Disseminating Philippine Census Data through the Web

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by

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Abstract

The census bureau (National Statistics Office) in the Philippines publishes its voluminous data on paper approximately one to two years after the survey has been finished. NSO has later made an effort of disseminating the data in digital form. But because of inevitable bottlenecks, digital production is not much faster than publishing the data on paper. The main objective of this study is to identify and to create a suitable interface using the web as the medium between the user community and the census bureau. The major step undertaken in this endeavour started by an inventory of existing websites of the national statistical agencies or census bureaus in the world by describing the various functionalities these websites have. Then a few of these websites together with four cartographic viewers of census data were analysed meticulously, noting down their common characteristics, which were used for the implementation of the user requirement surveys and the selection of software and hardware for creating a prototype. In addition, the current situation at the NSO in the Philippines was analysed. Execution of local and on-line user requirements surveys followed. A majority of respondents in these surveys approved the implementation of the proposed functionalities in the prototype. The framework and organization of the prototype’s components were according to the following: selection of geographic/administrative area, selection of topics and selection of output format. Manifold together with OWTChart.exe were the main tools used for developing the prototype, which classifies the system hybrid. A subset of the census geo-database was used to test the prototype. To assess the efficiency and effectiveness of the prototype’s design, a user feedback survey was conducted comprehensively using the “think aloud” research method. Subjects/users were asked to undergo a comprehensive evaluation of the prototype expressing one’s thoughts verbally while executing the given tasks. After analysing the user test results, measures to improve the design were carried out. The major improvements done in this respect were the revision of the user’s guide and the reorganization of the components in the prototype’s main page.

Keywords
census data, census geo-database, census spatial database, statistical data, web dissemination, Internet dissemination, on-line dissemination, Internet mapping, think aloud, thinking aloud
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1. Introduction

1.1. Overview

A census is a survey of information on any type of entities such as people or human population, agriculture, animals, etc. A human census is a process of collecting information on the official count of the human population of a specific area of interest or country as a whole. In this study, however, the term ‘census’ should be taken subsequently as referring to people. The survey that has become one of governments’ mandates is usually conducted every five (mid-decade) or ten (decennial) years. In some respect, censuses are not taken in every country in the world, for instance in the Netherlands. In most of these countries, socio-economic and demographic data for the country as a whole are collected by the national statistical bureaus in other ways. The problems of dissemination remain the same. Therefore, whenever in this thesis reference is made to census data, this could also encompass “or other statistical data collected at national level”.

Census contains demographic characteristics (such as statistics on births, deaths, and other vital statistics on the community) and socio-economic characteristics (i.e., social and economic condition) (Gove, 1981). These characteristics are enumerated by variables or attributes—a principal component of census data. The period that the survey or census is taken corresponds to another component of census data—the time (Openshaw, 1995). Census information is collected at the household level, enumerating its individual members as well as the respective housing conditions. This is the lowest level of aggregation. With the addition of the locational information (data for a number of households living together in an enumeration area, grouped at various administrative levels), the third component of the census data is conceived—the census geography.

Before, the primary users of census data were only the central and local governments, for planning and policymaking. However, the use has been diversified to the private and business sectors, academic institutions, international community or organisations, and the public. Census data has a wide variety of applications. To name but a few: for teaching/education purposes, planning and decision-making, marketing, health/medical services, budget/funding allocation, engineering works or infrastructure, research, outreach programs or community services, information/news or mass media, Geographical Information Systems (GIS), and more.

Census data were originally disseminated on paper and in textual or tabular form. Because of its geographic component, maps may also play a useful role in the dissemination of census data, next to the help they provide to enumerators in census-taking (UN, 2000). However, for a long time census bureaus found it too difficult and, perhaps, too time-consuming to produce many post-census maps. Nevertheless, the introduction of GIS has slowly incorporated maps in the publications as effective means to present the aggregate results. In addition, GIS also facilitates analysis and dissemination of the census data, also by means of electronic media like diskettes and CD-ROMs. The maturity of
World Wide Web (WWW) technology has also brought the idea of disseminating such information through this medium. To name a few examples are the popular American FactFinder of the US Census Bureau (URL 1), the Office of Population Statistics and Census of UK (URL 3) and Statistics Netherlands (URL 11).

Web maps are maps published on the WWW. When defined, web maps are not really different from the conventional maps that are often used and seen. These are still geographic representations or abstractions of the real world, classified as general reference maps, also known as topographic maps, or representations of the derived information of one or more spatial phenomena, classified as thematic or statistical maps (Slocum, 1999). General reference maps show e.g. land use/covers, relief, administrative boundaries, hydrography, etc. Thematic maps show e.g. population densities, percentage of dwellings with electricity for lighting, etc. The roles web maps play in census data dissemination are: to simplify the process of retrieving or downloading selectively the information from the voluminous census database in the form of clickable or mouse-over maps; to provide a preview of the data prior to downloading in the form of thematic profiles from ready-made statistical maps; as mere presentations or output of the absolute or derived information produced by data manipulations; and, as a user interactive interface.

1.1.1. Value of the WWW vis-à-vis other electronic media for the dissemination of census data

WWW is a system that allows dissemination of electronic documents and data that may be residing in different sites around the world. WWW is a subset of Internet technology. Internet (also known as “the Net” (ITC, 2001a)) is a system of computer networks that is globally interconnected for the purpose of sharing resources and communication services like FTP, HTTP, e-mails, etc. Intranet has the same concept as Internet but it only refers to linked computer networks in the local environment. FTP (File Transfer Protocol) is a set of codes and conventions used for transporting of files over the network. While HTTP (HyperText Transport Protocol) is a set of codes and conventions used in the WWW.

The value of WWW over other electronic means of disseminating census data is its accessibility and actuality. Accessibility means convenience in accessing information anytime and anywhere (i.e., no geographic or political barrier, for instance). Actuality means up-to-date posting whenever there is a change of information content. A diskette is an inferior storage medium for disseminating voluminous digital collections of census data. Other storage devices like Zip, Jaz, tape, optical disk and CD-ROM will require a user to purchase and worry about installing such a device on the computer. Another disadvantage is the inconvenience of making inquiries of the availability of such data, waiting for responses from the provider and yet shouldering the expense of transferring the data to a portable device and mailing it—all in spite of, perhaps, free data. The web surmounted these shortcomings. Queries can be done right at your fingertips and the cost of acquiring the data through the web is much cheaper compared to conventional ordering. Sometimes users don’t even have to spend a single centavo to download the information.

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1 WWW and web have the same notion for World Wide Web. These terms will then be used interchangeably throughout the report.
Even though updating information electronically is far much faster than doing it in conventional ways, actuality lies on the kind of electronic medium being used for disseminating the updates. Socio-economic/demographic data are usually changing rapidly and become obsolete very quickly. Hence, in the past, it was difficult to accept that there was often a considerable time period between collection and production of the data. Producing statistical information on (say) CD-ROM does not seem practical. Production involves time and money; yet, not everyone is willing to buy the product so there is hardly a return of investment. Posting updates on the web is the most practical solution. Web providers can even make it an attractive animated website for instance in the field of demography, showing series of population growth maps linked with their corresponding age-group pyramids or, perhaps in the field of medical science, a statistical map showing the percent of infants who received inoculations/vaccinations or, probably an alerting statistical map of the relative number of still births or percent of infants who did not survive in the first year. This type of “advertisement” is something that will catch users’ attention to look over and find out what other valuable information is there.

1.1.2. Drawbacks of the WWW

The use of WWW technology can also pose some problems and limitations such as in the aspect of actuality, which becomes a problem if the data is not updated regularly. Another issue is the instability or volatility of the information on the web: what is seen in the web right now may not be there tomorrow (Koussoulakou and van Elzakker, 1997). This also happens to losing contact to other websites known as dead links or bad links. Furthermore, finding the data can sometimes be difficult due to the language barrier, wrong spelling or typing errors, inappropriate use of keywords and perhaps difficulty in understanding the terms or symbols used by website owners.

The number of users on the web is exponentially increasing which tends to congest the traffic despite the technological advancements of increasing the bandwidth and speed of the Internet highways. Technological limitations on the user’s side depend on the technology (model) of the PC, speed of the modem and telephone line or cable networks. Census data is by nature voluminous, which slows down the speed of downloading the information to the end user. Accessing, manipulating and creating presentations using this data online is also time intensive. If the speed of the Internet provider does not compensate the demand, users tend to lose their interest in accessing the website again. Even though this limitation is not just from the provider’s side but also from the user’s side, still the provider must think about how to improve the speed of data transfer. Redesigning the system will increase the efficiency of accessibility e.g. by adapting the progression of interpretable programming languages, the application of plug-ins or applets and minimizing the graphic and information content to reduce the file and image size of web maps (possibly transformed into clickable or mouse-over maps that serve as links to corresponding or other information).

Despite these disadvantages of the WWW, it is still preferred over other electronic means of disseminating census data because the limitations are not permanent like those of the electronic media mentioned in the previous section. As a matter of fact, the drawbacks can often be solved in a compromised way between the owners of the website and the users.
1.2. Census Data Dissemination in the Philippines

Up to now, the census bureau in the Philippines (National Statistics Office) publishes its voluminous data on paper. In its normal publication cycle, it takes approximately one to two years after the data collection has been finished for the interested people to get hold of a copy of this data. The information is presented in tabular or textual form with maps being used only later for providing a geographical context to the surveyed area (usually only up to the provincial level).

The census bureau has later on (sometime in mid 1990s) made an effort of disseminating the data also on CD-ROMs. However, the supplied proprietary application (IMPS 4.1, Integrated Microcomputer Processing System, developed by the US Bureau of Census (URL 8)) that is used to view the data is not generally user friendly, especially not for someone who is neither a demographer nor a statistician who has learned the techniques of using the software.

Besides, the digital production adopted is not much faster than publishing the census data on paper. An inevitable bottleneck is the pre-processing phase of the census data, which has something to do with the organization’s workflow management. Another bottleneck, an external one, is the current process of requesting for the data, which comes with its own customary bureaucracy from the census bureau. Not all potential users of census data (such as students) need all the information the census bureau can offer. Published volumes on paper and CD-ROMs sometimes tend to be overkill. Yet, the time to inquire for specific information from the census bureau is currently a constraint; one has to know where the location of the local census bureau is; one must do it during office hours; for non-demographers or social scientists, one must need a knowledgeable personnel to guide him/her during the process of inquiring and/or requesting the data; in case of people making inquiries by telephone, one has to either be on queue or make several attempts to be connected; furthermore, even after the inquiry, the delivery of the data is very slow.

So, paper and CD-ROMs are one of the types of carrier for disseminating census data in the Philippines. The Internet is however another type of carrier and has potential advantages over other types of carrier due to its inherent characteristics such as accessibility and actuality. Since the current means of dissemination in the Philippines exhibit a lot of constraints and are obviously not efficient; and with the increasing number of Internet/WWW users in the country, the idea was to use the Internet as a medium for disseminating the census data in the Philippines.

1.3. The Problem

It is clear that there are bottlenecks in acquiring and disseminating census data from the census bureau. This research will focus on tackling only the external bottleneck, that is the one between the user community and the census bureau. With all sorts of bureaucracy in the organization, tackling the internal bottleneck would introduce a lot of circumstances beyond the researcher’s control, which might not be feasible to deal within the MSc thesis period.
1.4. **Objectives of the Study**

So far, only a few census organizations from developed countries had established this kind of information system. To cover the cost of distribution and setting up the infrastructure, the information is made available to the public at minimal cost. However, basic socio-economic and demographic attributes are often made available without cost for demonstration purposes. Setting up a fast access system with off-the-shelf software (e.g., dedicated Internet map server software), may not be the most cost effective and practical solution to this problem as the software may be quite expensive or perhaps, considering the existing database structure presently used, too radical to be of sensible use for census bureaus in developing countries such as the Philippines. In this respect, the aim of this research is to develop a generic web based system utilizing as much as possible whatever existing resources are available at the National Statistics Office of the Philippines and a design that is based on the users’ preferences. It is envisioned that such a system will run quite efficiently even with the most inferior computer platform at the user community side.

Therefore, the objective of this study is **to identify and to create a suitable interface** using the web as the medium between the users of census data and the census bureau (see Figure 1.1); a system that will:

- Speed up data dissemination and retrieval
- Simplify the inquiry process
- Offer cartographic and other user-friendly means for data retrieval
- Provide live, "dynamic" and up-to-date data with continuous access
- Implement a geographic visualization protocol for the exploration, analysis and presentation of the census data
- Offer different functionalities to explore the database prior to downloading from the census bureau
- Run on standard computer platforms/configurations at the users’ side
- Maximize the available resources at the census bureau

![Figure 1.1](image_url) **The objective is to develop the interface between users and producers of census data**
1.5. Methodologies and Structure of the Report

To attain the objectives of this study with a good scientific background, the research started with some reviews of literature related to census and other statistical data dissemination through the web, web map use and methodological researches on effective designs (i.e., user interfaces) for disseminating spatial data in general. Furthermore, an inventory of existing websites of national statistical agencies worldwide or census bureaus in particular will be conducted to find out what has been done already in terms of disseminating data in general and in terms of disseminating census data. The inventory resulted in a description of various functionalities these census websites have, which may be found in Chapter 2. Then a few of these websites will be analysed meticulously together with some software tools that are publicly accessible on the web for visualizing census data.

Chapter 3 is a report of the analysis of the situation at the National Statistics Office (NSO) in the Philippines. This is the next goal of this research: to determine what its current activities and services on the web were, the available computer-related resources and its future plans on enhancing the dissemination of the census data through the web. In the same chapter, a report on the formulation of the questionnaires and execution of the user requirements surveys will follow. The importance of this endeavour is to find out: the census data users’ awareness of the acquisition and use of this data and other statistical data provided by their respective census bureaus or national statistical agencies; the current computer platform or configuration of the user, which will be used as one of the criteria for selecting the software and hardware; the literacy of the user, which will influence the design of the prototype’s user interface; and the approval of the proposed functionalities from the users (or respondents), which are identified in Chapter 2. Two kinds of surveys will be executed for the purpose of having well diverse user groups coming from different disciplines and places (i.e., countries of origin). One, to be conducted at the researcher’s home place using the conventional survey method and the other one at ITC in a manner of an on-line or web-based survey. The results from the surveys will be analysed and are presented in Chapter 4 as the conceptual framework.

This chapter begins with the description of the conceptual model of the web-based prototype for the dissemination of the Philippine census data, followed by the selection of software and hardware as tools for developing the prototype. The preparation of the census spatial database and the realization of the prototype are also technically documented in this chapter including all problems and limitations encountered.

Chapter 5 documents the first test round of the prototype, which is comprehensively evaluated by some respondents from the previous survey, who signified to participate in the activity. The rationale of the “think aloud” research method that is used in this survey is also documented. Then, an analysis of the feedback on the efficiency of the prototype’s design obtained herein will be conducted, documented and will later be brought up as one of the recommendations in Chapter 6 which also contains a summary of the conclusions of this research.
2. Existing Websites of Census Bureaus

2.1. Introduction

This chapter will report on what is there already in the world in terms of disseminating census and other statistical data in general and in terms of disseminating these data through the WWW. A description of the functionalities of more than 120 websites of census bureaus worldwide is provided first. A very few websites from the table were selected for further analysis and evaluation, together with some commercial and academic websites. The website of the National Statistics Office in the Philippines will also be accounted and analysed herein. The rationale of this undertaking was to facilitate the identification of the functionalities, which would be proposed first in the user requirements survey (Chapter 3) and the formulation of a list of possible software and hardware that would be used as one of the tools for developing the prototype (Chapter 4).

2.2. Description of Census Bureaus’ Websites

To ascertain on what has been done already all over the world, an investigation of 121 websites worldwide was conducted. These websites are recognized as the websites of the census bureaus or official statistical agencies of the different countries in the world that primarily provide census data (population and housing) and other statistical data (such as economic, labour or employment) for the country as a whole. However, the investigation was focused mainly on the dissemination of census data. The following (in boldface) are used as criteria for describing each website as to what built-in functions it has, the use of maps and the complexity to access the database. These criteria, which reflect of course the possibilities of use, were also used as column headings in Table 2.1:

1. **Official national language.** One of the factors that countries are different from one another is the commonly spoken language or dialect (see Figure 2.1). It is useful to find out if the respective websites are publishing the information in its own language. This reflects that the website is directed towards users who live in the country itself.

2. **English language.** This is the language that is universally spoken, understood or used as a medium of instruction by many professionals and students worldwide. So it is good to find out if the website has an English version (see Figure 2.1). This may be a reflection of the fact that the census bureau also wants to make the census data accessible to users outside the country.

3. **Other languages.** Some countries use or adopt more than one (foreign) language. For example, in Belgium Dutch, French and German are languages spoken by substantial parts of the population. On the other hand, there are also websites giving access to foreigners who do not speak English, but another language such as Spanish or French (see URL 24).
4. **Does it have a keyword search?** Not all websites are organized in a comprehensive way (i.e., fitting to all levels of users). A web page may be overwhelming or complicated enough to find the information the user needs. With the help of a keyword search engine, one can be guided through (see the upper left corner of Figure 2.2).

