

CONFERENCE OF EUROPEAN STATISTICIANS

UN/ECE Work Session on Statistical Metadata
(Washington, D.C., United States, 28-30 November 2000)

Topic (i): Statistical metadata for dissemination

BEST PRACTICES IN DESIGNING WEBSITES FOR DISSEMINATION OF STATISTICS

Submitted by Statistics Sweden¹

Invited paper

I. INTRODUCTION

1. Web technologies have during the last years evolved to one of the most important information channels. It is one of the backbones in the development of what is called information society. That has, of course, also been recognised as a big challenge by national and international statistical offices. Nearly all national and international statistical institutes have developed and implemented web sites. During the last years the Internet technology - and in particular the web technology – can be considered as probably the most important development in the area of information dissemination. Today it is difficult to foresee the Internet development for the next ten years. But it can be taken for sure that the electronic dissemination will take over a fast growing part of the whole output of a statistical office. That will lead to an extended use of web technologies, to larger and more complex statistical websites, higher expectations of the statistical users, etc. That will lead to higher demands on the implementation of websites. There will be stronger requests to standardise basic statistical functionalities on the website. In particular, it will have a large impact on the standards for data exchange and the use of metadata. It can also be foreseen that the fast evolution of the Internet use will require a higher degree of metadata standardisation across the national and international statistical offices around the world.

2. The Internet is today used for a number of purposes and the scope of usage will still grow. The Internet can be considered as a worldwide network linking together resources from all over the world. The Internet functionality has already today an important impact on the basic information technologies. There is a trend that Internet technologies will more and more replace the traditional IT architecture. The Internet technology is today composed of a number of functional features as:

- ◆ Electronic mail (E-mail) is the basic function of the Internet. E-mail is a common engine to send electronic messages to anybody in the world that has an e-mail address. E-mail can contain short or long messages and any files can be attached to the message. The e-mail function has been connected to a number of software packages that allow software controlled sending of e-mail messages and includes attachments as for instance files with statistical data. Powerful standard software has been developed to manage electronic mail systems.
- ◆ Websites are the most widespread and visible Internet facility. The web technology offers a large amount of different functional possibilities.
- ◆ FTP² -server is a basic function to disseminate data files.
- ◆ Browsers and mailing software – are software packages used on the users workstations to manage the Internet functionalities. They provide the possibilities to access websites and FTP-servers, to receive

¹ Prepared by Lars Rauch. This paper may not be considered as the official position of Statistics Sweden. It expresses the opinion of the author.

² FTP - File Transfer Protocol

and send e-mails. MS Explorer and Netscape are today probably the most known and applied browsers in world.

3. Within the frame of that basic functionality a growing number of application areas has been developed. E-trade, business-to-business represents some of the latest Internet issues. But not all of them are of great interest for a statistical office, at least not yet.

4. This paper will not focus on technical questions of the development and use but rather on issues related to the use of web technologies for statistical websites from the users point of view. The real starting point for this paper is the following documents that have already been discussed at different meetings.

- ◆ Guidelines for Statistical Metadata on the Internet - UNSC/ECE - CES Statistical Standards and Studies, No. 52, 2000
- ◆ Guidelines for the Modeling of Statistical Data and Metadata - UNSC/ECE CES methodological Material, 1995

5. The present paper may be considered as a kind of continuation of the above-mentioned documents. The content should not be seen as final conclusions, rather as a further step in the discussions that hopefully will lead to a broader harmonisation in the use of web technologies for statistical offices.

II. THE USERS OF A STATISTICAL WEBSITE

6. Probably it would be worth to make a distinction between visitors and users of a website. A visitor can be anybody who is surfing in the web space and accessing your website, also by accident. A user is a visitor who wants to apply the content of the website for some purposes. In some way the definition of visitors and users is not sharp and overlapping each other. It may happen that visitors will turn to be users. Maybe also vice versa.

