIBILITY EVALUATED OR TESTED AGAINST THESE STANDARDS?

14. The review of the literature revealed a number of different approaches to evaluating the accessibility or usability of statistical websites. These ranged from an audit approach of what the website covers; qualitative research into users' perceptions, expectations, and experience; to analysis of website "hits" or usage and analysis of the users' path using tracking software. Some studies used a combination of approaches.

### Audit or inspection approach

15. Most of the website design standards have been evaluated using an audit approach, undertaken either manually, automated or a combination of the two.<sup>15</sup> Others have used an audit approach combined with user experience: for example 'Surfing with Ed',<sup>16</sup> a monthly series of reviews by a UK official statistician that has looked at a different country's statistical website each month for a number of years. In it, he looks at aspects such as navigation, user orientation, features or metadata.

### Qualitative research methods

16. Qualitative research methods are used to assess the user's experience of the website. Much of the guidance relates to usability testing which tends to be small scale and unsystematic compared to social research methods. Also, its purpose tends to be formative rather than summative – the results of each test or set of tests contribute to the development of the website that is often then assessed by the next tester, and so on.
17. Guidance for usability testing, such as that written by Nielsen, covers advice about people doing the testing, the setting for the test, tasks, and measurement.<sup>17,19</sup> Some guidance is also given about other research methods than could be used to evaluate website design, such as observation, questionnaires and interviews, focus groups, computer logs, and user feedback.
18. Much guidance is based on or refers to Nielsen's work. The Cabinet Office's guidance on website design,<sup>11</sup> for example, contains advice on user testing including who to use as testers and how to treat them, how to measure the testing session, and the importance of knowing who the regular users are: their level of Internet experience, interest in subject matter, and demographic characteristics. The ONS is putting this into practice, and developing user

*personas* to ensure that the needs of a range of users are met.<sup>2</sup> Other researchers have recommended researching how the user achieves their goals and to include evaluation of the search engine as well as navigation through menus.<sup>18</sup>

## Analysis of computer log files

19. Another way of measuring the user experience is to collect quantitative data while they carry out online tasks. Technology has developed, but basic methods to record the user's progress through the task have remained the same. Written or manual methods, such as self-reported logs or screen snapshots, have been replaced with web tracking software. However, similar items are measured, such as the number of keystrokes, the time taken and the path taken through the Internet to complete the task.<sup>19</sup>
20. Another measure is to analyse the links between websites using "webmetric" techniques. This counts the number of links between websites to find the most popular, and has been used in a study to compare online networks with social ones.<sup>20</sup>

## WHAT ARE THE MAIN BARRIERS TO ACCESSIBILITY?

21. A good deal of the literature on accessibility research concludes that the websites they evaluated were not designed with the user in mind and identifies specific barriers and makes recommendations for improvements. The barriers were user guidance, website design and navigation, geography, search tools, data formats, and analysis tools, and these are described in more detail below.

### Online help and user guidance

22. Much of the literature describes statistical websites that were insufficiently user-focussed, and did not provide sufficient explanatory information about the data or that it was difficult to find this information. It has been noted that online statistics are likely to present barriers to users already familiar with the paper versions,<sup>21</sup> though most of these barriers can be mitigated by a user-focussed web design.
23. A 2005 study of the US Government website FedStats (the American portal for official statistics) recommended presenting this explanatory information in small amounts – "just-in-time, just-enough" help that is presented when needed – which they suggested might be provided by an interactive statistical glossary with context specific explanation.<sup>22</sup>

24. Commentary about the statistics is an area of concern and the researchers in the study described above argued that there should be “no naked data”; the story behind the numbers is always needed. In addition, the Statistics Commission has previously expressed concerns about the frankness and fullness of the commentary that accompanies the figures.<sup>23</sup>
25. The importance of metadata is recognised – this refers to information about the statistical data that makes it easier to interpret and use, and techniques that help users avoid misusing data.<sup>24</sup> Recommendations for improvements include adding more context or metadata such as definitions, and explanation about the data.<sup>25</sup> This information should be easy to find, preferably located closer to the data.<sup>2</sup> It should also include information about the currency of the website and when each data item was last updated.<sup>26</sup>
26. Use of “scientific” words in presentation of data should be avoided;<sup>27</sup> one commentator has remarked that the data descriptions do not describe the information available very well and that there is a tendency towards using jargon and technical descriptions<sup>21</sup> and misuse of conventions such as alphabetic listings that list include items beginning with “the” under T.<sup>28</sup>