5. **Census data retrieval format: Textual, Tabular, Chart, Presentation map.** This function describes how the census data is pre-formatted or presented on the web when the user retrieves the information from the census bureau’s on-line database (see Figure 2.2).
6. **Data download capability.** This is an important function to find out if the website has options for users to download the previewed data (see Figure 2.3) especially the tables and text in a format (e.g., .xls, .dbf, .pdf) that can be imported or interpreted directly by another program (e.g., MS Excel, or a GIS package like ArcView).

![Figure 2.3 Screenshot of a download option of the census data](Source: URL 1, October 2001)

7. **Census data retrieval cost:** Free, Registration required, Other methods of payment. In many countries in the world, the expense of collecting census data is normally taken from public funds (i.e., indirectly from income taxes). Thus, published census data are considered public property and, may therefore be available for free in many countries. However, to cover the cost of distribution (Groot, 2001; Kabel, 2000), such as publications and setting up an infrastructure for disseminating the data, the data may be made available to the public at minimal cost. This could either fall under other methods of payment (e.g., acquiring the published results on paper), subscription or both.

8. **Geographical differentiation/levels of aggregation:** 1st level-National, 2nd level, 3rd level, 4th level. This section describes at which administrative level the census bureau is publishing its data on the web. Since each country uses different terminologies for different administrative levels (i.e., geographical boundaries), a generic term is employed to avoid confusion.

9. **Individualized output of census data:** Tabular, Chart, Thematic map, Interactivity. This section describes the website’s availability to provide individual on-line data preparation to the user and how the result is presented on the web. Tabular, chart and thematic map items are types of individualized output in static form, while interactivity identifies the possibility for the user to change the current displays (e.g., changing the legend) of the static presentation. In a thorough analysis of a few selected websites, this functionality will be analysed further as to its flexibility to switch between different output display formats or static presentations, items in the legend, etc. (see Table 2.2).
10. Geographical or map interface for census data retrieval. This section indicates the availability of a web map interface for census data retrieval to define the geographical extent of the data such as clicking on the areas of interest or drawing a box around it (see Figure 2.4).

(a) two options of selecting administrative areas of interest: by means of a clickable map (left) or hyperlinks of the different administrative names (right) (Source: URL Australia, October 2001)

(b) three options of selecting administrative areas of interest: by means of a clickable map, drawing a box on the map or drop-down list (‘Locatie’ section) of the different administrative levels (Source: Cartographic viewer of Statistics Netherlands, URL 11, October 2001)

Figure 2.4 Screenshots of web map interfaces for census data retrieval
**Table 2.1 Tabular Description of the National Statistical Offices/Agencies’ Websites**

See “Table 2-1.xls” workbook (MS-Excel)

NOTE: To maintain the proper layout of “NSO table” worksheet, it must be printed on an A3 paper, in landscape orientation, with a scale of 67% and at 300 dpi using HP5si-1007 (CAI office).
Please replace this with page 2 of Table 2.1
2.2.1. Descriptive summary

121 Websites of census bureaus worldwide were identified (see Figure 2.5), collected and analysed. However, 5 of these sites were inaccessible up to the last attempt in October 2001. Table 2.1 depicts the availability of functionalities by means of dots and were basically described based on its English version page and the researcher’s ability to decipher the information and functionalities if the website does not have an English version. This summary is classified in three sub-sections: the opening interface, which groups columns 1-4 of the table; retrieval of the census data, which groups columns 5-9; and, the geographic functionality in column 10.

Figure 2.5 World map depicting countries with census bureaus with a website (shaded countries)

The opening interface

Among the sites that have been successfully accessed (116 in total), 83% are publishing using its official national language. This identification was made possible with the help of the Central Intelligence Agency’s (CIA) website, “The World Factbook 2001” (URL 4). Although for some countries listed in that factbook wherein more than one language are found to be widely spoken but no official language is indicated, a choice is made such that if the website publishes its information in a language other than English aside from having an English version or none at all, the ‘official national language’ cell in the table is marked. It is discouraging for a user coming from an international community to find out that only 81% of these sites publish in or have an English version page. Most of the websites that do not have an English version are countries in Latin America. There are 15% websites that have another language version. A website that has keyword search functionality is an advantage, for one can be guided through the right information link or page in that website despite its possible complexity; however, only 37% have this functionality.
Retrieval of the census data

In terms of retrieving the census data, 36% of census bureaus websites present or organize the information in textual form (analytical), 92% as tables, 49% in graphical or chart form, but only 19% present it in thematic/statistical map form. The latter indicates that the possibility of the use of maps has not been explored yet or employed by most of these agencies. As a matter of fact, only 5(4%) countries have used all the possible formats the census data can be organized or presented in when retrieved. A tabular format is customarily how the census results are presented and only 22 (19%) countries have used this retrieval format in combination with the use of maps. Most websites don’t give options to users to download the data directly to a portable format (such as .xls, or .dbf). So far, only 30% were found to have offered this functionality. In terms of the cost of retrieving the data, most countries (88%) disseminate the basic census information freely on the web. However, for acquiring other census- and statistical-related publications either in digital or paper form, other methods of payment were offered. Some websites have a statistical data bank or database for on-line data analysis or individual data preparation. However 8% of these require one to first login to their system before one can gain access to their databases. As to the result or static presentation of this operation (i.e., from on-line data analysis and/or preparation), 13% of websites present it in tabular form, very few of 2% and 3% present in chart and thematic map forms respectively. In terms of the level of data aggregation, surprisingly only 89% of the websites publish census data on national level (one would expect 100%) although from other levels of aggregation one can manually summarize the results to its national level. Only 3% of websites have given the users an interactive cartographic display or visualization. This is a function where one can change map displays and the like. Moreover, this functionality is one of the bases for picking a few websites from the list for further analysis.

Geographic functionality

Based on the findings on the use of maps in the previous sub-section or paragraph, the number of websites has gone down to 18% that have a geographical or map interface as a utility to find and select data. This can be in forms of clickable maps, click-over or dragging the mouse to define a box/area of interest, both methods, and more.

2.2.2. Closer analysis of selected websites including that of the Philippines

After assessing the availability of the functionalities offered by the national census bureaus worldwide, a selection of four websites aside from the Philippine NSO (also see Section 3.1.3) was made for further analysis. These are Israel’s Central Bureau of Statistics (CBS), Statistical Office of the Republic of Slovenia, Statistics Sweden (SCB), and the United States of America’s Census Bureau’s American FactFinder. In this analysis, a critical evaluation was made on how a particular geographical or administrative area and a particular topic or subject are selected; how previous census data may be retrieved; what kind of on-line data analysis or individual data preparation is offered; whether there is flexibility to switch or change from the default output display; whether items such as gallery, annotation, classification and colour scheme may be changed in the standard presentation, and lastly, the software and hardware used to set up the infrastructure. But then again, the choice was also based on the availability of the interface in its English version. In addition, four publicly accessible cartographic viewers of census data were included in this analysis, namely: CIESIN Demographic Data (DD) Viewer, Descartes, Cartographic Data Visualizer (CDV) and the Statistics Netherlands’ Buurt in Beeld (see URL 5, URL 7, URL 2, and URL 11 respectively). CIESIN DDViewer demonstrates the use of 220 demographic variables from the 1990 US Census. Descartes in this respect uses a Leices-
tershire sample census dataset\(^2\). While CDV uses a sample dataset from 1991 UK Census Area Statistics. Buurt in Beeld (Neighbourhood in the Picture when translated to English) of the Statistics Netherlands is a web-based cartographic viewer of the statistical information at the country’s district and neighbourhood/local level, which unfortunately is published in Dutch only. Among the four additional items, only CDV is a single-user application; however, there is an online or web-based facility of this version that was provided by Manchester Information Datasets and Associated Services (MIDAS) but is only exclusive to registered academic institutions in UK.

A table to summarize the analysis is presented underneath (see Table 2.2). In terms of retrieving the census data, all of the selected websites are publishing it in an accustomed format—as tables. Analytical texts, charts and maps are not as often employed as the tables. One will definitely wonder why some of the selected websites were still evaluated further then. For some reasons, Israel has a sophisticated interface (found under the website’s GIS section) for manipulating the data and maps together. On the other hand, Slovenia was nevertheless chosen for its good way of rendering its statistical database to the public. Above all, the selected websites including that of the Philippine NSO are disseminating the data on the web for free. In terms of its capability to provide on-line data analysis or individual data preparation which will yield a static output format, the selected websites present the output in tabular form, none in chart form, and only Israel, Sweden and the United States have the capability to present the output in thematic map form. All of the selected websites and the Philippine NSO have a geographic capability for selecting particular information from the census (see Table 2.2). With regards to interactivity (4th item in column 9 of Table 2.1), only Israel, US and Sweden have interactive cartographic display/visualization functionality.

Table 2.2 shows that the selection of a particular geographical or administrative area is commonly performed by means of clickable map, hyperlinks and/or drop-down list. On the other hand, the common methods used in the selection of a particular topic are in a form of drop-down list and hyperlinks. With regards to retrieval of previous census data, only half of these websites have this functionality and generally in the form of drop-down lists of subjects and period. Most of the selected websites have a ‘simple’ function (i.e., tally according to category) of on-line data analysis or individual data preparation and by means of drop-down lists of subjects or census variables. In the same manner, only Israel offers a statistical function, whereas Slovenia and Sweden provide the functionality for time-series analysis. In terms of flexibility to switch between output displays, only the US has provided the functionality where one can switch between tabular display and map display. With regards to flexibility to change the gallery of the standard presentation, only Sweden among the selected census bureaus websites and the four cartographic viewers offers this functionality. For the flexibility of changing the annotation, Israel, US, CIESIN DDViewer and Descartes have the functionality. However, the majority of the selected websites provide the functionality to change the current classification method or the number of categories and the colour scheme of the current display/presentation. All these characteristics were the basis for identifying the possible functionalities of the prototype; firstly, in a manner of proposed questions in the user requirements survey (refer to Chapter 3).

\(^2\) An alternative URL at http://borneo.gmd.de/and/java/iris/ (or see URL 6) can be used to try other sample datasets.
Table 2.2 Characteristics of Five Selected Websites and Four Cartographic Viewers of Census Data

<table>
<thead>
<tr>
<th>Name of the Census Bureau/Software Program</th>
<th>Selection for a particular geographical area</th>
<th>Selection for a particular topic</th>
<th>Retrieval of previous Census data</th>
<th>Cartographic data on individual data presentation</th>
<th>Flexibility to switch or change the output of display format</th>
<th>Flexibility to change the standard presentation of cartographic data</th>
<th>Data source</th>
<th>Software &amp; Hardware Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Israel's Central Bureau of Statistics (CBS)</td>
<td>only specific site on socioeconomic level</td>
<td>list of subjects or topics in hypertext</td>
<td>fixed format with a flexible period on deep-down list</td>
<td>yes (previously chosen for details)</td>
<td>not supported</td>
<td>method covers only the main variables</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Philippines National Statistics Office (PSO)</td>
<td>at the regional level, then the level too specific for a clickable map and hypertext to access the provincial and municipal level statistics</td>
<td>list of subjects or topics in hypertext</td>
<td>fixed format with a flexible period on deep-down list</td>
<td>not supported</td>
<td>method covers only the main variables</td>
<td>not supported</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Statistical Office of the Republic of Slovenia (SORS)</td>
<td>clickable map, dropdown list, with own legend</td>
<td>list of subjects or topics in hypertext</td>
<td>subject to fixed format with a flexible period on deep-down list</td>
<td>yes</td>
<td>supported</td>
<td>method covers only the main variables</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Statistics Sweden (SB)</td>
<td>clickable map that will show the information of the chosen area</td>
<td>list of subjects or topics in hypertext</td>
<td>fixed format with a flexible period on deep-down list</td>
<td>yes</td>
<td>supported</td>
<td>method covers only the main variables</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>United States Census Bureau’s American FactFinder</td>
<td>clicks on selection methods (state, county, city, etc.) with deep-down list, fixed map, hypertext and clickable map linked to data</td>
<td>list of subjects in hypertext</td>
<td>fixed format with a flexible period on deep-down list</td>
<td>yes</td>
<td>supported</td>
<td>method covers only the main variables</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Statistics Netherlands (CBS)</td>
<td>clickable map, zooming &amp; scrolling box on the map and clickable links with a choice of an area at the district level</td>
<td>list of subjects in hypertext</td>
<td>fixed format with a flexible period on deep-down list</td>
<td>yes</td>
<td>supported</td>
<td>method covers only the main variables</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Czech Statistical Office (CSU)</td>
<td>clickable map, three on the list</td>
<td>list of subjects or topics in hypertext</td>
<td>fixed format with a flexible period on deep-down list</td>
<td>yes</td>
<td>supported</td>
<td>method covers only the main variables</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Data source Exploring Location and Census Dataset (CVS)</td>
<td>clickable map that will show the chosen area on the corresponding map</td>
<td>list of subjects or topics in hypertext</td>
<td>fixed format with a flexible period on deep-down list</td>
<td>yes</td>
<td>supported</td>
<td>method covers only the main variables</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Cartographic Data Viewer (CDV)</td>
<td>clickable map over the map</td>
<td>list of subjects or topics in hypertext</td>
<td>fixed format with a flexible period on deep-down list</td>
<td>yes</td>
<td>supported</td>
<td>method covers only the main variables</td>
<td>yes</td>
<td>no</td>
</tr>
</tbody>
</table>
As to the hardware and software these websites used, there are various kinds of computer hardware configurations. Three websites use the commercial top-of-the-line ESRI’s ARCIMS software, two use Java applets, and one proprietary or non-commercial web map server program for Internet mapping. Many selected census bureaus websites use Microsoft-based operating systems (such as Windows NT) for running web services. This information contributes very much as resources for a prospect list of possible software programs that may be used as one of the tools for developing the prototype (see Section 4.2.1).

2.3. Concluding Remarks

A general investigation of 121 websites worldwide was conducted according to its respective ways of disseminating the census data on the web, such as built-in functions, concept of map use and complexity of accessing the database, which was described comprehensively in Table 2.1. Then a closer look at a few selected websites, which were found to have catered more functionalities as well as at the Philippine NSO and four publicly accessible software programs as cartographic viewers of census data was carried out. The websites that were analysed further were Israel’s Central Bureau of Statistics, Statistical Office of the Republic of Slovenia, Statistics Sweden, and the United States of America’s Census Bureau’s American FactFinder. The cartographic viewers that were evaluated were CIESIN Demographic Data Viewer, Descartes, Cartographic Data Visualizer, and Statistics Netherlands’ Buurt in Beeld. As seen in Table 2.2, the characteristics of the selected websites, the Philippine NSO, and the cartographic viewers were focused on: the selection of the geographic/administrative area, selection of topics, retrieval format and flexibility, interactive function, and the software and hardware used. These characteristics were the basis for identifying the functionalities in the prototype, which were then tested as proposed functionalities in the form of questions in the user requirements survey (Chapter 3). On the other hand, the information on software and hardware used by these websites and the four cartographic viewers contributed very much as resources for coming up with a list of possible software programs that might be used as tools for developing the prototype (see Section 4.2.1 in Chapter 4).
3. Situation Analysis and User Surveys

This chapter will begin with an analysis of the situation of the Philippine National Statistics Office (NSO), which will elucidate its current activities and services on the web, its available computer-related resources and their future plans on enhancing the dissemination of the census data through the web. Then the next section will discuss about the design of the questionnaire and the implementation of the survey, followed by the presentation of the analysis of the results from the survey. Two kinds of user requirements surveys were executed: one in the Philippines using a conventional survey method and the other one at ITC in a manner of an on-line or web-based survey. The rationale was to find out from a well diverse groups of users coming from different disciplines and corners in the world (i.e., countries of origin) the various functionalities they need and/or require.

3.1. Situation Analysis of the Philippine National Statistics Office (NSO)

3.1.1. Background

The NSO in the Philippines is the recognized official statistical agency of the country. Its mandate is to conduct statistical surveys by enumeration, sampling, studies, projections, etc., on all censuses of population, housing, agriculture, commerce/economic, and industry; compile civil registry documents and other statistical data and information from other statistical agencies; solemnize civil-related registrations (e.g., birth certificates, marriage); assist/coordinate other statistical agencies and institutions; and, produce, publish and disseminate general purpose statistics to government departments, government bureaus, local governments, commercial/private sectors, international community, academe, research institutions, media, and most of all the general public.

In the Philippines, census (although considered a rough survey or just estimates) started as early as 1570 when the Spanish started colonizing the country (for 333 years). However, the acquisition of the detailed census (Census of Population and Housing) was first carried out only in 1903. NSO officially became an entity on 19th of August 1940 under Commonwealth Act (C.A.) No. 591 as Bureau of the Census and Statistics (BCS). It was then renamed to National Census and Statistics Office (NCSO) before it became known under its current name and came under the administrative supervision of another government organization, the National Economic and Development Authority (NEDA).

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3 Sections 3.1.1 and 3.1.2 are mainly derived from the “About NSO” section of the NSO website (see URL 10).
3.1.2. Activities and services

The following are NSO’s detailed current activities and services:

− conducting of census surveys on population and housing, agriculture and fisheries, establishments (its economic activities), and buildings

− carrying out of socio-economic household surveys on labour force, national health, national demographics, family income and expenditures, Filipino overseas workers, household operated activities, and functional literacy, education and mass media.