7. The real users are the crucial point of any website. If you have no users at all the website is probably more or less unnecessary and useless. Although the number of Internet users is growing very fast, it is still a limited resource for a particular website. There is a hard competition on the market to attract the users to the websites because it is more or less always a decision of the user whether he/she wants to access a certain website or not. And you have to see that users are very different. You normally want to attract a certain group of potential users to your website. In most cases some marketing activities will be needed to reach the wanted frequency of website access.

8. A statistical office cannot control what kind of visitors and users will access its web pages. It is possible to restrict the access to certain users by providing user-id and passwords, at least to some parts of the website. Any kind of access restriction should be well motivated, commercial aspects can be behind such behaviour. On the other hand, it would be of great interest to know who is accessing the website, and maybe also why. There are software tools available on the market to make some rough estimation about user access. But that is not sufficient for deeper analysis. To get a better grasp of the user situation you need some communication, for instance:

- ◆ Register all users that are using certain services on the website;
- ◆ Provide feedback facilities for the users.

9. In general, users (visitors) can be classified in different ways. One possible distinction could be:

- ◆ Occasional users and users visiting your web pages by accident;

- ◆ Regular users that need the information for their work (e.g. journalists) or are for some reasons interested in it;
- ◆ Professional users, which for their original work have to use statistical data and information and wants to get it from the website;
- ◆ Researchers and advanced users that are looking for information for their research work and for further processing and analysing.

10. Another distinction between different user types could be:

- ◆ Individuals that are interested in statistical information but not necessarily for professional reasons – the interested citizen.
- ◆ Private and public institutions as for instance companies, governmental bodies, etc.
- ◆ Scientific institutes and universities that want to use statistical data for their own research.

11. Of course, there does not exist a clear specification and general definition of different kind of users. Normally different kind of users may have very different needs, concerning both the content and the way to use the website. For the success it is needed to have a clear user policy, for instance:

- ◆ The website should be of interest for a broad audience;
- ◆ Focus on a target user group that has to be defined carefully;

12. Such a policy will influence both the layout, the content and the offered functionalities of web pages. Different parts of the website may be dedicated to different kind of users.

13. It is another important question is whether the website is oriented only to users of the own country, respectively users that are using your home language or whether the website should reach an international audience. In the last case you have to choose a multilingual approach for your website. Publishing a website in different languages is a special burden that should not be underestimated. But for a large number of NSO's it is very important to offer a multi-lingual approach, in particular in the case of multi-lingual countries.

14. A sound strategy would be not to focus on just one kind of users, but to serve several groups of users. All of them can play important roles on the customer's side of a statistical office. In general, the users should always be in focus of the work of a statistical institute. Specific needs of the different user groups will be considered within the following chapters embedded in the web design issues.

15. To be successful it is essential to study not only the needs for information but also the behaviour of different users. Modern methods as Use Case Studies could be very helpful to make different specifications. The expectations of different kind of users and the knowledge how the users really want to work with a statistical website should guide the design of a website both from the contents and the technical point of view. It should also be recognised that the behaviour and needs of a group of users may change over time. Therefore the maintenance of a website has to take into account such problems.

16. The change of the user behaviour can have different reasons, for instance the implementation of new facilities in the Internet world; the gain of more experience may lead to new demands, etc.

III. WEBSITE CONTENT

17. When a statistical office has stated that the website will be the main distribution channel of statistical information then the content of a website could be defined as the main output repository of the office. That comprises traditional publications as well as a number of new outputs due to the functionality of the Internet technology.

18. Basically a user will expect statistics from a statistical website. Statistical information can be provided in various shapes. The content of a statistical website could for instance consist of:

- ◆ Fixed statistical tables with key figures and other basic statistical data;
- ◆ Statistical publications in a web-readable format, i.e. publications that contains text, figures, graphics, maps, etc.;
- ◆ Pre-defined tables, time series etc. - for instance, for downloading or further processing;
- ◆ Flexible access to databases;
- ◆ Download functions for tables, publications, etc.;
- ◆ Information about the statistical office – organisational structure, responsible staff, contact persons, etc.;
- ◆ General description of main activities, statistical subject areas, available services, etc.;
- ◆ Links to other statistical and related sources.