## Website design and navigation

27. Reviewers of the literature for e-government<sup>29</sup> found that poor web design was a significant barrier to e-government in the UK; others have criticised the inconsistency of government websites.<sup>21</sup> Another difficulty observed of government websites generally is that websites have been structured around government organisation rather than user need.<sup>28,30</sup>
28. One study of website accessibility,<sup>27</sup> based on FedStats, recommended a general principle of designing a statistical website for novice users. Statistics producers and website managers should not assume that all users regularly accessed the site and as a consequence had learned how to use it, nor should they presume that users should know the structure of organisations or agencies and so easy navigation of the site should be provided.
29. Navigation refers to how easy it is for the user to find their way around the website, for example with menu options or a site map. Navigation is crucial to being able to use a website and some researchers have said that it is one of the key factors in determining e-government readiness and maturity. Website designers should aim to “minimize scrolling and clicking”<sup>22</sup> and avoid simply placing the digital versions of paper publications onto the website. Files in portable document format (pdf) cause particular problems for navigation compared with web formats because the information they contain cannot be indexed as effectively.<sup>21</sup>

30. A portal website is one that acts as an index or gateway to a number of other websites via a set of links to other websites, and/or a search engine. Some of the literature covers research carried out on the FedStats portal, while other studies cover the issue of portals in a theoretical way, as the possible solution to the problems caused by numerous or disparate websites. Some users have described the ONS website as a portal as it contains some links to statistics produced by other departments and administration, though they claimed it “inadequate for the task”.<sup>31</sup>
31. The Neighbourhood Statistics website, described as an “online data resource”, offers a possible model for a statistics portal. It has been cited as an example of good practice for drawing on different sources of data in various parts of government to provide users with a “one-stop shop”.<sup>32</sup>

## Geography

32. Of particular concern to commentators and users in the context of statistical accessibility is the decentralised system for UK official statistics, and in particular the impact of devolution. The system has been described as “fragmented”, with users having to “cobble together” statistics for the UK as a whole from various departments and administrations.<sup>33</sup> The Statistics Commission previously recommended in relation to education statistics that the four UK administrations should recognise their users, and take a consistent approach to the publication of performance data for individual schools.<sup>34</sup>
33. Where available, statistics for smaller geographies, such as local authority or ward level, are made available on the Neighbourhood Statistics website. However, the lack of availability of local statistics on other websites remains a barrier.

## Search function

34. Paragraph 58 below describes how search engines work. The commercial search engines have set high standards and the cry “couldn’t it be more like Google” is frequently heard in usability studies when testing a website’s own search function<sup>18</sup>. ONS’s usability research,<sup>2</sup> for instance, found that Google-style search tools were preferred because they allowed for wider interpretation of search terms.
35. Other researchers have gone further in their recommendations, stating that there should be a facility for users to perform a ‘comparative search’, enabling, for example, comparison of statistics for two cities; and that advanced search facilities should be available.<sup>27</sup> Others have argued for using technology more efficiently to enable users to access data; this might include adding a *data* option to the Google toolbar.<sup>35</sup>

## Data formats

36. A range of data formats is important for accessibility because users comprehend information in different ways – in text, tables, charts, or maps, and want to use it in different ways, such as downloading the data for further analysis. Users prefer statistics to be available in a variety of formats – the ONS presents information in “nuggets” or short statistical news stories on its website,<sup>36</sup> but has been criticised for its presentation of graphs without displaying the underlying data in a table.<sup>21</sup>
37. Documents in pdf format are unpopular with users and commentators, because they are difficult to navigate or transfer into a format for further analysis. From research with its users, ONS has found that these users primarily want the data to analyse themselves, and the commentary is of secondary importance.<sup>2</sup>
38. Statistics are increasingly presented in the form of maps – the literature highlights examples of good practice, eg by the Environment Agency and the Department for Environment, Food and Rural Affairs.<sup>32</sup> The literature review did not find any research into the accessibility of mapped statistical data.