− carrying out of industry and price surveys for Consumer, Wholesale and Retail Price Indexes (from its weekly and monthly price surveys), its monthly, quarterly and annual survey of establishments, its annual survey on construction projects of local governments, and the quarterly survey on employment and compensation nationwide.

− providing administrative-based statistics on foreign trade, domestic trade (commodity flow), private building construction generated from building permits database, and vital statistics generated from birth, death, marriage certificates.

− conducting economic and social studies such as construction of life tables, aspects in migration, fertility, mortality, projections, etc.

− issuance and/or authentication of civil registry documents such as birth, death and marriage certificates.

Detailed census and other statistical data are currently made available to the users in the form of printed reports. In addition, census data is also made digitally available on diskettes and CD-ROMs but only for censuses gathered from 1990 onwards. Users who have special arrangements with NSO (such as collaborative projects) may acquire the data in other ways than the accustomed mode. On the other hand, a summary or overview of census and other statistical data is also made available at NSO’s website. A detailed census survey is executed every ten years (decade) and is collected at the lowest administrative level, the Barangay (formerly known as Barrio). Then again, an inventory of the total population in the country is conducted every five years (mid-decade) and also at the lowest administrative level. The levels of data aggregation are distinguished in the Philippines according to its administrative and legislative levels (see Table 3.1 and Figure 3.1). For other statistical data, the period of data collection and the level of aggregation depend on the subject of interest. For example, labour force statistics are collected quarterly and at regional level, while consumer price indices are collected monthly and also at regional level.
Table 3.1  A hierarchical list of administrative and legislative levels in the Philippines

<table>
<thead>
<tr>
<th>Level name</th>
<th>Level type</th>
<th>Aggregation information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire Country</td>
<td>Administrative</td>
<td>Highest level of aggregation</td>
</tr>
<tr>
<td>Region</td>
<td>Legislative</td>
<td>Group of provinces (see Figure 3.1a)</td>
</tr>
<tr>
<td>Province</td>
<td>Administrative</td>
<td>Group of municipalities or districts (see Figure 3.1a)</td>
</tr>
<tr>
<td>District</td>
<td>Legislative</td>
<td>A group of municipalities that constitute a congressional district</td>
</tr>
<tr>
<td>Municipality</td>
<td>Administrative</td>
<td>A cluster of barangay constitutes a municipality (see Figure 3.1b)</td>
</tr>
<tr>
<td>Barangay</td>
<td>Administrative</td>
<td>Lowest level of aggregation (see Figure 3.1b)</td>
</tr>
</tbody>
</table>

Figure 3.1  Maps of different administrative and legislative boundaries in the Philippines

3.1.3. NSO on the web

On-line services
The NSO established its website in May 1, 1997 (see Figure 3.2). Since then the bureau has been disseminating through the web the census and other statistical information as one of its services to the public. It was only recently that the bureau started employing the concept of maps on the web. However, this use of maps only serves as an alternative selection in a form of a clickable web map for retrieving geographically statistical information of the lower administrative level (provincial) (see Figure 3.3).
The most recent service NSO has put on the web is the facility to request for civil registry documents such as birth and marriage certificates. The service is called *e-Census*, which minimizes the amount of legwork instead of spending time queuing or waiting to be serviced by an NSO staff. NSO has also put a list of publications in any format and/or media one can order through the web. For most requested statistics, NSO has put up a Quickstat section where one can be updated monthly on the most recent foreign and domestic trade figures, labour and employment statistics, population, etc. Another interesting section NSO has on the web is the Sectoral Statistics where the country’s statistical information is organized in a comprehensive way (indexed). With regards to census related information published in this section, only an overview of the country’s vital statistics is provided as a whole, or by regions including its provinces and major cities, or even down to the smallest administrative or aggregation level, the barangay4. Typically, an overview of the country’s vital statistics contains only three demographic variables (total population, number of households and average household size) except for Census 2000, which contains about seven demographic variables.

4 The publication of population counts in barangay level was only for the year 2000 survey.
The infrastructure
The connection to NSO’s website has a magnitude of about 64Kbps (kilo-bits per second) line. The web server is ran by Microsoft’s (MS) Internet Information Service (IIS) version 4.0 under the operating environment of MS-Windows NT 4.0 on a Pentium III computer with 128 MB (Mega-bytes) of memory (RAM) and 9 GB (Giga-bytes) of harddisk space.

NSO’s Future plans
For NSO’s mapping activities, ArcView software is being used. However the software is limited to run in a local environment only. And web maps are normally used only as an alternative means to retrieving prepared census results as previously been cited in this section. Though NSO has aspiration to enhance its dissemination of census and other statistical data, the present hindrance is allotting of funds and a good feasibility study on putting up such an infrastructure on the web. This desire came out of a general survey that is regularly conducted to clients visiting the NSO library. With regards to clients visiting their website, NSO does not have the facility yet to conduct an on-line survey. They only get comments and suggestions from clients who signed on their on-line guest book. In this respect, designing and implementing a customized survey was one of the scopes of this research—to determine the users requirements (and wishes) for making better the dissemination through the web of the census data in particular.
3.2. The Questionnaire

To be able to identify the most desirable functionalities for creating a suitable interface between the users of the census data and the census bureau (NSO) using the Internet/WWW as the medium, a survey was required. Two versions of a questionnaire was formulated in this survey to fit in to two different target groups: local users of census data in the country (the Philippines) and possible other users of census data recruited from students and staff in the ITC community and from professionals coming from different government agencies in the Philippines with Internet connection. So, there is a ‘Philippine version’ and an ‘ITC version’ of the questionnaire respectively.

Formulation and design of the questionnaires

The questions that were formulated may be classified as follows: user’s awareness of the acquisition and use of the census and other statistical data provided by its respective census bureau or national statistical agency; the current computer platform or configuration and literacy of the user; and, the researcher’s proposed functionalities or dissemination method and the use of maps on the web. The following were proposed functionalities obtained from the common characteristics identified in Table 2.2: flexibility to select data for a particular geographical or administrative area; flexibility to select a particular topic of interest; flexibility to choose the format of how census data be presented or organized such as tables, plain text document, graphs or statistical maps; flexibility to choose the method of retrieving or downloading the census data such as print the data on paper or download to a local harddisk or diskette; and flexibility to interactively change the default presentation (tables, plain text, graphs, maps) or design on-line an individual presentation or visualization using the census data without any need to install additional software/program/plug-in in the computer. For the ITC version, the name of the user’s country of origin was asked for the purpose of segregating and analysing afterwards the responses based on countries. Another difference between the two versions is the addition of hyperlinks (URLs) in the ITC version, which will serve as visual aids to the questions being raised respectively. Tick boxes and very few scribbles were employed to minimize the respondent’s time filling in the questionnaire; as a matter of fact, the design of the questionnaire is made in a way that it would be self-administered. The two versions of the questionnaires are attached in Appendix A for reference.

Survey implementation

As mentioned earlier in this section, there were two target groups in this survey. It was decided that the first group would consist of a sample of fifty (50) respondents, which would be collected from the researcher’s home place in Cebu City, Philippines. Typically the prospects must be coming from different organizations and/or institutions and with different educational attainments for a good diversity of census data use. On the other hand, it was not feasible to determine the sample size and possible respondents of the second group in the ITC community. Therefore, an on-line survey was decided for convenience of collecting the data and to take advantage of the Internet/Intranet technology in ITC. The following four alternatives for making the survey possible in electronic form were considered: using QDesigner version 3.21 (Question Mark Designer) which is also used by the Educational Affairs department of ITC; as an ASP (Active Server Pages) document using Dreamweaver Ultradev version 4.0, which can easily be published on ITC’s Intranet; using the system called Blackboard that is used in ITC’s distance learning program; and Metanomix by Etin Adviseurs (see URL 9), a Dutch company that specializes on surveys via Internet. All alternatives were assessed according to their ease of use and the cost of publishing the survey on the net. Despite QDesigner’s user-friendliness, it lacks the
ability to include hyperlinks in the questionnaire and yet, one has to run the program locally by copy- 
ing first the attached link file to the desktop computer. Regarding ASP, it was noted that creating an interface for a questionnaire is time consuming because it involves a lot of programming and yet, putting a writable database was not possible at the researcher’s side for security reasons imposed by ITC. As to the Blackboard system, putting an on-line survey beside ITC’s running distance learning program was possible; however, it was only possible for one to login to the system anonymously which would only overwrite the previous response. With regards to putting up the survey on-line using Metanomix, the company volunteered to do the dirty job at no cost. Therefore, the choice was made to publish the ‘ITC version’ survey through the goodwill of Metanomix. The company’s strategy to make money is to translate the customer’s survey specifications to a set of web pages and design a corresponding database for storing the responses, which both are residing on the company’s web server. Then the customer can get hold of the database (provided by respondents of the survey) in a format that the customer desires (e.g., MS Excel worksheet). On the other hand, the researcher’s home office, the Office of Population Studies (OPS) of the University of San Carlos, took the dirty job of personally conducting the other survey in the Philippines under the researcher’s supervision. Here, the survey method was conventional wherein OPS produced the questionnaire on paper, then distributed to 50 respondents and were collected back.

3.3. Analysis of the Results

Since there were two forms of survey, the results came in different formats. Metanomix delivered the database in MS-Excel format containing all the responses from the ‘ITC version’ survey, whilst OPS sent the completed questionnaires in paper form, which had to be encoded in the computer. The database that was sent by Metanomix was reorganized and recoded prior to running the marginals for analysing the survey results.

3.3.1. Analysis of the results from the on-line survey

A total of 192 participations were recorded in the database however, only 56 cases/observations were considered completed and/or valid for analysis. The other 136 were discarded because these were not completely filled in by the respondents. A summary of respondents’ countries of origin is described in Table 3.2.

Since the representation from each country is not enough and logical to be analysed individually, a grouping of two is proposed, one from the Philippines and one from the rest of the participating countries, with a corresponding population of 21 and 35 respondents. Most of the respondents from the Philippines are statisticians (19%), development planners (29%) and as part-time researchers/scientists (19%). These only indicate that most of these respondents may be working in the government, which was also confirmed when 86% of these respondents replied that the type of their organization is government. With regards to the rest of the respondents in the survey (the other group), 20% are partly working as teachers, 37% as part-time researchers/scientists, 17% as part-time development planners and 17% as part-time engineers, which was logical when most of these respondents replied that they are either coming from academic institutions (31%) or government organizations.

5 Part-time in the sense that the respondent indicated more than one type of profession he/she is practicing back home.
Table 3.2  Number of valid respondents of the on-line survey and countries of origin

<table>
<thead>
<tr>
<th>Country</th>
<th># of respondents</th>
<th>Country</th>
<th># of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>1</td>
<td>Malawi</td>
<td>3</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>1</td>
<td>Malaysia</td>
<td>1</td>
</tr>
<tr>
<td>Bhutan</td>
<td>1</td>
<td>Mexico</td>
<td>1</td>
</tr>
<tr>
<td>Brazil</td>
<td>1</td>
<td>Mongolia</td>
<td>1</td>
</tr>
<tr>
<td>Cameroon</td>
<td>1</td>
<td>Netherlands</td>
<td>6</td>
</tr>
<tr>
<td>Colombia</td>
<td>2</td>
<td>Philippines</td>
<td>21</td>
</tr>
<tr>
<td>Egypt</td>
<td>1</td>
<td>Puerto Rico</td>
<td>1</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>1</td>
<td>South Africa</td>
<td>1</td>
</tr>
<tr>
<td>India</td>
<td>2</td>
<td>Sri Lanka</td>
<td>2</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2</td>
<td>Uganda</td>
<td>1</td>
</tr>
<tr>
<td>Israel</td>
<td>1</td>
<td>Vietnam</td>
<td>2</td>
</tr>
<tr>
<td>Japan</td>
<td>1</td>
<td>Zambia</td>
<td>1</td>
</tr>
</tbody>
</table>

67% of respondents in the Philippines have used census data for more than 5 years now while 19% are between 2-5 years and the use of the data is for planning/decision-making and for GIS applications. As to the other group of respondents, more than half have used the data for more than 5 years also and 20% are also between 2-5 years. The use of the data is primarily for teaching or educational purposes, planning/decision-making, research and GIS. When the respondents were asked as to whether their respective census bureaus are maintaining a website, 95% in the Philippines said yes as opposed to only 49% from the other group. In this other group, 43% has denied the knowledge of an existence or maintenance of a census data website in their country. Downloading the data directly from the Internet, by personal/direct appearance and from published books/materials are the common means of acquiring the census data in the Philippines whilst the two latter were how census data are acquired based on most of the responses from the other group. The majority of both groups (62% from the Philippines and 60% from the rest) said that the census data is still in paper form when acquired. 91% of the respondents in the Philippines said that contacting or reaching the census bureau is not a problem at all while only 49% from the other group agreed and the rest either said no or has declined to the question. In terms of the cost of acquiring the census data, 43% in the Philippines said it’s free and 38% said that a fee is only for the distribution/copying fee. In the other group, 40% said that the data is free for acquisition and a fair distribution of responses said that there is a fee incurred. Most of the respondents from both groups said that the census data is still organized, disseminated or presented in tabular form when they acquired it. When asked whether one still needs an expert help or a knowledgeable person to guide him during the process of inquiring and/or requesting for the data, the majority of both groups said no.

In terms of accessibility to computers and Internet back in the respondents’ respective home countries, most of the respondents in the Philippines said that they gain access at work (office) and at the Internet or computer café/kiosk/shop while the majority of the other group said that in addition to the latter (the two), they have computers and internet connection at home too. With respect to the respondents’ computer literacy, majority of both groups are on the average level. There are a fair number of respondents from both groups who said that the reason why one cannot view the information or image on the Internet/web on the computer is because of the additional programs/software/plug-ins that need
to be installed first. However a few number from the other group has said that there is no problem at all. With regards to the flexibility to install software programs or configuring the set-up of the computer, 38% of the respondents in the Philippines said one can do it anytime; some 57% said that it is possible but through a computer administrator. From the rest of the group, 63% can do it anytime and only 26% need a computer administrator to do the task.

As to the use of the Internet/web as a medium for disseminating or delivering the services at the census bureau, all the respondents in the Philippines agreed on the idea while 83% agreed from the other group. With regards to the flexibility of choosing the retrieval or downloading method for the census data, more than 90% from both groups liked the idea. In terms of selecting the data specifically for a particular geographical or administrative area, all the respondents in the Philippines were interested and also the 94% from the other group. When asked as to how one would like to make the selection, most of the respondents from both groups chose both methods that were proposed such as by clicking or drawing a box on a map and by selecting the name of the area (e.g., from a drop-down list). For selecting a particular topic or subject such as migration, population or education, almost every one from both groups were interested in such functionality. When asked as to what way one wants to make the selection, most of the respondents from both groups chose both methods that were proposed: by selecting the name of the topic (e.g., from the drop-down list) and by a keyword search. When the functionality of one to be able to choose the format of how census data be presented or organized was proposed (such as tables, plain text document, graphs or statistical maps), most of the respondents from both groups agreed on the idea. Furthermore, most of the respondents from both groups also liked the idea of the flexibility to interactively change the default presentation (tables, plain text, graphs, maps) or design on-line one’s own output/presentation/visualization using the census data without any need to install additional software programs or plug-ins in the computer. Therefore, most of the respondents have appreciated then the functionality of producing or designing maps on-line using the census data, which was also confirmed from the number who had responded positively.

3.3.2. Analysis of the results from the local survey

As expected, 50 respondents were collected in the survey and most of them are coming from the government (40%), followed by a number of professionals in academic institutions, private or non-government sectors and research offices. Most of these respondents indicated that they have more than one job as part-time researcher/scientists, managers/directors/administrators, development planners, engineers and public/religious servants.

The majority of the respondents have used census data for more than five years now primarily for research purposes and for planning/decision-making, which reflect back to the respondents’ line of work as mentioned in the previous paragraph. In addition, few of these respondents indicated that they also used the data for other applications such as budget/funding allocation, teaching/education, information/news and GIS. When these respondents were asked about their knowledge of NSO’s website maintenance, 64% said yes and the rest said no, which explains why there was a great number of responses who said that acquiring for the census data is still by personal or direct appearance. Based on the latter, one could tell that locating the (nearest) office of NSO may not be a problem at all, which was also confirmed by 88% of these respondents. As to how the census data is transmitted to the requesting party, 80% of the respondents said that the media used is still paper (i.e., publication on paper, photocopy, hardcopy, print-out). With regards to the cost of the acquisition, 42% said that the cost
was minimal only for the distribution or copying fee and 36% said that it was free. In terms of what form the census data is disseminated in or organized when the respondent requests for it, 30% said that it was in the form of analytical texts (i.e., combination of tables, graphs and texts/explanation) and 56% said that it was in tabular format. When asked whether one still needs an expert help or a knowledgeable person to guide him/her during the process of inquiring and/or requesting for the census data, 54% said no and the rest said yes.