19. There may be a kind of redundancy how to present statistics according to the different needs of various types of users. To avoid any inconsistencies between the different presentation methods it is recommended to develop a unified output data source for the available statistical data. One database system – an output database - behind all publications would be very helpful in this respect. Such a database system can be organised in different ways, it could be a central resource or a well-organised distributed system within the office. The implementation of a statistical data warehouse system would be a good tool to integrate statistics from different subject matter areas and offer the external users an integrated view to the whole statistical system.

20. At this point it should be stressed that it is not only a question of good navigation to find statistical information on the website. A good search function should be supported both by navigation tools and statistical metadata. In many cases the user wants to start the search by using metadata. The user needs statistical metadata for a number of other purposes when using a statistical website.

21. The availability of metadata should support and provide:

- ◆ Searching data (as already mentioned);
- ◆ Understanding and transparency of the content of data:
 - ◆ Definition of variables, classifications, etc.;
 - ◆ Description of statistical surveys providing statistical data;
 - ◆ Information about data quality;
 - ◆ Etc.;
- ◆ Information about important events with impact on data. Such events could be the redefinition of statistical variables, absence of data for certain time periods, external events with impact on statistics – e.g. a new regional structure, etc.;
- ◆ Contacts to the responsible department in the statistical office, contact person, etc.;
- ◆ Presentation of the statistical office, its position in the society, its responsibilities, etc.

22. The usage of metadata on the website requires that the metadata are consistent across the whole system. To achieve this goal it is necessary to have a good metadata system behind the website publishing of statistical information. A standardised metadata resource for the statistical system, not only for the web publishing needs, would be helpful. It could ensure that an agreed standard set of metadata will be maintained in one place and distributed to the different system applications from that source. For that purpose it is necessary to define office wide metadata standards. It would be a big advantage to be able to define more metadata standards that are valid on an international level. There exist already a number of standardised metadata in form of international classification standards. But that should be extended to get well-accepted standards for the typical metadata object types, as variable, value set, classification as such, etc. Some cooperative work has already started in this field between some NSO's

for some statistical areas. Metadata standards will be an emerging issue for the harmonisation of the presentation of statistical information via websites covering different statistics of different countries.

23. The dissemination of statistics via Internet using websites requires a standardisation of the transmission of statistical data. Statistical data must be provided in a well-accepted format that can be used to import data into software packages used by the customer. GESMES is such a format that for instance is used for data exchange between Eurostat and NSO's.

24. XML is on the way to be a standard method to exchange data between different technical environments. The usage of XML for the exchange of data requires a certain degree of standardisation of metadata to be able to use the real advantages of that open format. Downloading of statistical data in XML format will probably be the most used format in near future.

IV. WEBSITE ARCHITECTURE AND FUNCTIONS

IV.1 Website architecture

25. A website consists of a number of Web pages that have to be linked together. A Web page itself may consist of a number of areas with different functionalities. A large website can consist of several thousand of Web pages with a lot of cross-references between them and many links to other websites. Because that architecture can be very complicated it is necessary to keep a good control over the website, otherwise the website can be very confusing for a user.

26. Definition of the content of Web pages and the style of presentation are two different things. A bad presentation can destroy the content and make users to give up accessing the website. There are a number of good rules how to create a Web page. But the web designer has always to keep the expectations of the target audience in mind. Examples what you have to consider when developing a website are:

Response time

27. That is a very important issue that will touch all the website. Do not expect that the user has time and enjoy to wait for website responses. It is a very sensitive issue. The user may be in the following situations:

- ◆ A new or occasional user who wants to visit your website, sometimes by accident. This user normally will surf away very soon if the response time is too long. That mostly means several seconds. Probably he/she will never come back
- ◆ The professional user who needs the information. He/she must wait, but will be quite angry – i.e. you have got an unsatisfied user.

28. The basic rule should be to avoid all unnecessary features, which may provide a “sophisticated” layout but is time consuming. The normal user of statistics is very rational and wants to get all kind of information as fast as possible. Nice images, a lot of colours, complicated structured pages are mostly useless for such kind of users. The website should not steal time of the users.