## Analysis tools and other advanced barriers to accessibility

39. The online maps mentioned above are examples of the effective use of technology in providing interactive ways of presenting the statistics. Other research has recommended that tools for analysing the data online should be provided and that users should have the option to choose the granularity of geography and time series<sup>27</sup> and web designers should “provide alternative ways to slice and dice datasets”.<sup>22</sup> An early study found that sophisticated users want more access to raw data, or if this is not possible, tables that they can manipulate.<sup>25</sup>
40. Other barriers to accessibility are the lack of archived data,<sup>2</sup> restrictions on access to administrative data,<sup>33</sup> and charging for certain data.<sup>37</sup>

## THE USERS

### Who are the users?

41. Many researchers of the accessibility of official statistics have started from the list of users that the information is intended for; few have begun by finding out who are, or could be, the users. Various lists of categories of users have been produced.<sup>3,38,39</sup> Website usability studies and studies of statistical users have

tended to categorise users in terms of their expertise,<sup>40</sup> how processed is the data they use<sup>41</sup> or the purpose of their use of the data.<sup>42</sup> Others have categorised by topic or type of organisation.<sup>43,44</sup>

42. The development of the Internet has brought changes in the way that people access and use information – not the least being an increasing familiarity with searching methods. We describe in paragraph 54 below that the proportion of the population with access to the Internet is increasing and there is likely to be an increase in the number of non-specialist users accessing statistics. One commentator has described the low rate of statistical “literacy” amongst users as a ‘gulf’ between statisticians and their users and potential users<sup>45</sup>.
43. The main users are not passive recipients of official statistics but can provide feedback to ensure that these statistics are relevant and of good quality. User groups, comprising professional users of official statistics, have asked that they be recognised as customers, with systems put in place to ensure that their needs are “identified, evaluated and implemented”.<sup>33</sup>
44. In a review of the literature for e-government, reviewers noted that government is not using analyses of web hits strategically.<sup>29</sup> A forthcoming review of tax data by the Statistics Commission has found that HMRC appears to have little information about who accesses tax statistics on its two websites; the Statistics Commission believes that they need to find out more about their users.

## A taxonomy of users’ tasks (what users want to do)

45. Based on information supplied by the providers of US government statistics, researchers developed a general taxonomy of user tasks<sup>38</sup> which were later used to develop scenarios for other studies. Tasks were categorised by their purpose – to learn, verify, judge, explore, to plan and forecast, or to be referred to another information provider. The researchers note that the diversity of purposes means that there is no single right way for a website to handle all tasks or queries but a system designed as a referral system (or portal) should link to the relevant website rather than to specific databases within websites.
46. Other dimensions of the taxonomy include the constraints of time (information from a particular time period wanted), volume (a particular amount of information is wanted) and geography (information from a particular geographic area wanted). A semantic dimension described the topic, the level of abstraction and specificity and the number of facets. Comparison was an activity common to all user types as was the need for context for tables, including definitions, data quality such as variance and other metadata.

## How we search for information

47. Researchers have found that behaviour in looking for statistics is no different than when searching for other information – so the problems that emerge, such as with word matching or with files in portable document format (pdf), are generally similar.<sup>46</sup> From this research it was recommended that web site developers enhance indexing structures to include users' terminology.
48. Users are strongly guided by the organisation of a website<sup>38</sup> and often turn to search engines to compensate for clumsy web design.<sup>47</sup> Although users do not necessarily understand how the search engines work, they expect to find what they are looking for on the first page of search results, and if their first attempt is unsuccessful, they refine the search terms in an iterative process rather than switching to another search engine<sup>48</sup> or using advanced search tools.<sup>47</sup>
49. Research by ONS<sup>49</sup> into how their users access the website found this was usually via a search engine, or through the site already being on the user's list of "favourites". This reiterates studies by Nielsen that indicate a search engine is most common way of arriving at a website;<sup>11</sup> however this could be partly due to ignorance about typing in URLs directly.<sup>11</sup> Once onto the relevant website, around fifteen to twenty per cent of web users go straight to a site's search facility rather than use the navigation.<sup>11</sup>
50. There is a distinction made between using search engines for "discovery" versus "recovery".<sup>50</sup> A study looking at how scientific researchers use search engines found that a discovery, or exploratory approach tends to be used in researching topics that are newer, or susceptible to rapid changes in domain names, while the recovery approach uses the search engine as an *aide memoire* for locating known sources for topics that the researchers are already familiar with.<sup>20</sup>
51. A commentator has noted that the way we expect to find, access and manipulate data has been influenced by the impact of Google, Amazon and statistical analysis software.<sup>51</sup> The same commentator voices a warning for accessibility that "as users become less and less technically specialist, and the interfaces become easier and easier to use, the risk of incorrect or methodologically flawed analyses increases dramatically."