The majority of the respondents gain access to computers and the Internet/WWW mostly at their respective offices, then a little less at the Internet or computer café/kiosk/shops, followed by respondents who have computers at home although not all have Internet connections. In terms of the respondents’ computer literacy, the majority (74%) are on the average level. When asked as to the incidence of not being able to view the information or image on the Internet/web aside from the possibility of an Internet connection problem, 36% said that the cause is due to some software programs or plug-ins that need to be installed in the computer first, while 20% could not identify the cause of the problem and 24% experienced nothing at all. With regards to the liberty to install software programs or tinker/configure the set-up of the computer one is using most of the time, almost half of the respondents said that the task is done via a computer administrator and a fair response of one can do it at will and one never all.

Almost all the respondents (98%) in the survey have a similar opinion on the idea of disseminating the census data or NSO catering services to the public through the Internet/WWW to speed up the delivery of services, avoid office hours constraints and waiting time for one’s request(s) to be entertained at the NSO’s premises. Also the same number of respondents agreed to the proposals of having the flexibility to choose the method of retrieving or downloading the census data on the web such as downloading to a diskette or printing it, selecting the data specifically for a particular geographical or administrative area of interest and selecting only for a particular topic or subject such as migration, population, etc. As to how the selection be done in the two latter cases, the majority of respondents chose both methods of selecting the geography by clicking or drawing a box on a map and by selecting the name of the area (e.g., from a drop-down list). For choosing the particular subject or topic of interest in the census, both methods such as selecting the name of the topic (e.g., from a drop-down list) and by a keyword search were preferred by a little more than half of the respondents and 30% explicitly chose only the former. With regards to the proposed functionality of choosing the organization or presentation format (such as tables, graphs or statistical maps) when the census data is retrieved or downloaded from, 96% of the respondents approved the idea. As to the interactive functionality to change the default presentation (e.g., from tables to maps or changing the cartographic settings) or design on-line one’s own output/presentation/visualization using the census data without any need to install additional software programs or plug-ins in the computer, 92% agreed with the proposal. To the concept of the use of web maps, there were 96% respondents who appreciated the proposed idea of incorporating the functionality in the dissemination of census data.
3.4. Conclusion

The analysis of the situation at the National Statistics Office (NSO) in the Philippines was the next step in this research to determine what its current activities and services on the web are, the available computer-related resources and its future plans on enhancing the dissemination of the census data through the web. NSO started disseminating through the web census and other statistical information on May 1, 1997. However, census related information published on the web merely served as overview of the country’s vital statistics. One still has to do legworks on the bureaucratic way of acquiring the more detailed census and other statistical data at the local/regional offices of NSO. The information obtained from NSO regarding its Internet infrastructure, current financial situation and future plans (for improving the dissemination of their data) also provided a good basis for the selection of software and hardware and were actually part of the criteria, of course.

The formulation of questionnaires and execution of the user requirement surveys followed. The objectives of this endeavour were to find out:

- the census data users’ awareness of the acquisition and use of this data and other statistical data provided by their respective census bureau or national statistical agency
- the current computer platform or configuration of the user, which would be one of the criteria for selecting the software and hardware
- the literacy of the user, which would influence the design of the prototype’s user interface
- and the approval of the proposed functionalities from the users.

There were two kinds of surveys executed for the purpose of having a diverse group of users coming from different disciplines and places (i.e., countries of origin): one conducted at the researcher’s home place using the conventional survey method and the other one at ITC in a manner of an on-line or web-based survey, using the Metanomix system.

Based on the analyses drawn from the two user requirement surveys, it is obvious that Internet has not fully been utilized yet as one of the carriers for acquiring or disseminating the census data but is mostly being used only to contact and/or place orders or requests at the census bureau in general. At the time of the analysis of websites and the user requirement surveys were conducted, only very few census bureaus in the world exploited the capability of the Internet and the World Wide Web. Nevertheless, the surveys have proved out when almost all the respondents affirmed the idea of using the Internet/WWW to speed up the dissemination of the census data. Although in reality, it is still by personal or direct appearance most users acquire the data from the bureau and normally still on paper. This statement is also supported by the researcher’s impression during the process of describing the available functionalities of the census bureaus worldwide: the majority of them are only showing national level statistics or a few basic statistical figures for lower administrative levels. In short, if one is interested in acquiring in-depth statistics or detailed census information, one has to either order/request via the Internet or by personal appearance at the nearest local census bureau. Census data is customarily organized in tables when disseminated or presented to the public. Sometimes it can also be in a form of analytical texts, which is a combination of tables, graphs and perhaps statistical maps. This indicates that the use of maps has not been fully adopted yet for the dissemination of census data let alone their exploration and analysis. This also comes forward from the analysis of the survey re-
sults, backed up by Table 2.1. Getting access to computers and Internet at work and at the Internet café/kiosk/shop were typically the answers of the respondents in the surveys, which indicates that in general one does not have the freedom to configure the set-up of the computer or install software programs or plug-ins when needed except through a computer administrator. This constraint is one of the criteria used for selecting the software and hardware that was implemented in developing the prototype. As to the proposed functionalities, the majority of the respondents in the two surveys endorsed the idea of having these incorporated in the prototype. These functionalities will then be presented and discussed in the first section of the next chapter.
4. The Prototype

This chapter will begin with a description of a conceptual framework of a prototype of a web-interface for the dissemination of Philippine census data. This framework outlines the functionalities that will be incorporated in the design. The second section deals with the software and hardware used in developing the prototype. The first part of the third section reports on the data used for testing the prototype. The second part provides the technical description of the prototype and the last part accounts for all the problems and limitations encountered during the development of the prototype.

4.1. Conceptual Framework

The analyses of the results from the two surveys drawn in Chapter 3 showed that all the proposed functionalities in the user requirements survey were compliant by the majority of the respondents. The following is a list of functionalities that practically mould the prototype with illustrative references to some websites described in Chapter 2, which were also used to exemplify the proposed functionalities in the surveys (refer to Chapter 3).

- Selection of a group of or a single administrative unit(s) (see Figure 2.4):
  - as a drop-down list and/or hyperlinks of the different administrative levels, which will further show the names of the succeeding administrative levels
  - as a map image where one can either click on a particular administrative unit or draw a box on the map
  - as aids to selection, a “place name search” (see the upper left part of Figure2.2), “quick locational views” and “zoom to name” are added

Not all potential users of the prototype may have the same level of topographical knowledge so it is good to have flexibility of selection in this respect.

- Selection of a topic or subject (see Figure 4.1):
  - as a drop-down list and/or hyperlinks showing the different categories such as migration, population, housing, education, health, etc.
  - keyword search

Not all potential users of the prototype may have a background in demographics or in social sciences. So it is convenient to guide one’s quest in a form of categorical subjects and/or keyword search.
Once a particular category is chosen, one should have the option either to prepare one’s own data set based on the selection of parameters (see the example in Figure 4.2) or use what is already prepared (Figure 4.1).

![Figure 4.1](Source: URL 1, October 2001)

**DE FACTO POPULATION AT END OF PERIOD: TOTAL**

<table>
<thead>
<tr>
<th>Population, by population group</th>
<th>POPULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Date: 01/01/1991</td>
<td>End Date: 31/12/1994</td>
</tr>
<tr>
<td>Time Unit: End of Month</td>
<td>Data Kind: Original Data</td>
</tr>
<tr>
<td>Type of Calc: Thousands</td>
<td>Prices:</td>
</tr>
<tr>
<td>Unit Kind: 05/01/98</td>
<td>Last Updated:</td>
</tr>
</tbody>
</table>

**Choose Parameters**

- **YEAR**
  - From: 1991
  - To: 1997
- **MONTH**
  - January

![Figure 4.2](Source: URL 23, October 2001)
For the individual data specification, one should have the option either to run the descriptive statistics (frequency or tabulation of the variable’s figures) or cross-tabulations of two variables (i.e. all figures of one variable are tabulated against each figure of the other variable). A list of variables may be in drop-down style and another drop-down list for the corresponding period. If the cross-tabulation option is chosen, another drop-down list will be given for the second variable. Logically, the second variable bears the same period.

- Selection of output format (see Figure 2.2):
  - a switchable option for convenience in the form of radio buttons for: text/plain html (see Figure 2.3 or Figure 4.9 without gridlines), tabular (see Figure 2.3 or Figure 4.9), chart (see Figure 4.10) and thematic map (see Figure 4.11).

There are many different types of representation dealing with different kinds of data and different user questions. Chart types vary from simple (2D) ones to sophisticated (3D and/or combination of different chart types) ones. The most common chart types are: line, bar, pie, xy (scatter plot), area, high-low-close (hlc), pyramid (horizontal bar), and their corresponding 3Ds (see Appendix C). There are many map types available for thematic or statistical mapping. The most common map types are: nominal point and line symbol maps, chorochromatic maps, dot maps, proportional point symbol maps, proportional diagram maps, flowline maps, isoline maps, proportional symbol grid maps, prism maps (stepped statistical surfaces) and choropleth maps (see Appendix C). Ideally, the system should have the flexibility to produce all different types of representation.

Not all potential users of the prototype may have a background in GIS or cartography. So given this flexibility, one may be able to learn new ways of presenting the data, so as to get a better insight in and overview of these data.

- There should also be a download option in the output function (see Figure 2.3). This is for the convenience of one who wants to avail of the information to a format other than viewing on the screen, either to print or to save the data as a digital file (e.g., xls for the tables).

- There should preferably also be an edit option if the chosen output format is thematic map or chart. An interactive manipulation on the chart’s annotation (such as title, gridlines, etc.) and switching of galleries except for a single valued topic should be provided. For the thematic map, one should be able to cartographically manipulate the map’s annotation (such as legend title, map title, etc.), classification and colour scheme (see Figure 4.3). Given this flexibility, one may be able to customize the presentation to one’s taste, explore the data and discover new insights.

To illustrate the flow of how the census data could be disseminated through the web by the prototype, a diagram is shown in Figure 4.4. The shaded items are the options on how the arguments can be selected. The hierarchy starts with the selection of administrative area, followed by the selection of topics and then the exploration, analysis and presentation. If one has a glance on publications on demographics, socio-economics and other statistical information about a country for instance, normally the information is organized in its administrative and/or legislative levels before each subject or topic is presented subsequently (NSO, 1970; 1995). A practical example is: “What is the number of inhabi-
tants in Province X?” The plausible method is to obtain the census on Province X (either publication in digital form or on paper) and then dig on the subject related to the Census of Population. This is just similar to inquiring the subject at the office in-charge of the census records. An officer in-charge will definitely ask the client first which area one is interested in. If a less knowledgeable person is left to find the answers alone in a library of census records and starts with looking for the topic first (say, “number of inhabitants”), one will definitely become overwhelmed if not frustrated by the numerous records found. However, if the person has the common sense to start looking for the area of concern first, that means, one has already limited the search to that area only, then it is likely that the person can find the answers quicker.
4.2. Selection of Software and Hardware

4.2.1. Selection of software that will be used for developing the prototype

A list of some possible software programs and tools for the implementation of the prototype on the web is presented in Table 4.1. First, the criteria for the selection of appropriate software and hardware, which will be used for the development of the prototype will be reviewed. The criteria are ordered here according to their importance.

1. A system that must run on any type and version of internet browsers

From the user requirements survey, there is still a fair number of respondents who claim that the cause of not being able to view the information on the web is because of the additional programs/software/plug-ins that are needed to be installed first; yet, not all have the freedom to configure or install anything on the computer but through a computer administrator. Therefore, this constraint must be noted for software that requires plug-ins or features that are only present in the newer versions of Internet browsers. The importance of this criterion also goes back to the objectives of this research in Chapter 1.
2. Copyright/security issue (Groot, 2001; Kabel, 2000)

Census data is considered public property (i.e. “free”) in the Philippines, although to cover the cost of distribution, a nominal overhead cost is charged when acquiring for the data. This situation is similar to acquiring of administrative boundary maps that are sold on paper at the national mapping agency (NAMRIA) in the Philippines. Since digital information of these maps is not yet commercially available, many organisations and companies invested on digitising these maps for their own use/interest. In the case of NSO, sharing or even selling of digital boundary information of the administrative maps is never allowed (Pido, 2001). This is an issue in the Philippines in general one cannot dispute for many reasons: protection or return of investment, unresolved administrative boundaries, no right to sell to a third party, etc. As a consequence, the design of the system (prototype) must conform to this restriction set by NSO, which influenced the choice of Internet mapping approach discussed below.

3. Speed/network traffic issue (Kraak & Brown, 2001; UN, 2000)

This issue is best addressed by the different strategies used in Internet mapping, which are server-side, client-side and hybrid/mixed. Server-side, which is also known as “thin client/fat server” architecture, handles all of the processing at the server side. There is data integrity and it requires only a basic Internet browser to communicate with the server. Thus, the security aspects mentioned above are solved in this approach. However, since all the processing is done at the server, the speed of one’s requests may be severely affected by the status of the network traffic. Examples of server-side programs are Internet map servers (IMS) and Common Gateway Interface (CGI6). On the other hand, the strategy of client-side performs the other way around. Most of the processing is done at the client’s side. It only communicates with the server to download the necessary information to the client’s computer to perform a task. A common example of a client-side program is a Java applet, which is a small program that normally performs most of the tasks of the client at one’s end. However, for applets to run properly, one must have a newer Internet browser that has the capability to interpret the said program. A hybrid solution is a combination of the server and client-side approaches basically employing the advantages of both. The drawback may be that the design of the system comes out complicated and/or not optimised.

4. Capability to handle large spatial datasets

Analysing the pros and cons of each approach used in Internet mapping will give light to what is ideal when handling large spatial datasets. Since client-side mapping downloads the data first from the server, transporting over a slow Internet connection and/or heavy network traffic may not be a sensible solution unless an intelligent system sends only small chunks of the data from a large dataset. But, what if one is interested in retrieving the information of all the barangay (the smallest administrative level) in the country or retrieving large map files all the

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6 CGI is a standalone executable file that is able to run on the web, which accepts parameters passed by the users for processing and returns the result normally as a graphics file that is compatible to any Internet browser.
time? Obviously, the server-side or perhaps a hybrid approach can handle this but definitely not the client-side solution.

5. Capability to accomplish the proposed functionalities

This is a question of software limitations with respect to meeting the specifications of the prototype. This is actually the limiting factor that influences the initial list of possible software presented in Table 4.1. This includes the compliancy of the software to integrate or be integrated with other software programs, programming languages, or operating systems (such as Windows NT).

6. Cost

Software should be cheap considering the current situation (i.e., budget allocation) at the NSO.

7. Thematic cartographic visualization possibilities

Software should be able to perform various types of thematic cartographic visualization. There are few mapping methods that are more appropriate (i.e., following the good cartographic grammar) to use to represent the information. So if the software has this feature (perform many possibilities and flexibilities of thematic cartographic visualization), one may be able to explore and discover new ideas from manipulating the presentation. Furthermore, if the default presentation of a thematic map is cartographically not correct or slightly incorrect, one may also have a chance to adjust it.

8. Spatial data format flexibility

Software should be able to read the current spatial data format NSO is using (ArcView shape-file format).

9. Customer support

There are drawbacks for cheap software. Many of these may not have user support such as those that are classified freeware or shareware. The customer support column in Table 4.1 identifies only the support directly coming from the developer of the software per se and not from the possible listserves where users share and exchange their expertise or ideas on the web.
### Table 4.1 Possible software programs

<table>
<thead>
<tr>
<th>Software program name</th>
<th>Software program type</th>
<th>Selective browser version</th>
<th>Copyright issue</th>
<th>Speed issue</th>
<th>Dataset capacity</th>
<th>Flexibility and ability</th>
<th>Cost</th>
<th>Visualization flexibility</th>
<th>Import flexibility</th>
<th>Customer support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manifold 5.0 (URL 13)</td>
<td>Internet map server</td>
<td>none</td>
<td>data is kept safe at the server side</td>
<td>fast</td>
<td>able to handle large datasets</td>
<td>compliant with other programs</td>
<td>$245 (US)</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>BJ_Map (URL 20)</td>
<td>CGI based Internet map server</td>
<td>none</td>
<td>data is kept safe at the server side</td>
<td>fast</td>
<td>able to handle large datasets</td>
<td>compliant with other programs</td>
<td>Free but commercially not available</td>
<td>limited</td>
<td>requires third party conversion module</td>
<td>Yes, but contact developer (Go, 2001)</td>
</tr>
<tr>
<td>ESRF's ArcIMS (URL 21) or MapInfo's MapXtreme (URL 22)</td>
<td>Internet map server</td>
<td>none</td>
<td>data is kept safe at the server side</td>
<td>moderate</td>
<td>able to handle large datasets</td>
<td>compliant with other programs</td>
<td>$12,500 - $17,000 (US) (Dolanas, 2001; Borg, 2001)</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Geotools (URL 18) and Jmappe (URL 12)</td>
<td>Java appllets</td>
<td>latest versions of Internet browsers</td>
<td>data is downloaded to the client's side</td>
<td>depends on the client's computer</td>
<td>cannot handle large datasets</td>
<td>compliant with other programs</td>
<td>Freeware except for Jmappe 3.2</td>
<td>yes</td>
<td>yes</td>
<td>none</td>
</tr>
<tr>
<td>Java appllets, CGI programs and lightweight IMS</td>
<td>hybrid</td>
<td>latest versions of Internet browsers</td>
<td>it depends on the design</td>
<td>it depends on the design</td>
<td>it depends on the design</td>
<td>compliant with other programs</td>
<td>Freeware for appllets</td>
<td>yes</td>
<td>yes</td>
<td>?</td>
</tr>
</tbody>
</table>
In Table 4.1, those items that meet a condition are shaded completely and those that partially meet the criteria, are also partially shaded. In Table 4.1, the software is listed in order of preference, based on its lesser hardware and Internet connectivity constraints between the NSO in the Philippines and the client’s side. The price, the scale of use (whether it is an overkill or not for this type of application) and the flexibility of the software are considered also but are given with a lesser weight. BJ_Map is a proprietary program of Statistics Sweden. This is the only proposed software that is not commercially available; yet, one can avail of a copy for free. However, the choice was awarded to the Manifold 5.0 because of BJ_Map’s limiting factors: no built-in conversion module for reading other map file format; the way some information is visualized cartographically is not correct; no flexibility to change map types; and maintenance and support are too risky with only one person responsible for the program. Besides Manifold’s newness on the GIS market, the cost of acquiring the software has beat the popular Internet map server programs such as ArcIMS and MapXtreme. Learning to know and evaluating Manifold software for this particular application was considered to be an interesting element of the MSc thesis research project.