29. Of course, depending of the application response time may be longer, as for instance in the case of downloading of data. But in any case it is a high priority task to keep response time always reasonable short.

The Home Page

30. That is the starting page of your website, i.e. it is the normal entry point to the website. Visiting this page the user will get his first impression of the whole website. A good design of the home page

should never be underestimated. It should appear very fast (response time), be well structured with a plain guide how to go on. An overview about the contents of the website with links to the different parts could be a common rule. Of course, it must be very clear what organisation is presenting its website. The home page may already contain some statistical key figures under the condition that they really are important and always updated.

Navigation

31. One of the basic user interaction with a website is clicking from one Web page to another. The navigation through a website should be easy to understand and efficient from the user's point of view.

- ◆ All texts on a Web page with underlying hyperlinks should be distinguished from plain text. The links provided should help the user to find the shortest way to the wanted information. Therefore it is important to investigate how the different users utilise the website.
- ◆ The user should never get lost in the website. It can be very irritating to be somewhere on the website without knowing how to continue in a meaningful way. There should always be a hyperlink at least to the home page. But that is often not sufficient. When the website has a clear structured architecture then you should always provide hyperlinks some steps back to beginning of a certain part of the website. When the user for instance has entered an area where a user-id is necessary, he/she should not by accidentally clicking on a hyperlink exit that area. Implementing of links on a website should be done very carefully.
- ◆ The website should provide hyperlinks to other websites when that is useful for the user.

Physical Website architecture

32. The physical website architecture may not be so important for the users, because in most cases it is hidden for them. The key issue for the users is the navigation structure. But for the maintenance and further development of a website a good architecture will be very helpful. The physical design of a website can be compared with the design of a software program. Modularity, clear logical structure, good documentation are rules that also should be applied when designing a website.

Web page design

33. Of a much higher relevance for the usage of a website is the design of web pages. There are a number of problems the designer has to take care of.

- ◆ The available monitor and the chosen resolution limit the visible part of the physical size of a page. That is a very crucial point for the web page design because the users are equipped with different displays. You have to find a good compromise that should match the available equipment of the majority of your users. The availability of displays is changing over time. In many countries you can today expect 17" displays and a resolution of 1024x768 pixel. That could be an acceptable standard.
- ◆ It would always be ideal if the physical size of a page corresponds to the physical parameters of the screen. But often it is very difficult to keep the size of a page to those parameters. Already relatively small statistical tables will be larger. When publishing such tables the user must scroll to get all parts of the page visible. Scrolling can be done vertical and/or horizontal. It is a common accepted experience that horizontal scrolling should be avoided if possible. Another rule should be that the content of the visible part of a table (as an example) should always be understandable. That means that for instance the column head and stub labels should not disappear during scrolling.
- ◆ Resolution independent web page design solves some of the problems related to the different monitor types. Instead of using fixed pixel size objects you specify the layout in percentages of the available screen area.
- ◆ Browser independent design is another important issue that has to be considered carefully when designing web pages. There are different browsers on the market and different version of the same

browser. The web design should take into consideration market leading browsers and also earlier versions of the browsers, maybe two earlier releases.

- ◆ The structure of the web pages should be clear and easy to understand. They should be consistent throughout the whole website. For instance, the same functionality should be represented on the web pages always in the same way. As an example, an "OK" function should be a button with the same graphical representation on all Web pages. You should not use different names for the same function, e.g. *OK* in one place and *Finish* in another one.

IV.2 Website functions

34. The technical functionality of a website can be static or dynamic. Both are useful for a statistical website but the dynamic aspects of a website will probably be more in focus for the future development. The development of most statistical websites started with the use of static Web pages, i.e. Web pages that are pure publication pages with a chain of links between them. The user can go from one page to another but no real interaction by the user is expected and possible.

35. Typical application of static Web pages are:

- ◆ Publication of documents;
- ◆ Simple search functions in Web pages and published documents – that could in some way already be considered as a kind of dynamic feature but it is not what really is meant;
- ◆ Static or fixed tables, graphics, statistical maps, etc.
- ◆ Normally all kind of administrative information on a website, for instance information about the office, responsible staff, etc.
- ◆ Download functions of pre-specified statistical data.