## How we scan information

52. The wide availability of information on the Web and the ease of accessing it via search engines have led to what has been called "information snacking".<sup>47</sup> This refers to the short time that people are prepared to spend scanning a website or web page. It is increasingly rare for people to scan an entire document other

than by using search facilities. The recommended solution is to provide information in easy to read, bite-sized chunks, with the facility to drill down for more detail or explanation as appropriate.

53. UK government guidance on website design relating to user behaviour is to ensure that text is “scannable” with highlighted keywords, beginning the item with the conclusion and keeping it concise and in plain language.<sup>11</sup>

## TECHNOLOGICAL DEVELOPMENTS

### The Internet

54. The rate of households acquiring Internet access has been rapid – in 2006, 57 per cent an Internet connection, up from 36 per cent in 2001.<sup>52</sup> Currently, nearly four out of five Internet connections are via broadband.<sup>53</sup> The principal reason for households to go online was to find information,<sup>54</sup> and following the increasing use of online shopping websites is the opportunity to expand the use of public service transactional websites.
55. There has been an increase in information sharing websites – a development that the Cabinet Office recently hailed for its effect in “democratising information and driving citizens’ appetite for sharing advice and opinions in new ways”.<sup>55</sup>
56. Web users have the opportunity to tailor Internet content for their own needs, customising web page content or sharing information about individual websites through the use of social bookmarking websites (ie sites that enable users to share online their favourite sites and to develop virtual information networks). Some website owners, such as newspapers, offer readers the opportunity to propose the page they are reading for inclusion in a hosted social bookmarking site, thus increasing readership of that newspaper’s site. This has raised expectations about the ability of websites to make content relevant to individual users and so facilitate finding information, or for websites to offer users the options to personalise the content they view.

### The authority of information

57. The Internet raises difficulties about the authority of information. Whilst blogs (web logs) encourage access to a wider source of ideas and comment, they also increase the risks of misinformation. Blogs are used by the authoritative (for example, the ONS blog as part of its consultation on geographies<sup>56</sup>) and the merely opinionated. The online self-managing encyclopaedia Wikipedia is now much bigger than, for example, Encyclopaedia Britannica. The Internet

offers unlimited access to information posted on it – much of it accurate, some of it dishonest, much misleading. Hence the need for trusted sources has seldom, if ever, been stronger.

## Search engines

58. Users tend to only look at the first page of search results<sup>48</sup> and so a high ranking in search engine results is an important aspect for accessibility. Search engines work by indexing links with a combination of keyword search and an algorithm that ranks most commonly linked or rated websites – eg Google ranks by the volume of links to the page, Ask ranks by experts' usage of those pages.<sup>57</sup> Much has been written about the quality of the Google algorithm and the effectiveness of its intuitive approach.<sup>58</sup>
59. A related study<sup>20</sup> looked at how easy it was to find science websites and found that search engines varied in quality but all play a major gatekeeping role. The recall capacity of search engines varies and there were differences in the quality and content of results. The researchers concluded that the Web has a particular structure that determines access and the visibility or “presence” or popularity of a topic is important to being able to find it.

## CONCLUSIONS

### What has the literature review told us?

60. From the literature review we have gleaned sufficient information firstly to inform the design, and secondly in order to contextualise our research findings. It guided us in deciding what variables to control for and influenced us in deciding to split users according to their expertise in searching for statistics, and according to whether they started their search from a search engine or from a government website. It highlighted the most common barriers to accessibility and so informed the development of the questions we used to test all aspects of accessibility. The literature about technological developments and about user behaviour enabled us to set our findings into context and inform our recommendations.
61. The literature informed us that the type of accessibility barriers we found were not unique to UK government statistics. This means that solutions to these barriers might be found elsewhere – Swires-Henessey for example, notes a number of good practice examples in his final review of statistical websites.<sup>16</sup> Maps are very recently being used to display statistical information online, and the lack of literature about the accessibility of mapped statistical data is indicative of the lag between technological developments and evaluative research.

## Future research

62. Human-centred design, including usability testing, is at the heart of UK government web design and testing with users will most likely to inform future developments. However, the UN advises keeping abreast of new technology: “technology is rapidly loosening the constraints that used to affect its (statistical offices’) activities. Tracking technological advances has become almost as important as conducting studies of user needs and satisfaction.”<sup>3</sup>

## NOTES AND REFERENCES

- <sup>1</sup> Searches were made in the House of Commons and Treasury libraries, publications and current projects by the Statistics Commission, and online searches of government and other organisations' websites, online searches using Google and GoogleScholar, and media websites. The search terms were: *statistics government website access user uk*. The searches were carried out between May 2006 and April 2007.
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