4.2.2. Selection of hardware and installation of additional software for Manifold

Manifold System Release 5.00 Professional is digital map management software developed by Manifold.Net in Nevada, USA (URL 13). Manifold (in short) provides a full suite of classic GIS vector, raster, terrain, CAD, cartographic capabilities and advanced database capabilities for data exploration and discovery (Rotow, 2002). It is the first GIS that provide a fully integrated neurofuzzy inference engine (fuzzy logic) and “active columns” that hold sophisticated formulas in database tables. It also includes full programming capability and a web server for Internet mapping. A summary of Manifold’s competitive features is presented underneath.

- Serving maps on the web at no additional cost. One has to buy the Internet map server extension for ArcView to be able to serve maps on the web.
- Points, lines and areas (polygons) may be combined in the same drawing or layer.
- Topology is maintained and computed automatically on the fly without any user intervention required.
- Georegistration of vector and raster images is quite handy.
- It has flexibility to import many different data formats.
- It has professional graphics editing capabilities and many image editing functions and transformations.
- It is capable to create composite RGB Landsat images and enhance them by mixing higher resolution bands with lower resolution bands.
- Capable of visualizing terrains in 3D windows. ArcView cannot do this without an extension.
- Capable of resampling surfaces (DEM/DTM) at different resolutions while maintaining georegistration.
- Can do cookie-cutting a layer full of areas, lines and points by another area(s) in one pass. ArcView cannot mix objects in layers.
- It has a facility to connect to a GPS receiver for moving map mode and data acquisition.
- Very flexible and many scripting languages for developing customized applications.
• It has intrinsic fields/columns for drawing objects to automatically give location, area, bearing, etc.
• It has “active columns” feature in the table (database). Manifold came up with this feature to store very sophisticated formulas.
• It automatically saves projects in compressed format.
• Can use bookmarks in tables, scripts and text files.
• Can find records in tables using “More Like This”.
• It has a Decision Support System with flexible queries using fuzzy logic.

In spite of Manifold’s promising features, the company sells the product at a very low price to attract more potential users. This software was already out in the market in late summer of 2001 (as Phase 1) despite its constant state of development. It was only in early of January 2002 that the company has completed their Professional edition (Phase 2).

Since Manifold is categorized as an Internet map server, the client may not have to own or gain access to the most modern computer set-up. A low-end Pentium (say, Pentium 133 MHz) computer with an Internet connection and even an earlier version of an Internet browser suffice. The emphasis then lies on the basic software and hardware requirements needed to install Manifold on the census data supplier’s end (server side).

The following is the minimum computer hardware configuration that allows the installation of Manifold 5.0:

CPU processor: 200MHz Pentium (500MHz PIII or greater recommended)
Memory: 64MB RAM (256 or greater recommended)
Video: 800 x 600 SVGA display (1024 x 768 or greater recommended)
Harddisk: 100 MB harddisk free space (gigabytes of free space recommended)
Optional: CD ROM

In addition are the following minimum Windows configuration requirements:

OS: Windows ’95, ’98, Me, NT 4.0, 2000 or XP
Internet browser: Internet Explorer 5.5 (or newer version)
Other software: Microsoft’s Data Access Components (MDAC) version 2.6
DCOM95, GLU32.DLL/OPENGL32.DLL (for Windows ’95 platform only)
Microsoft’s Jet 4.0 database engine
Internet Information Service (IIS) (for Windows NT and later OS) or
Personal Web Server (PWS) (for Windows ’95 and ’98)
Note: all this software is freely available on the web
Miscellaneous: Recent service packs of the abovementioned components

Once IIS or PWS is installed, it is highly recommended to create a folder/directory for storing Manifold published pages/files in C:\inetpub\wwwroot\ or wherever the root for Internet services is set to.
This way, all the files and sub-folders are accessible remotely. The said folder must then be configured in the IIS or PWS console to access scripts and executables stored within.

All these requirements have been met in the current MSc thesis research environment. Conferring with the current website infrastructure of NSO (refer to Section 3.1.3), the abovementioned requirements don’t pose any problem to setting up Manifold IMS at NSO, when the prototype is actually integrated into their dissemination process. This achievement has just fulfilled one of the objectives of this research.

4.3. Building the prototype

4.3.1. Preparation of census geo-database

There are six different administrative and legislative levels in the Philippine context (see Table 3.1 and Figure 3.1). To test the prototype, it is sufficient to use only a subset of the census data indicating at least one aspect (or census variable) of each representation of absolute and relative figures. An example of absolute figures is the “number of inhabitants”. Whilst an example of relative (or derived) figures is the “population density” (number of inhabitants per km²). As to the boundary information of the administrative and legislative units, the following are map files that are used to correspond with the different levels of census data aggregation: a map layer of the entire country, a map layer of all the regions in the country, a map layer of all the provinces in the country, a map layer of all the municipalities in Cebu province, and a map layer of all the barangay in Cebu province. For the district map layer, no information could be acquired. All map layers that were used for the prototype were already in ArcView shapefile format. The information of the selected census variables was organized in MS-Access data format. To avoid confusion between the acquired census database and the database of the selected census variables, the latter was referred to as the “population database” and will be used subsequently. Since it appeared that not all object/unit names in the map layers were identical with the names used in the population database, all unit names of the map layers from each aggregation level were extracted respectively, matched against the names in the population database, and updated.

For Manifold to recognize all the map layers that were prepared earlier in ArcView shapefile format, these had to be imported to Manifold’s local environment, re-projected to the correct map projection of the Philippines (which is UTM 51N) and then saved in its proprietary project (.map) file format. The latter is the only data format Manifold’s Internet map server can recognize when being used as map layers of a web application. This is an explicable rationale because this contains some settings such as projection information, zooming ranges, a portfolio of Manifold’s components (e.g., layout component, drawing component, table component, etc.), etc., which cannot be saved or found in the individual map layers. These map layers are vector files which in nature do not carry any projection information. In general, projections are external orientations of a map that can be set and reset by any GIS software used to viewing the map. As long as one knows the coordinate system (i.e., the internal X and Y which is sometimes referred to as Longitude and Latitude) of the map, this can be projected to the right orientation. In this case, the geographic information of all the map layers is stored in Geographic Coordinates (also known as Longitude and Latitude).
The most efficient way of managing the population database is to make it an independent entity [even though it can be joined together with the map layers inside Manifold’s project (.map) file], as long as the names of both entities (database and maps) remain consistent. Hence, to make the database globally known in the system (i.e., from Internet, Intranet, local users of the computer and other applications), it has to be established as an ODBC\(^7\) system data source. Since the population database is an MS-Access data format, one has to specify the corresponding database driver via the ODBC Data Source Administrator\(^8\). This is for the reason that an instance of installed MS-Access application on the computer (or server) will not work nor is accessible by users remotely.

### 4.3.2. Technical description of the prototype

The initial step undertaken was to create the opening web page, which serves as the user interface. It is based on the exported component of the Manifold project file that was prepared in Section 4.3.1. Aside from being a typical GIS software, Manifold has a feature that exports few of its components to web pages. As mentioned earlier (Section 4.2.2), the exported page and its auxiliary files and/or pages must be in the designated folder for Manifold, for it to become an Internet map server page. This page is an Active Server Page (ASP)\(^9\), which can post requests from the user to the web server. Then whatever instruction was sent to the web server, it makes communication requests with other servers (such as application servers, database servers, etc.) that handle the respective services needed during the process. Any results coming from the auxiliary servers will then go to the web server first for proper translation to a HyperText Markup Language (HTML)\(^10\) format and sent to the user. All this processing is transparent to the user. For a clearer picture of how the prototype works, a schematic diagram of the entire mechanism is shown in Figure 4.5.

---

\(^7\) ODBC stands for Open DataBase Connectivity. It is an interface that facilitates the accessibility of a database by any application in a form of Sequential Query Language (SQL).

\(^8\) ODBC Data Source Administrator can be accessed either from the Settings - Control Panel of Windows or from any application/program that can call this utility (e.g., Macromedia’s Ultradev).

\(^9\) ASP is a server-side scripting language for web applications that provide interaction to the user. ASP may contain HTML codes for client-side purposes (e.g., viewing of results from the requests made by the client).

\(^10\) HTML is an ASCII text file that contains tagged (marked up) elements that renders special functions and/or displays when viewed with an Internet browser. Elements such as texts that contain links to other web pages or perform certain tasks are called hyper(text)links.
Description of the functionalities of the user interface

Due to the limited time available for developing the prototype, the list of functionalities that are supposed to be in the prototype is minimized. Items that could not be included are marked, while circled items are combined. This adjustment of the conceptual framework presented in Figure 4.4 is shown in Figure 4.6. With regards to the presentation format, only five chart types and two map types were employed due to time constraints. These chart types are: line, bar, 3D bar, pie and 3D pie. Logically, a default pie chart is displayed for a single valued topic (e.g., the population of the entire country) otherwise a line chart is provided. Considering that these types of chart are fundamental, simple and are more familiar than the others, the choice is sufficient to test the prototype. On the other hand, two thematic map types are: shaded areal objects or polygons known as a choropleth map and a proportional point symbol map. The system would automatically present the proper map type to give the user the correct cartographic visualization and impression of the data. For relative quantitative figures such as “the number of inhabitants per km²” or “the % of population being illiterate”, the choropleth is chosen; while proportional point symbols are used for representing absolute quantitative figures such as “number of inhabitants” (ITC, 2001b; Slocum, 1999; UN, 2000). The choice (two thematic map types) is also seen to be sufficient to represent the two types of quantitative information (relative and absolute) of the current subset of census data that is used for testing the prototype.
The default opening map server page (Figure 4.7) from Manifold’s “export to – web page” function was revised to comply with the specifications of the conceptual framework in Section 4.1 (Figure 4.8). There are four main sections on the page. The one on the left is the map image display with a toolbar of icons on top. The right hand side of the page is divided (by horizontal lines) into three sections: for the selection of geographical/administrative area (see item #1 of Figure 4.8), for the selection of topic/subject (see item #2 of Figure 4.8), and for the selection of output format (see item #3 of Figure 4.8), respectively. These sections are the important points to consider prior to retrieving the desired information, which will be expound shortly. To give an overview to the users, a “user’s guide” button is provided on the lower right corner which pops up a new window (see Appendix D).

On the selection of a geographical or administrative area, the “Administrative layer configuration” pane influences, which map layers are displayed in the map image display section. The pane contains two drop-down lists. On the left is the hierarchical list of the different administrative and legislative levels (see Table 3.1) and on the right the list of its corresponding sub-levels. For instance, if one is interested to view the regions including its provinces on the map prior to selection, one has to select “region” from the left drop-down list first followed by selection of “provinces” from the right drop-down list. Any change on these lists updates the display of the map layers on the left (map image display section). With regards to selecting of objects (administrative units on the map image), the default selection is set to [All], which is shown as a faint grey message just above the “User’s guide” button.
However, one can also select an individual object by toggling (on/off) the button (see the toolbar of icons located just above the map image section in Figure 4.8) and then start clicking an object of concern on the map image. The object selected will be marked red. Only one object can be selected at the same time.

**Figure 4.7** A standard web page exported from Manifold

**Figure 4.8** The appearance of the prototype’s user interface
Furthermore, as other aids to the selection of areas, a pane for “Place name search”, a pane for “Zoom to name” and a pane for “Quick locational views” are provided. These panes are collapsible to avoid the user from getting distracted during the process of selecting areas. Clicking on the drawing indicated by either ☒ or ☒ on the pane’s title bar collapses or expands the pane. These panes are just tools for finding objects or areas on the map layers and not for automatic selection of objects when found. The “Place name search” pane contains an input box where one can type in a string pattern one wants to search for and a button to start the search process. Once the search process is finished, a small window pops up with a result. The function of this pane is to acquaint the user with the kind of administrative level the name (string pattern) that is being searched for. This way, one will know the proper map layer he/she must specify in the “Administrative layer configuration” pane. It is possible that the name that is being searched for finds occurrences in several map layers or none at all. The “Zoom to name” pane contains one input box for typing in the string pattern, a drop-down list, which contains the list of map layers from the “sub-level” or right drop-down list of the “Administrative layer configuration” pane, and a button to commence. As the name implies, the function of this pane is to bring the person to the location (zoom to fit the entire window) of the given name (string pattern) in the input box if found on the current map layer indicated on the drop-down list. If the string pattern is not found, nothing happens. The “Quick locational views” pane contains a drop-down list of prepared zooms of some objects (administrative area objects) based on the current map layer indicated in the “sub-level” drop-down list of the “Administrative layer configuration” pane. This pane provides a list of available object (administrative area) names that can be brought to focus when selected.

For the selection of topics or subjects, a drop-down list containing the available topics is provided. The availability of these topics depends on the current map layer being set in the “sub-level” drop-down list of the “Administrative layer configuration” pane (see Table 4.2).

For the selection of output format, three options are given in the form of radio buttons and a “Go” button to finally view the information based on the specifications provided by the user. The choices for output format are: Text/Table, Chart, and Thematic map. All these choices will bring the user to a different web page corresponding to the choice of output format made. There are download buttons seen at the upper right corner of each output format web page, for printing and saving the viewed information to a digital file. However, these buttons are not yet active. On the other hand, an active “Back to previous page” button is located at the lower right corner of the same pages.

<table>
<thead>
<tr>
<th>Subject</th>
<th>National</th>
<th>Regional</th>
<th>Provincial</th>
<th>Municipal</th>
<th>Barangay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of inhabitants in 1970</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Number of inhabitants in 1980</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Number of inhabitants in 1990</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Number of inhabitants in 2000</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Population density in 1970</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Population density in 1980</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Population density in 1990</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Population density in 2000</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Number of households in 2000</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
There are two main divisions formatted as tables in the Text/Table output format web page (see Figure 4.9). The upper division displays the title or name of the topic that was selected from the “Select a topic/subject” pane of the opening page and a table of records of the administrative/legislative units based on the map layer that is chosen in the “Select area” drop-down list of the “Administrative layer configuration” pane of the opening page. The lower division displays the table of records of the selected area/object(s) based on the map layer that is indicated in the “sub-level” drop-down list of the “Administrative layer configuration” pane of the opening page.

**Figure 4.9 Screenshot of a Text/Table output**

In a Chart output format web page (see Figure 4.10), if there is only one object selected in the map image display, the default chart type is a pie chart otherwise a line chart. The logical reason for this is, to be able to view the values or records of the chosen object in another chart type, one has to have at least two objects selected. For consistency, a drop-down list of chart types and a button to reload the values/records of the objects with a new chart type, will only show up if the prototype senses more than one selected object previously. Due to time constraints, the only editing option given here is the changing of chart types. Moreover, an external to the Manifold IMS program was used for generating charts since the current version of Manifold does not allow one to create charts on the fly. This program is called OWTChart.exe (URL 16), a CGI chart generator program. Preparing of these charts in Manifold and then publishing them is possible, but tedious and time consuming.

All the maps used in the Thematic map output format web page are just prepared maps in Manifold. Currently, there is no flexibility of one to do interactive GIS mapping using the current version of Manifold IMS such as changing of map annotations, classification, choice of colours, etc. In general, all published maps are read-only in Manifold IMS. However, this limitation is expected to be resolved when Manifold releases their Enterprise edition (Rotow, 2002). So the editing function in this respect is deferred for the time being. For convenience of viewing the maps, a toolbar of icons more or less similar to the one on the opening page is provided (see Figure 4.11). The choice of colours, classification method and number of classes used in preparing of the thematic maps were based on the researcher’s discretion. For choropleth maps, graduation of lightest to darkest brown denote low to high population density respectively. For proportional symbol maps, graduations of smallest to largest circle denote few to many inhabitants/households respectively. The technique used for classifying the data was natural breaks, although it may not seem so obvious due to the rounding off of most value ranges. It was observed that using this technique a good visual contrast and ideal cartographic repre-
sentation of the data was achieved because it explicitly considers the data distribution (UN, 2000). There was no fixed number of classes used.