36. Dynamic Web pages require interaction by users. The user will get control about how to work with the website. The user will be in the position to decide and select what information should be provided. That means that the user is not only clicking and selecting from already prepared alternatives, which also can look very dynamic, but the user is controlling the processing of requests. The user can specify requests that are processed on the server side. As dynamic web features should be considered, for instance:

- ◆ Flexible database access where the user can select data for presentation on the website or for downloading
- ◆ Remote data processing, for instance with web enabled tabulation systems, dynamic time series processing, dynamic graphic presentation systems, etc.

37. To achieve this kind of flexibility it is necessary to provide an appropriate background database environment. Output databases and output-oriented data warehouse applications seem to be the fundament of dynamic websites of a number of national statistical offices.

38. The web technology can also be used for an active communication from the website publisher to the users. Registered users could get automatically - by using the e-mail function - information about website news. The user will be informed when and what kind of new statistical information is available. That can avoid unnecessary visits of the website. It is also possible and certainly useful to provide a service sending updated statistical data automatically by e-mail. For instance, when a data is updated in a database the updated data will be send to customers automatically when they have subscribed to such a service.

39. Data collection via Internet is another hot topic for statistical offices. It certainly does not belong to the dissemination part of statistics, but it should be mentioned at least. The collection of data is still one of big burdens and most costly. Corresponding to the development of the Internet infrastructure in the

country the use of Internet for data collection will be introduced. It can be expected that it will improve the data quality and reduce the costs. The web technology provides a new technological platform and will in the future also be used to collect data from the respondents of statistical surveys by using electronic questionnaires and other kind of interfaces to fill in data.

V. DEVELOPMENT AND MAINTENANCE ISSUES

40. In nearly all statistical offices it is today not the question whether a website should be developed and implemented or not but probably more the problems of managing websites and reengineering of existing ones. Still today printed statistical tables and publications are the most common way of a statistical office to visualise its results to the society. The Internet has started to change it and this development will continue. In a number of countries already today the website of a statistical office is the real entry point for external users. We can expect that in the future printed publications will loose some of its importance. It is the website that will be the most essential dissemination channel.

41. The development and maintenance of the website of a statistical office should not be a task only of IT-experts and special dissemination staff. The support by the high level management of the office is one of the most essential success factors. For the administration of the website of a NSO an Editorial Board could be set up with representatives from all departments that are contributing to the website. It would be a good advice to include main external users in such a board. The Editorial Board could be responsible for

- ◆ Maintenance of the content,
- ◆ Website layout,
- ◆ General structure of the website,
- ◆ General functionality of the website
- ◆ Organisation and administration of the maintenance of the website,
- ◆ Definition and specification of procedures to load and update the website,
- ◆ Technical development of the website,
- ◆ Etc.

42. It is necessary to have a clear picture about the administrative organisation of a website. But there may be also a danger to over-organise the website management. In a large organisation as national statistical offices in some cases it would normally be more efficient to have a certain distribution of responsibilities inside the office. Subject matter departments should be responsible to load the website with statistical information following the general rules agreed upon in the editorial board.

43. The website maintenance can be divided into

- ◆ The technical maintenance and development, and
- ◆ The maintenance of the content.

44. The NSO should have a clear strategy as regards the technical development of the website. The development of the Internet is very fast, both as regards the functionality and for the available power and capacities. The possible transfer rate of data via Internet is growing. Transfer rates that are hundred times faster than today will be available. That will dramatically change the possibilities to use Internet for dissemination of statistics. This developing technical infrastructure is a great challenge for statistical offices. Because this development will not be equal fast for all users at the same time - in a number of countries it will take some time, maybe some years – before new technical features are common for all users. That means that there will be users with high speed connection with for instance 2 mb transfer rate and others that still are on a normal modem speed level, for instance 56 kb transfer rate. The development of the website must take care of both types of users, which is a new dimension in defining different kind of users.