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Most of the icons in the toolbar perform similar tasks as the navigable icons in any GIS software. An active icon is indicated depressed except for the “zoom to full view” and “clear the current selection” icons wherein the icon that was last active will return active after the operation of the two former
icons is finished. The “center area tool” icon performs like panning the map to a position that puts the location of the last click of the mouse on the center of the display area. These two icons perform zoom in and out respectively. Wherever the mouse is clicked on the map image, that location will be used as the center of the zoomed area. Drawing a box or clicking on the map using these icons will perform in a similar way. The “zoom to full view” resets the current view of the map image to its full extent. The “object info tool” works in the same way as ArcView’s info tool wherein any information of the clicked (or selected) object on the map image will be displayed in a separate window. The “select object tool” performs the selection of objects on the map image by clicking on an area/object of interest. Whatever is selected will turn red and the faint grey message on the lower right hand side of the page will show the name of the currently selected object(s). As the name implies the “clear the current selection” icon will do it the other way around.

Population density in 2000 (persons/sq.km.)

![Thematic map output](image)

**Figure 4.11** A screenshot of a Thematic map output
4.3.3. Problems and limitations encountered

Manifold version 5 was purchased because of its apparent advantages, as discussed in Section 4.2.1. However, in the beginning it was not realized that Manifold still was in a constant state of development with (on average) about weekly updates. Not all desirable functionalities were implemented yet. As a consequence, there were some inevitable delays on the researcher’s part in developing the prototype. One irritating scenario was the frequent downloading of updates and activation of some functions that used to work in the previous update; yet, these were accidentally disabled in the following update. For the published web pages of Manifold to work properly, these web pages (its respective folders) must be inside a main folder that must be called “Manifold”. Despite the flexibility, power and ease of programming or customizing applications using this software in the local environment, Manifold limits itself to publishing of maps (composed or not) on the web only. Up until now (final release of Phase 2), there is no way to do an even simple interactive GIS on the web. All project (.map) files of Manifold are set read-only when published on the web. As a result, the editing function of maps is deferred in the prototype.

There is also a limitation to using SQL commands in the prototype. Not all SQL statements that work in a local environment work on the web. This is due to the limitation of the ODBC driver of the database being used.

The sizes of Manifold’s project (.map) files including the prepared thematic maps are quite big; generalization of the information of the map layers being used is required. But since there are already gaps and other problems with on some boundaries when acquired as ArcView shapefiles, generalizing or normalizing the topologies of these boundaries didn’t come out well. These map files need to be edited first before generalizing them. Due to time constraints, this has not been done.

There is no flexibility of one to create several thematic maps using the same map layer in Manifold. This is due to the fact that any change made to the map layer is dynamic in the entire project. For this reason, the researcher created several project (.map) files for each topic in the “Selection of topic/subject” pane and for each aggregation level.

4.4. Conclusion

The functionalities that were formulated in Chapter 2 and endorsed by the respondents in Chapter 3, constituted the conceptual framework of the prototype (see Section 4.1). However, it was only possible to fulfill few of these functionalities due to the limited time available for developing the prototype (see Figure 4.6). Therefore, a clickable map and drop-down lists only do the selection of geographic/administrative area. The “place name search”, “quick locational views” and “zoom to name” serve as aids to the selection. Furthermore, the selection of area(s) of interest can either be in one administrative layer/level only or including the respective sub-levels. This selection option can be configured in the “Administrative layer configuration”. With regards to the selection of topics, only a drop-down list was implemented in the prototype. For the selection of output format, the available options are text/table, chart and thematic map. Modifying the current presentation of charts is possible
in the prototype but not thematic maps due to the current limitation of Manifold to provide interactivity on the web.

Then the selection of software and hardware as tools for developing the prototype followed. A list of possible software programs was presented. Some of these items were knowledge acquired from characterizing the selected websites of census bureaus that were described in Chapter 2 and popular cartographic viewers of the census data. Among the software programs presented, Manifold was chosen because it only requires a standard Internet browser, it protects copyright of the data, it is fast because it is just a lightweight IMS but capable of handling large datasets, programmable/customisable, it has flexibility to read other map file formats, cheap and has a good customer support reputation. With regards to the hardware requirements for running Manifold, it was seen that ancillary installation of software programs and minor configuration do not pose any problem at the researcher’s end, likewise at NSO.

As far as the sample data for use with the prototype are concerned: there are six different levels of aggregation that correspond to administrative boundary maps and the census database. But for the two lowest levels, only a dataset of Cebu was acquired which was sufficient to test the prototype. The opening web page, which is the user interface of the prototype, was based on the exported web page of Manifold. The exported web page was revised to meet the compromised specifications in the conceptual framework. An external CGI program called OWTChart.exe was used to generate the charts in the prototype, which classifies the prototype to be a hybrid system. Since the current version of Manifold’s IMS does not allow interactive GIS operations yet, the edit function of thematic maps was deferred. Nonetheless, the prototype was still suitable for testing.
5. User Feedback

It has been concluded from the previous chapter that the prototype was ready for a first test round with potential users. Consequently, this chapter will recount all the feedback from the pioneer users that were documented during the user feedback survey. The user feedback survey was conducted comprehensively using the “think aloud” research method, which comprises the first section of this chapter. Then followed by the analysis of the users’ feedback in the second section. Measures to deal with the results of the user tests make up the third section. The fourth section brings the conclusion of this chapter.

5.1. The “Think Aloud” Research Method

One of the main objectives of this research, which was cited earlier in Chapter 1, is to create a suitable interface (i.e., the prototype) that will simplify the inquiry process—an interface that will fit to all levels of users or users from different perspectives. Therefore, it was considered to be important to have the prototype evaluated by a few users from different disciplines in a cognitive way using an in-depth survey method called “thinking aloud”, a method that has been proposed by van Elzakker (1998a, 1998b, 1999), in the field of exploratory cartography. Other survey methods available are: product analysis, questionnaires or structured interviews without problem solving, retrospection (i.e., interviews after problem solving), introspection (i.e., subjects reporting at intermediate points of their own choice during problem solving), and questioning and prompting subjects during the process of problem solving (Elzakker, 1999). However, “thinking aloud” survey method was favoured over these methods because of many positive aspects described in Table 5.1.

Thinking aloud is a process of expressing one’s thoughts verbally. This method has been an effective tool in disciplines like psychological research, knowledge engineering, educational science and linguistics (Elzakker, 1998a;1999). The subject, in this case: the tester of the prototype was requested to speak out while performing the given tasks. The subject’s facial expressions, gestures or body language and voice, which were taken by a video camera, were recorded in the video player-recorder vis-à-vis the activity in the computer screen, which was captured through a TV-out signal of the graphics card. For a clearer sound recording of the subject’s voice, an external microphone was attached close to the subject’s mouth. The synchronization of these activities was made possible through a video quad unit, which splices all input coming from different instruments to one prior to recording in the video player-recorder. Figure 5.1 illustrates the mechanism of acquiring qualitative observations using this method.
Table 5.1 Advantages and disadvantages of “thinking aloud” and other survey methods (as cited by van Elzakker, 1999)

<table>
<thead>
<tr>
<th>Survey method</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Thinking aloud | • there is hardly any disturbance of the cognitive process because talking aloud during problem solving is done almost automatically  
• no memory errors since thoughts are spoken out immediately  
• subjects do not give an interpretation, rationalization or explanation of their thoughts  
• subjects are not bounded by structured interviews |
|               | • very time-consuming  
• subjects difficulty to translate their thoughts into words, thus resulting in incomplete data although this can be resolved by retrospection  
• subjects’ declining performance pertaining to consciousness about time |
| Others        | • not as time-consuming as think aloud method since all questions being raised are already predefined by the researcher |
|               | • may lead to invalid and incomplete data due to a disturbance of the cognitive process  
• memory errors  
• subjects feeling inclined to interpret and rationalize their problem solving performance  
• subjects may be steered too much into directions predicted by the researcher in an interview  
• subjects’ declining performance pertaining to consciousness about time |

Figure 5.1 Mechanism of acquiring user feedback using the “think aloud” method (set-up of think aloud research laboratory in ITC’s Division of Geoinformatics, Cartography and Visualization)

5.2. Analysis of the Users’ Feedback

Out of the 56 respondents from the on-line survey conducted earlier in order to identify the required functionalities of the prototype (see Chapter 3), there were forty-five (45) respondents who had signified to be willing to participate in a user test of the effectiveness of a prototype for the dissemination of census data in the Philippines. In view of the fact that the “thinking aloud” method is time consuming, a decision to test the prototype locally (only at ITC’s intranet) was made. There were 28 potential users from the ITC community but only 9 were asked to participate as subjects due to time constraints. Each subject was brought to the cartography laboratory where the equipment for the thinking aloud research method is set-up in the ITC’s premises. A briefing on the essence of this method was given to each subject just before starting the activity to attain mutual cooperation for a productive survey. In
addition, it was stressed out that the objective of this survey was to test the efficiency of the prototype and not the subject’s level of intelligence. The recording of the subject’s thinking aloud started at reading the on-line user’s guide for an overview of which functionalities are currently available in the prototype and instances of how the retrieval of information is done. Then, a set of four tasks was given to the subject to assess the efficiency and effectiveness (i.e., clarity) of the prototype’s design (see Table 5.2). The first three tasks envisaged the application of each type presented in the selection of output format in the prototype, which are text/table, chart and thematic map, respectively. The fourth task determined which output type the subject was more familiar with or used to retrieve the information. The users or subjects were not told about the intention of the fourth task: to assess the conformity between the subject’s facility to carry out the given tasks and clarity and organization of the functionalities in the prototype.

### Table 5.2 Tasks to assess the efficiency and effectiveness of the prototype’s design

<table>
<thead>
<tr>
<th>Task</th>
<th>Expected output format</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the # of inhabitants in year 2000 in the Capital region of the Philippines? [Metro Manila is the capital of the Philippines, which is sometimes referred to as the National Capital Region (NCR),]</td>
<td>table</td>
</tr>
<tr>
<td>2. What is the proportion of households in year 2000 in region VII with respect to other regions in the country without manually computing it? [Other terms denoting the same meaning for proportion are percentage and ratio. It can also be a part of a share, for example, in a pie chart.]</td>
<td>chart</td>
</tr>
<tr>
<td>3. Which part (north, central, south) of Cebu Province that has the highest population density in 1990? Hint: Use the smallest aggregation level for a more detailed information.</td>
<td>thematic map</td>
</tr>
<tr>
<td>4. What is the region with the smallest number of inhabitants in year 2000?</td>
<td>chart</td>
</tr>
</tbody>
</table>

5.2.1. The user’s guide

Only two subjects took a glimpse on the prototype’s opening page just before proceeding to read the user’s guide. Everyone was overwhelmed by the amount of text in the user’s guide, which discouraged a few to read further and instead jumped to start performing the given tasks. As a result, those who did not finish reading the user’s guide had difficulty performing the tasks. Some of them went back and forth the user’s guide for reference. Therefore, the comments were:

- to make the user’s guide window smaller, with horizontal flexibility of the text to wrap around when resizing the window. Thus eliminating the use of a horizontal scrollbar.
- to come up with two kinds of user’s guide: a quick reference guide and a detailed guide. A quick reference guide should contain descriptions of each item (including the icons in the toolbar) in the prototype briefly. While a detailed guide should contain a short description of the census database (including years) that is made available on the web, an overview of the Philippine geography, the current contents of the user’s guide (which this time should put the “Note” statements in separate paragraphs) and perhaps inclusion of a small sample application in a form of a tutorial lesson.
- for a good reference to the illustrations, all subjects suggested the application of interactive icons or hyperlinks for convenience and to minimize the chance of one getting lost in the process.
- a button to link the user’s guide window with the main (opening) page was also requested so that in case the main page gets accidentally closed, there should still be a chance for one to get
back. This was actually a consequence of the two subjects who accidentally closed the wrong
window and could not go back to the main page anymore to perform the given tasks.

But even though it was time consuming to read through the entire page, it was still found that the mes-

sage was clear in the user’s guide.

5.2.2. The first task: finding the number of inhabitants in the Capital region

The first task was to find out the number of inhabitants in year 2000 in the Capital region. It was indi-
cated in the prescription that the capital of the Philippines is Metro Manila, which is sometimes re-
ferred to as the National Capital Region (NCR). The hypothesis was to configure first the “Adminis-
trative layer configuration” in such a way that the “Select area” drop-down list (on the left side) would
have the “Entire Country” selected and the “sub-level” drop-down list (on the right side) would have
the “Regions” selected (see Figure 5.2a). To put this action in words, was to: view the country as a
whole including its regions. An alternative to configuring the layers was to view all the regions in the
country only, which means, selecting “Region” from the list in the “Select area” drop-down list and
selecting “none” from the list in the “sub-level” drop-down list (see Figure 5.2b). The second step in
the hypothesis was to select the “number of inhabitants in 2000” topic in the “Select a topic/subject”
drop-down list (see Figure 5.2c). The third step would then be to click on the radio button for
“Text/Table” in the “Select the output format” section and commencing the retrieval of the informa-
tion by clicking on the “Go” button underneath (see Figure 5.2d). The resulting new page shows the
outcome for all the regions in the country in tabular form, which one could just easily browse to locate
the area of concern, which was Metro Manila or NCR (see Figure 5.3). An alternative was to retrieve
the information for Metro Manila or NCR only; thus, filtering the resulting table. To do this was to
either use one of the panes (such as quick locational views) in the aid to selection group and then se-
lect the object Metro Manila or NCR (depending on which layers were configured) on the map image
using the “Select object tool” icon in the toolbar, or use the “Zoom in” tool in the toolbar to view the
area of interest closer and select the said object using the “Select object tool” icon. This would then
be followed by performing the second and third steps of the hypothesis above to see the result: by se-
lecting the “number of inhabitants in 2000” topic in the “Select a topic/subject” drop-down list and
“Text/table” radio button in the “Select the output format” section.

Due to the addition of the grouped panes as aids to selection (such as “Place name search”, “Zoom to
name” and “Quick locational views”), which were put right below the “Administrative layer configu-
ration” pane, users were distracted from directly performing the main steps as hypothesized. Instead,
they got the wrong connotation of the actual functions that led to unsatisfactory performance. Only
three subjects were able to perform the task without any problem or delay. However, with frequent
consultation of the user’s guide by those testers who got stuck, the subjects still managed to reach the
desired result eventually leaving the others in disarray (i.e., still not able to grasp the process).
One striking comment from all the subjects was the unclarity of the actual functions of some items in the prototype. The function of each drop-down list ("Select area" and "sub-level") of the "Administrative layer configuration" pane was not so clear to the subjects. Subjects also thought that using the facilities in the "aids to selection" group would automatically select an object or area of interest. Another comment was the lack of facility to provide a sort of administrative unit name list as an alternative to select an object or area of interest. The following are suggestions raised by the subjects:

- finding a way to restore an inactive or minimized auxiliary window(s) on the foreground when called by a function in the prototype. This is because of the current inability to set the focus to the right window. Or, if this is not possible then perhaps providing an interactive dis-
play of an object’s administrative name by means of a tool/icon (e.g., cursor/mouse/object info).
• providing a miniature window (beside the map image display) containing the full extent of the current map layers. This is to give an idea to the subject on the geographic location of the zoomed image.
• adding the corresponding unit (of measure) of each displayed numeric figure in the info window.

5.2.3. The second task: finding the proportion of a whole
The second task was to find out the proportion of households in year 2000 in region VII with respect to the total number of households in the country without computing it manually. It was added as a hint that the term proportion denotes the same meaning for percentage, ratio and part of a share, as could be represented, for instance, in a pie chart. The hypothetical process is similar to that of the previous task except for the type of output format (which should be a chart instead of a text/table), the administrative area of concern (this time region VII) and the selected topic (number of households in 2000).

![Figure 5.4 Output of the second task depicting the proportion of region VII](image)

Again, the difficulties encountered by most of the subjects were basically similar to the ones mentioned in the previous task. In addition to one’s difficulty to achieve the desired result immediately was the failure to: understand the task, finish reading it and comprehend the given clue. Most of the subjects tried to figure out the solution first from analysing the resulting table. It was only later when most of them got the courage of trying other types of output format and performing a few trial and errors until the desired result was achieved.

The same kinds of comments as uttered during the execution of the previous task were raised during this activity. In addition to the suggestions brought up in the previous task, an addition of another button in the chart output format page was suggested as a direct link to the main page of the prototype. Since the researcher did not have enough time refining the annotations in the chart, it was expected
that subjects would criticize the current way of presenting the results in chart form. In this respect, subjects suggested that there must be axes labels, name(s) of the administrative unit (if an object was selected) or level (if all objects in the layer were selected) as a subtitle. Alternate short names of the administrative unit names must be used to label each item on the chart to minimize the overlapping of labels and a forced one-to-one label–figure/value correspondence on the chart to avoid misleading information from automatic generalization of annotations (see Figure 5.5). Actually if one examines the graph carefully in Figure 5.5, particularly the highest peak, it fell right between Catmon and Consolacion. The labels were only visible for municipalities falling on the vertical gridlines of the chart. The highest peak actually belongs to Cebu City, but most subjects took the notion that it belongs to Catmon instead, since there was no name for Cebu City at all (nor one-to-one label-value correspondence) and yet, not all subjects have enough knowledge of the area.

5.2.4. The third task: a higher order map using task

The third task was to find out which part of Cebu province had the highest population density in 1990. The question did not require one to specifically identify the individual administrative units having the highest population density in 1990 but only an educated guess whether the concentration was more in the northern portion, central portion, or southern portion of the island. To get more detailed information on this respect, a hint to use the smallest aggregation level was given.

The hypothetical execution of this task was more or less similar to the previous ones. One just had to configure the administrative layer either to display all provinces (left drop-down list) including its municipalities/barangay (right drop-down list) and then zoom in to Cebu province by either using the “Zoom to name” pane or the “Quick locational views” pane. The selected topic must be “population density in 2000” and the type of output format must be a thematic map (see Figure 4.11 or Figure 5.6).
This was the most difficult task most of the subjects had experienced. The trouble was the English vocabulary “part” which implies geographic area or location. Most subjects started exploring the possibility of finding the right answer to the question by analysing the results in the table first, which did not give a good result due to the amount of individual values per administrative unit one had to spend time going through. Then there were attempts to use charts but that still did not give any quick result until the last type in the list of output format was tried, which was the thematic map. All subjects were very delighted to see how effective a thematic map was when it comes to presenting the results related to areas or geographic locations. Actually only two subjects went straight to choosing the thematic map as the output format without going through other output types first. This only meant that the majority still do not have the gist for map use (i.e., the purpose or benefits of using maps).

The unclarity of the actual functions of some items in the prototype was stressed again. Some subjects suggested a reorganization of other functions in a way that these would no longer confuse the future users of the prototype. Other comments and suggestions that were previously mentioned in tasks 1 and 2 were raised again such as addition of another button in the thematic map output format page, which would serve as a direct link to the main page of the prototype. This way, one does not have to keep on clicking the existing button several times just to go back to the main page of the prototype.
5.2.5. The last task: quickly finding the region with the smallest number of inhabitants

The last task was to find out which region in the Philippines had the smallest number of inhabitants in year 2000. The assumption was to choose the Region layer, making it the main layer without any sub-level, or viewing the entire country layer with the Region layer as the sub-level. This should then be followed by selecting the topic (number of inhabitants in 2000) and putting it in chart form instead of a thematic map, considering that there are smaller regional units in which overlapping proportional symbols may misinform the reader/subject (see Figure 5.7). The last problem could be solved by a toolbar of icons that is also provided in the thematic map output page (quite similar to the main page). Icons such as “zoom in”, “center/pan” and “object info” are quite useful in this respect. However, most users were still not aware of its usefulness. With regards to the users’ feedback, the same kind of general critics and suggestions were raised.

Figure 5.7 Different renditions of the fourth task showing chart (line or bar) as the quickest way to spot the region with the smallest number of inhabitants
After all the trouble most of the subjects had been through, the subjects became more familiar with the functionalities in the prototype because of: experiencing and understanding the advantages and disadvantages of using one type of output format or another, after a thorough reading of the user’s guide and the flexibility of configuring the layer views in different scenarios. As a matter of fact, most users immediately selected chart to find the region with the smallest number of inhabitants and switched between different chart types in the gallery. Then some of the subjects opted to check their findings using the thematic map and table. There was only one subject who started choosing the output in thematic map form and tried using some icons in the toolbar to navigate on the map image.

5.3. Measures to Deal with the Results of the User Tests

Despite the low number of subjects who were asked to evaluate closely the efficiency of the prototype’s design, the amount of feedback obtained was gratifying and adequate to improve the design. The following is a summary of improvements recommended for the prototype prior to making it publicly accessible on the web:

1. revision of the user’s guide by coming up with two guides: a quick reference guide which should describe briefly each item or function in the prototype and a detailed guide which should contain the following:
   - a short description of the census database
   - an overview of the country’s geography
   - the current contents of the user’s guide (original version) with addition of hyperlinks and/or an interactive interface and
   - a small tutorial lesson.
2. the window of the user’s guide should be resizable. Thus, allowing the text to wrap around to maintain the convenience of scrolling only the window vertically.
3. a button to link to the main page of the prototype should be incorporated on the user’s guide page for convenience.
4. there should be a relocation of the panes belonging to the group, “aids to selection” in the main page of the prototype so as not to confuse the user from these utilities.
5. drop-down lists for the administrative unit names should be provided as an alternative to selecting an area of interest.
6. activation of a called or requested window in the background.
7. there should be corresponding units of measure added on each displayed numeric figure in the info window.
8. a miniature window should be placed near the map image display area to give one an idea of the actual location of the zoomed area.
9. with regards to improving the output page of the chart, the following should be added:
   - axes labels
   - name(s) of the administrative unit or level as a subtitle
   - application of alternate short names of the administrative unit names to minimize the incidence of overlapping labels
   - a customized one-to-one label-figure correspondence.
10. a linked button to directly bring one back to the main page of the prototype should also be added in the chart and thematic map output page.

So far, only items 7, 8 and 9 on the list above were not implemented because of time constraints. A new version of the user’s guide that is now resizable is shown in Figure 5.8. This page provides links to the quick reference guide, the detailed guide and the main page (see Appendix D for more details). The group “aids to selection” has been relocated in the opening/main page of the prototype (see lower right hand side of Figure 5.9). A colour or contrast was also applied to distinguish between the main items for selection and this group (see Figure 5.9). A new pane called “Administrative unit names” was added as an alternative selection of objects/areas of interest (see Figure 5.9). The drop-down lists of this pane correspond to the administrative levels indicated in the “Administrative level/layer configuration” pane. Activation of any minimized or background auxiliary window was also worked out. So whenever an auxiliary window is called the focus is given to that window. A linked button to directly bring one back to the main page of the prototype was also added in the chart and thematic map output pages. Those items that were not implemented yet would be included in the list of recommendations in the next chapter.

Figure 5.8 New version of the user’s guide

Figure 5.9 New opening page of the prototype
5.4. Concluding Remarks

Thinking aloud is a process of expressing one’s thoughts verbally. This method proved to be a potentially useful tool to improve the design of the prototype. To assess the efficiency of the prototype, subjects were given a few tasks to perform. This activity involves cognitive processes both on the side of the subjects (giving the feedback) and the researcher (analysing the feedback). Although there are other ways of acquiring feedback from the users/subjects such as questionnaires or email interviews, the advantage of the think aloud method is its in-depth and unrestricted or unlimited acquisition of qualitative information from the subject. Expression of one’s thoughts is the essence of this method. However, some subjects may not be able to speak out aloud all the time during the process. But, since acquisition of information was also done by recording input from the video camera and screen capturing of the mouse, keyboard strokes and ephemeral displays on the computer, the execution of task could still be monitored well. The only major drawback seen in this method was the extensive process of acquiring the data and analysing the results. Extensive means time consuming, which implies time as an important factor to consider when planning to use this research method. The researcher also noticed during the survey that time was also a factor that affected the subjects’ performance. As observed in the playback of the recordings, those subjects that were caught checking their wrist watches, witnessed a declining performance as well.

After analysing the results from the user tests, a summary of improvements was presented. Most of these improvements were implemented and these are:

- development of a quick reference guide and a detailed guide in the user’s guide
- flexible window of the user’s guide
- incorporation of a link button to the main page of the prototype in the user’s guide, chart output page and thematic map output page
- relocation of the “aids to selection” group
- application of administrative unit names as an alternative to selecting an object/area of interest
- making any minimized or unfocused auxiliary window active when called by a function in the prototype

The remaining items for improvement and the unimplemented functionalities (those that were marked in Figure 4.6) will be mentioned in the recommendations section of the next chapter.
6. Conclusion and Recommendations

This chapter will consolidate all the highlights and the future work of this research. A wrap up of all phases that brought rationale to this research constitutes the section of the conclusions. All suggestions, future plans (such as the implementation of the prototype at NSO in the Philippines) and refinements seen will be summarized and discussed under the section of the recommendations.

6.1. Conclusions

The major step undertaken in this endeavour started by analysing all existing websites of the national statistical agencies or census bureaus in the world as a way of finding out on what has already been there. Then followed a selection of very few websites, together with four cartographic viewers of census data for further analysis and evaluation. Common characteristics spotted from this task were noted down for the implementation of the user requirement surveys and the selection of software and hardware. The next phase started with the analysis of the situation at the National Statistics Office (NSO) in the Philippines. Formulation of the questionnaires and execution of the local and on-line user requirements surveys came next. The highlight of this stage was that all proposed functionalities obtained earlier (as common characteristics) were endorsed by the majority of the respondents. These functionalities that constituted the conceptual framework of the prototype were categorized into three major points: selection of geographic/administrative area, selection of topics and selection of the output format. Among the software programs that were brought up, Manifold was chosen to be the tool for developing the prototype because it has met all the conditions set. However, an alternate choice of OWTChart.exe was incorporated in the development to meet the specification of creating charts on the fly. As a consequence, the prototype is classified to be a hybrid system then. To test the prototype, a subset of the census geo-database was used. The last major step of this research was to obtain feedback on the efficiency and effectiveness of the prototype’s design from respondents who indicated their willingness to participate in the first user survey. Only nine (9) subjects were asked to undergo a comprehensive evaluation of the prototype using the “think aloud” research method. This is a method of expressing one’s thoughts verbally while executing the given tasks (or problem). Reorganization of the components in the prototype’s main page and revision of the user’s guide were the major improvements done after analysing the users feedback.
6.2. Recommendations

Due to the current limitations of the Internet map server of Manifold on the aspect of performing even a simple interactive GIS, there was no editing function (for interactive cartographic visualization) of maps in the prototype. However, this constraint can be overcome using external web tools that are freely available on the Internet (see URL 15) such as the Mapserver open source program (see URL 14), a CGI version of an Internet map server, which still meets the criterion on copyright issues mentioned in Section 4.2.1. However, due to the nature of a CGI program code, which requires intensive programming, there was no opportunity to try and explore the capabilities of this program. Therefore, it is highly recommended to continue this endeavour in the future.

Despite Manifold’s IMS limitations, the researcher was impressed by the power, flexibility and ease of use of its local GIS environment. Manifold was even compared with ESRI’s ArcView version 3.2 by the researcher and others who have shifted to Manifold. It was proven that the former is better over the latter for some reasons (see Section 4.2.2). Considering the cost (only $245 US versus ESRI products costing thousands of dollars) of acquiring Manifold and knowing that it is already built-in with a lightweight IMS, there is a very good potential to advocate the use of this program as one of the tools for teaching GIS in schools. Besides, existing map file formats from other GIS packages such as ArcView or MapInfo can be read or imported to Manifold without any problem.

Since administrative boundary map layers in this application are only used for visualizing the spatial data of the census, it is highly recommended that these layers are be generalized or topologically normalized in order to minimize the size of the map files for publication on the web. It is always a good attitude to consider the speed when disseminating data through the web. However, due to problems with some boundaries when acquired as ArcView shapefiles, it is recommended to edit or correct them first before generalizing the topologies of these maps.

Lastly, it is highly recommended that all remaining items in the summary of improvements (see Section 5.3) and functionalities in the conceptual framework that were not yet realized (see Figure 4.6) should be implemented to enhance the efficiency and effectiveness of the prototype. The remaining items are application of:

- units of measure in the info window
- miniature window of the full extent of the visible map layers (to give one an idea of the actual location of the zoomed area)
- other annotation components to make the chart presentation better.

While the unimplemented functionalities are:

- drawing of a box on the map and hyperlinks as alternative selections of geographic/administrative area of interest
- keyword search and hyperlinks as alternative selections of topics or subjects
- data analysis functionality and prepared topics in hyperlinks for exploration and analysis of the census data
- and download facility for the census data
It is also recommended to add the possibility of generating more chart and thematic map types (see Appendix C or Section 4.1) and include a real interactive cartographic exploration facility in the prototype. Gathering of users feedback should also be continued when this prototype becomes publicly accessible on the web to make the dissemination of the data even better.

Implementation of the Prototype at NSO in the Philippines

Since the majority of the proposed functionalities is already implemented in the prototype, the researcher will hand-over the design and the documentation to the beneficiary of this research, the Philippine NSO. It is suggested that this be considered now as one of NSO’s current activities on the web. Therefore, this entails a purchase of Manifold and complying the basic software and hardware requirements needed to install it. In view of the current website infrastructure of NSO (refer to Sections 3.1.3 and 4.2.2), these requirements do not pose any problem at all. However, additional manpower is required to set up the system of the prototype, program the rest of the functionalities or customize it and manage it. NSO must also take into account of hiring or training a staff in cartography to understand the underlying principles of disseminating and visualizing their data and apply the proper visualization protocols. Since it is not feasible to use the think aloud method for gathering of users feedback in this respect, it is suggested to do it instead in a structured interview on-line. The prototype may be put in a separate section called “on-line dissemination of census data”. Since this is going to be NSO’s newest on-line service, it is good that it publicizes the availability of this service nationwide. It is also the researcher’s intention to make this a generic application so that any interested census bureau in the world can avail of.
URLs

URL 1  American FactFinder
http://factfinder.census.gov/servlet/BasicFactsServlet

URL 2  Cartographic Data Visualizer
http://www.kinds.ac.uk/kinds/AboutKINDS/JANUS/cdv.htm

URL 3  Census Online of UK
http://www.census.pro.gov.uk

URL 4  CIA's The World Factbook 2001

URL 5  CIESIN Demographic Data Viewer
http://plue.sedac.ciesin.org/plue/ddviewer/

URL 6  Descartes: Intelligent Mapping and Visual Data Exploration in the WWW
http://borneo.gmd.de/and/java/iris/

URL 7  Exploring Leicestershire sample census dataset with Descartes
http://lenny.mcc.ac.uk/kindsdb6/

URL 8  The Integrated Microcomputer Processing System
http://www.census.gov/ipc/www/imps/

URL 9  Metanomix by Etin Adviseurs: for surveys via Internet
http://www.metanomix.nl

URL 10  National Statistics Office of the Philippines
http://www.census.gov.ph

URL 11  Statistics Netherlands (Centraal Bureau voor de Statistiek)
http://www.cbs.nl/nl/statline/kaarten/klikkaartinternet.htm

URL 12  JShape Java Applet
http://www.jshape.com/

URL 13  Manifold.Net
http://www.manifold.net/index.html

URL 14  Mapserver Open Source Package
http://mapserver.gis.umn.edu/

URL 15  Open Web Tools
http://www2.dmsolutions.ca/webtools/index.html

URL 16  OWTChart Engine
http://www2.dmsolutions.ca/webtools/owtchart/owtchart_chartgen.html

URL 17  ROSA Java Applet
http://www2.dmsolutions.ca/webtools/rosa/index.html

URL 18  GeoTools Applet Viewer
http://geotools.sourceforge.net/

URL 19  CartoAppletViewer
http://www.geo.unizh.ch/~acecconi/CartoApplet

URL 20  BJ_Map
http://www.h.scb.se/schbor/scbboju/bj.htm_en/index.html
<table>
<thead>
<tr>
<th>URL</th>
<th>Description</th>
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<tr>
<td>22</td>
<td>MapInfo MapXtreme for Windows</td>
<td><a href="http://dynamo.mapinfo.com/miproducts/Overview.cfm?productid=1101">http://dynamo.mapinfo.com/miproducts/Overview.cfm?productid=1101</a></td>
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<td>23</td>
<td>Central Bureau of Statistics (CBS) of Israel</td>
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<tr>
<td>24</td>
<td>National Office of Statistics (ONS) of Algeria</td>
<td><a href="http://www.ons.dz">http://www.ons.dz</a></td>
</tr>
<tr>
<td>26</td>
<td>Statistics Sweden (SCB)</td>
<td><a href="http://www.scb.se">http://www.scb.se</a></td>
</tr>
</tbody>
</table>
URLs of Census Bureaus Worldwide

Åland: Ålands Statistik (ASUB)
http://www.asub.aland.fi/

Albania: Institute of Statistics (INSTAT)
http://www.instat.gov.al/

Algeria: National Office of Statistics (ONS)
http://www.ons.dz

Andorra: Departament d'Estudis i d'Estadística (DEE)
http://estudis-estadistica.finances.ad/

Argentina: National Institute of Statistics and Censuses (INDEC)
http://www.indec.mecon.ar

Armenia: National Statistical Service of the Republic of Armenia (ARMSTAT)
http://www.armstat.am/

Aruba: Central Bureau of Statistics
http://www.arubastatistics.com/Index.htm

Australia: Australian Bureau of Statistics
http://www.abs.gov.au

Austria: Österreichisches Statistisches Zentralamt (ÖSTAT)
http://www.oestat.gv.at/

Azerbaijan: State Statistical Committee of Azerbaijan Republic
http://www.statcom.baku-az.com

Bangladesh: Bureau of Statistics
http://www.bbsgov.org/

Barbados: Barbados Statistical Service
http://www.bgis.gov.bb/stats/

Belarus: Ministry of Statistics and Analysis
http://www.minstat.gov.by/

Belgium: National Institute of Statistics
http://statbel.fgov.be/

Belize: Central Statistical Office (CSO)
http://www.cso.gov.bz/

Benin: Centre de Documentation et d'Informatique
http://planben.intnet.bj/

Bolivia: National Institute of Statistics (INE)
http://www.ine.gov.bo/

Botswana: Central Statistics Office (CSO)
http://www.cso.gov.bw/

Brazil: Brazilian Institute of Geography and Statistics (IBGE)
http://www.ibge.gov.br/