45. A strategic decision policy should express whether the statistical office will be in front of that development or follow it with a certain delay. Probably a NSO should not try to be a beta tester of all new Internet facilities, but wait until they are well established enough in the country. Such policy should be used for:

- ◆ Application of new software versions,
- ◆ Expected hardware conditions at the user's site (e.g. screens, pc power, transmission speed, etc.)
- ◆ Application of new Internet functions.

46. On the other hand a NSO should not wait too long before using new facilities. A good balance for new implementation of new developments should be kept.

47. Another important issue that has a big impact on the development and maintenance is the available human capacity of competence in the office. You need competence for:

- ◆ Website design, layout,
- ◆ Technical website development,
- ◆ Development and maintenance of the necessary IT infra-structure,
- ◆ Administration of customers relations,
- ◆ Etc.

48. Based on the strategic decisions and the available human and technical resources the use of the appropriate tools for the development of a website has to be chosen. Basically, it is necessary to decide about:

- ◆ Web server software
- ◆ Website development tools

49. Commercial software is available both for the UNIX and the Window platforms. Normally it would not be advisable to have another platform for the website as it is used for the server side of the statistical production system. In particular, the decision of the website development tools should be considered in relation to the available development resources and the level of envisaged ambition. There is a number of relatively easy to use tools available on the market that do not require very high level programming knowledge.

VI. SOME BASIC CONCLUSIONS

50. As already mentioned the development of the Internet and the whole communication structure is still in a starting phase. Although we already have seen more than one decade of development, the potential functions that can be related to the Internet will still grow very fast. The Internet technology will also have a strong impact on the whole IT infrastructure. Operating systems and application software will be more and more adapted to the Internet technologies. Probably the differences you still can see when working with Windows or Internet will more and more disappear. New operating systems will integrate the Internet approach in a much higher degree and take over the role of the basic software in our desktop computers.

51. We can also expect that the communication infrastructure in the world will evolve in the direction of a real worldwide network. If authorised, an Internet user should be able to link his computer to any other connected computer in the world. And the connection will work with high speed. That future will offer much extended possibilities for a statistical office to serve its users. At the same time that is a big and permanent challenge to adapt the new facilities, to keep the necessary competence up to date.

52. Speaking about success factors for a statistical website you should at first define what should be considered as a success. That is not so easy and the success of the website will differ from that of a commercial company. What should be measured? Some examples:

- ◆ More income for the NSO by selling statistics?
- ◆ Less printed output, because the user get it via the website?
- ◆ High frequency of visits, many users?
- ◆ Many downloads?
- ◆ Many questions and comments of the users?
- ◆ Less dissemination costs?

53. It would be recommendable to specify the goals and success criteria before implementing a statistical website.

54. What could be the most critical success factors for a statistical website? The following list should provide you with some guide.

- ◆ The users have to be in focus.
- ◆ It is important to map out
- ◆ Who are your users,
- ◆ What do they really need,
- ◆ What are they doing with statistical data,
- ◆ How do they work with statistical data,
- ◆ What are the different competence levels you can expect from your users
- ◆ The development and maintenance of a statistical website must have strong support among the management, in particular among the high level management of the statistical office.
- ◆ You have to ensure that the necessary competence is available for your office, either by your own staff or by engaging of external resources.
- ◆ The published statistical data must be consistent across the whole website.
- ◆ A flexible and consistent metadata support should ensure:
- ◆ The published statistical data must be transparent to understand by the users, any kind of misunderstanding and misinterpretation should be avoided.
- ◆ The metadata should support the comparability of data over time, i.e. historical data should be supported by metadata. That is important for time series, etc.
- ◆ It must be easy to find the wanted data inside the website.
- ◆ The user must be able to download data into his/her own technical environment. The data should be provided in well-accepted standard formats.
- ◆ The website architecture must provide an easy to understand navigation across the whole website.
- ◆ The response time must have high priority.

55. Depending on the main purposes of the website the mentioned success factors will of more or less importance. There may still be more success factors that should be included. What should be recognised is that the success of a website depends on a number of different factors and the whole website can easily fail if only one important factor fails.

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³ This reference list is not complete at all. It should be amended by proposals.