Bulgaria: National Statistical Institute (NSI)
http://www.nsi.bg

Cambodia: National Institute of Statistics
http://www.nis.gov.kh/

Canada: Statistics Canada:
http://www.statcan.ca/

Cape Verde: Instituto Nacional de Estatística (INE)
http://www.ine.cv/

Chile: National Institute of Statistics (INE)
http://www.ine.cl/

China: China Statistical Information Network
http://www.stats.gov.cn
Indonesia: Central Bureau of Statistics (BPS)  
http://www.bps.go.id

Iran: Statistical Centre of Iran (SCI)  
http://www.sci.or.ir/

Ireland: Central Statistics Office  
http://www.cso.ie

Israel: Central Bureau of Statistics (CBS)  
http://www.cbs.gov.il

Italy: National Institute of Statistics (ISTAT)  
http://www.istat.it

Jamaica: Statistical Institute of Jamaica (STATIN)  
http://www.statinja.com/

Japan: Japanese Statistics Bureau and Statistics Center  
http://www.stat.go.jp

Jordan: Department of Statistics (DOS)  
http://www.dos.gov.jo/

Kazakhstan: Agency of Republic of the Kazakhstan on Statistics  
http://www.kazstat.asdc.kz

Korea: National Statistical Office  
http://www.nso.go.kr

Kuwait: Statistics and Information Sector  
http://www.mop.gov.kw

Kyrgyzstan: National Statistical Committee of the Kyrgyz Republic  
http://nsc.bishkek.su

Latvia: Central Statistical Bureau of Latvia (CSB)  
http://www.csb.lv/

Lebanon: Central Administration for Statistics (CAS)  
http://www.cas.gov.lb/

Libya: National Corporation for Information and Documentation  

Lithuania: Department of Statistics (StD)  
http://www.std.lt

Luxembourg: National Institute of Statistics and Economic Studies  
http://statec.gouvernement.lu/

Macau: Statistics and Census Service (DSEC)  
http://www.dsec.gov.mo

Macedonia: Statistical Office of the Republic of Macedonia  
http://www.stat.gov.mk

Malawi: Malawi National Statistical Office  
http://www.nso.malawi.net

Malaysia: Department of Statistics (JP)  
http://www.statistics.gov.my

Maldives: Ministry of Planning & National Development  
http://www.planning.gov.mv/

Malta: Central Office of Statistics (COS)  
http://www.magnet.mt/home/cos

Marshall Islands: Republic of the Marshall Islands Statistical Information  
http://www.rmiembassyus.org/stats.html

Mauritania: Office National de la Statistique (ONS)  
http://www.ons.mr/

Mauritius: Central Statistics Office  
http://mcb.intnet.mu/cso.htm

Mexico: National Institute of Statistics, Geography and Informatics  
http://www.inegi.gob.mx/
Moldova: Departamentul Analize Statistice și Sociologice

Mongolia: Mongolian Statistics Website
http://www.nso.mn/

Morocco: Direction de la Statistique
http://www.statistic.gov.ma/

Mozambique: Instituto Nacional de Estatística (INE)
http://www.ine.gov.mz/

Netherlands: Central Bureau of Statistics (CBS)
http://www.cbs.nl

New Zealand: Te Tari Tatau - Statistics New Zealand
http://www.stats.govt.nz/statsweb.nsf

Norway: Statistics Norway (SSB)
http://www.ssb.no

Oman: Ministry of National Economy
http://www.moneoman.org/

Pakistan: Statistics Division
http://www.statpak.gov.pk/

Palestinian Authority: Palestinian Central Bureau of Statistics (PCBS)
http://www.pCBS.org

Panama: Contraloría General de la República de Panamá
http://www.contraloria.gob.pa/

Papua New Guinea: National Statistical Office (NSO) of Papua New Guinea
http://www.nso.gov.pg/

Paraguay: Dirección General de Estadística, Encuestas y Censos (DGEEC)
http://www.dgeec.gov.py/

Peru: National Institute of Statistics and Informatics
http://www.inei.gob.pe

Philippines: National Statistical Office
http://www.census.gov.ph/

Poland: Polish Official Statistics
http://www.stat.gov.pl

Portugal: National Institute of Statistics
http://www.ine.pt

Romania: National Commission for Statistics (NCS)
http://www.cns.ro/indexe.htm

Russia: Russian State Committee for Statistics
http://www.gks.ru

Saint Lucia: Central Statistic Office
http://www.stats.gov.lc/

Scotland: General Register Office for Scotland
http://wood.ccta.gov.uk/grosweb/grosweb.nsf/pages/home

Seychelles: Statistics and Database Administration Section
http://www.seychelles.net/misdstat/

Singapore: Department of Statistics
http://www.singstat.gov.sg/

Slovakia: Statistical Office of the Slovak Republic
http://www.statistics.sk

Slovenia: Statistical Office of the Republic of Slovenia
http://sigov3.sigov.si/zrs

South Africa: Statistics South Africa
http://www.statssa.gov.za/

South Korea: Korea National Statistical Office
http://www.nso.go.kr
Spain: National Institute of Statistics (INE)
http://www.ine.es/

Sri Lanka: Department of Census and Statistics (DCS)
http://www.statistics.gov.lk

Sweden: Statistics Sweden (SCB)
http://www.scb.se

Switzerland: Swiss Federal Statistical Office
http://www.statistik.admin.ch

Taiwan: National Statistics
http://www.stat.gov.tw

Thailand: National Statistical Office (NSO)
http://www.nso.go.th

Tunisia: Institut National de la Statistique (INS)
http://www.ins.nat.tn/

Turkey: State Institute of Statistics (SIS)
http://www.die.gov.tr

Ukraine: The State Committee of Statistics of Ukraine
http://www.ukrstat.gov.ua/

United Kingdom: Office for National Statistics
http://www.statistics.gov.uk

United States of America: U.S. Census Bureau
http://www.census.gov/

Uruguay: Instituto Nacional de Estadística (INE)
http://www.ine.gub.uy/

Uzbekistan: Ministry of Macroeconomy and Statistics
http://www.gov.uz/government/minmacro/

Venezuela: Central Office of Statistics and Informatics (OCEI)
http://www.oei.gov.ve/

Yugoslavia: Federal Statistical Office (SZS)
ACSM (1990), The Census Bureau's TIGER system. American Congress on Surveying and Mapping (ACSM), 17, 1, 133.


ARCNEWS (2000), U.S. Census American FactFinder Team Receives Vice President's Hammer Award. 5

ARCNEWS (2001), ESRI's New Web Portal Provides One-Stop Shop for Census-Related Information: Census Watch Helps Users Tune to the Latest Numbers. 23, 2, 47


BO, J. (2001), Private communication.


ITC (2001a), Module 12: "Web technology for GIS and mapping" lecture materials. ITC, Enschede, The Netherlands

ITC (2001b), Module 6: "Dissemination and Visualization of Spatial Data" lecture materials. ITC, Enschede, The Netherlands


MANIFOLD TECHNICAL SUPPORT (2001), Private communication.


Appendix A
ITC version:

CENSUS DATA USER REQUIREMENTS SURVEY

The purpose of this initial survey is to help me identifying desirable functionalities for a web interface between the users of Census data and the Census bureau (NSO). Whenever you read ‘Census data’, you may also read ‘...or other statistical data provided by the national statistics office’. Please answer the questions carefully and truthfully.

Daisy Redido-Cusi
MSc student in Geoinformatics
ITC, Enschede, The Netherlands

1. What is your country of origin?_________________________________

2. What is your line of work or profession in your country?

Please mark or check all that apply:
- Teacher
- Researcher/Scientist
- Student/No profession yet
- Manager/Director/Administrator
- Development Planner
- Environmentalist
- Social Worker
- Engineer
- Health/Medical practitioner
- Sales/Businessman
- Public/Religious servant
- Others (Specify):_________________________________

3. Please identify the type of your organization in your country.

Please mark or check only one:
- Academic/Education
- Government
- Non-Government
- Research
- Commercial/Business
- Medical
- Religious
- Home/Self-employed
- Others (Specify):_________________________________

4. Since when have you been using Census data?

Please mark or check only one:
- Less than a year
- 1 - 2 years
- 2 - 5 years
- more than 5 years
- I have never used Census data before, but I am planning to do so

5. Particularly where is the Census data applied to or why do you need this data?

Please mark or check all that apply:
- Teaching/Education
- Planning/Decision-making
- Marketing
- Health
- Budget/Funding allocation
- Engineering works or Infrastructure
- Research
- Community services or Outreach
- Information/News
- Publication
- GIS
- Small projects
- Others (Specify):_________________________________
6. Does the national statistics office or Census bureau in your country maintain a website?

Please mark or check only one:
☐ Yes  ☐ No  ☐ Don’t know

7. How do you acquire the Census data?

Please mark or check all that applies:
☐ Downloading the data directly
☐ Request or order by mail
☐ Request or order by phone
☐ Request or order through Bulletin Board System (BBS)
☐ Request or order through the Internet
☐ by personal/direct appearance
☐ from published books/materials obtained
☐ from elsewhere
☐ Others (Specify): ________________________

8. Normally, what is the media used to contain in particular the Census data when you get it?

Please mark or check only one:
☐ Paper, photocopy, handwritten or print-out
☐ Diskette, Bernoulli, Syquest or tape
☐ CD-ROM, Zip or Iomega disk
☐ Digital or softcopy downloaded from the Internet or BBS

9. If you have to contact the Census bureau (NSO) in your country, is the office or the address (email or postal) easy to reach/find?

Please mark or check only one:
☐ Yes  ☐ No  ☐ I don’t know the address  ☐ Not Applicable

10. Do you have to pay for acquiring the Census data?

Please mark or check only one:
☐ Yes, at full amount
☐ Yes, but discounted
☐ Only the distribution/copying fee
☐ No

11. In what form are the Census data organized, disseminated or presented when you get it?

Please mark or check only one:
☐ plain text
☐ charts (e.g., pie or bar graphs)
☐ in tables
☐ thematic or statistical maps

12. Do you need expert help or a knowledgeable person to guide you during the process of inquiring and/or requesting for the Census data?

☐ Yes  ☐ No
13. Where in your home country do you have access to computer(s)?

Please mark or check all that apply:
- At home
- At work (office)
- School/Library
- Internet or computer café/kioks/shop
- Somebody else’s computer, rented, or borrowed computer
- Others (Specify): ____________________________

14. Where in your home country do you have access to the Internet/WWW?

Please mark or check all that apply:
- At home
- At work (office)
- School/Library
- Internet or computer café/kioks/shop
- Somebody else’s computer, rented, or borrowed computer
- Others (Specify): ____________________________

15. Please rank honestly the level of your knowledge in computers by checking or marking only the appropriate box below.

- Expert
- Average
- Beginner

16. Does it happen to you that you cannot view the information or image on the Internet/web on the computer you are using most of the time, not because of the Internet connection?

Please mark or check all that apply:
- Yes, because it needs programs/software plug-ins to be installed in the computer first
- Yes, because the computer needs re-configuration
- Yes, sometimes but don’t know the cause
- Yes, because the computer is old
- No
- Others (Specify): ____________________________

17. Are you free or allowed to install software/programs or tinker/configure the setup of the computer you are using most of the time?

Please mark or check only one:
- Yes, anytime
- Yes, but through a computer administrator
- No, not at all

18. To speed up the delivery of services, avoid office hours problems/constraints and waiting time for your request to be entertained at the Census bureau, would you like the idea of disseminating the Census data or catering services to the public through the Internet/WWW?

- Yes
- I don’t care
- No

If No, why?

Please mark or check all that apply:
- No budget, too ambitious, too expensive to put up a system infrastructure
- Too expensive to maintain such a system
- Not practical, there are still a lot who do not know how to use a computer or Internet
- Internet connection is expensive
- Others (Specify): ____________________________
19. Would you prefer to be given flexibility or option to choose the method of retrieving or downloading the Census data; for example, print the data on paper or download to a local hard disk or diskette? OPTIONAL: Go and experience this function at: http://factfinder.census.gov/b0f?lang=en&vt=st.name=DEC_2000_SF1_U&DP1&geo_id=04000US936.html

☐ Yes ☐ I don't care ☐ No

20. Would you be interested in the possibility to only select data for a particular geographical area (e.g., for a particular province or municipality)? OPTIONAL: Go and experience this function at: http://www.abs.gov.au/ausstats/absweb/D331010US11NSF/19996d24c8f22d024a2565000001c0576/569af8d15c221964a2565010007e32f10OpenDocument

☐ Yes ☐ I don't care ☐ No

If so, in what way:
☐ by clicking or by drawing a box on a map
☐ by selecting the name of the area (e.g., from a drop-down list)
☐ by both methods

21. Would you be interested in the possibility to only select for a particular topic (e.g., migration, population, education)? OPTIONAL: Go and experience this function at: http://factfinder.census.gov/service/BasicFactsServlet (Show me... in "Start with Basic Facts" box)

☐ Yes ☐ I don't care ☐ No

If so, in what way:
☐ by selecting the name of the topic (e.g., from a drop-down list)
☐ by a keyword search
☐ by both methods

22. Would you like to be given flexibility or option to choose the format of how Census data be presented or organized such as tables, plain text document, graphs or statistical maps? OPTIONAL: Go and experience this function at: http://factfinder.census.gov/service/BasicFactsServlet

☐ Yes ☐ I don't care ☐ No

23. Would you like to be given flexibility to interactively change the default presentation (tables, plain text, graphs, maps) or design on-line your own output/presentation/visualization using the Census data without any need to install additional software/program/plug-in in your computer? OPTIONAL: Go and experience this function at: http://borneo.gmd.de/snd/java/ris/

☐ Yes, definitely
☐ Not really, I have my own special software/program
☐ I don't care
☐ No
24. Sometimes, graphic images/pictures are intuitive or informative in nature. A scenario:

Population density is defined as the number of people living per square meters or kilometers (i.e., population - area). Compare Table 1* and Figure 1* (on the next page), in terms of the population densities. Which of the two you can easily draw or point the growing population? It's the figure which shows two different years of population densities in thematic or statistical map form, right? With this figure, you can easily compare the trend of the population densities from 1978 to 1995. How about analyzing the trend using Table 1? Not easy or not that quick, right?

In this respect, would you appreciate to have the functionality of producing or designing maps on-line using the Census data?Optional: Go and experience some examples at: alleron.grid.de/and/java/iris/applet/index.cml.html

☐ Yes  ☐ I don't care  ☐ No

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</tr>
</tbody>
</table>

*Table 1 and Figure 1 are extracted from "The Mountains of Cebu and Their Inhabitants: Measurements and Estimates" by Flajer and Cusi, 1998.
25. Would you be willing to participate in a user test of the effectiveness of a prototype of a new website for the dissemination of Census in the Philippines? The test will be at ITC in December 2001 or January 2002.

☐ Yes  ☐ Maybe  ☐ No

If Yes or Maybe, please write down your email address ____________________

Thank you very much for your cooperation!
Philippine version:

CENSUS DATA USER REQUIREMENTS SURVEY

The purpose of this initial survey is to help me identify desirable functionalities for a web interface between the users of Census data and the Census bureau (NSO). Whenever you read ‘Census data’, you may also read ‘…or other statistical data provided by the national statistics office’. Please answer the questions carefully and truthfully.

Daisy Reddan-Cusi
MSc student in Geoinformatics
ITC, Enschede, The Netherlands

1. What is your line of work or profession in your country?

Please mark or check all that apply:

- Teacher
- Researcher/Scientist
- Student/No profession yet
- Manager/Director/Administrator
- Development Planner
- Environmentalist
- Social Worker
- Engineer
- Health/Medical Practitioner
- Sales/Businessman
- Public/Religious servant
- Others (Specify) ________________

2. Please identify the type of your organization in your country.

Please mark or check only one:

- Academic/Education
- Government
- Non-Government
- Research
- Commercial/Business
- Medical
- Religious
- None/Self-employed
- Others (Specify) ________________

3. Since when have you been using Census data?

Please mark or check only one:

- Less than a year
- 1 – 2 years
- 2 – 5 years
- More than 5 years
- I have never used Census data before, but I am planning to do so

4. Particularly where is the Census data applied to or why do you need this data?

Please mark or check all that apply:

- Teaching/Education
- Planning/Decision-making
- Marketing
- Health
- Budget/Funding allocation
- Engineering or Infrastructure
- Research
- Community services or Outreach
- Information/New Publication
- GIS
- Small projects
- Others (Specify) ________________

5. Does the national statistics office or Census bureau in your country maintain a website?

Please mark or check only one:

- Yes
- No
- Don't know
6. How do you acquire the Census data?

Please mark or check all that apply:
- [ ] Downloading the data directly
- [ ] Request or order by mail
- [ ] Request or order by phone
- [ ] Request or order through Bulletin Board System (BBS)
- [ ] Request or order through the Internet
- [ ] Request or order through the Internet by personal/direct appearance
- [ ] Request or order through the Internet from published books/materials obtained from elsewhere
- [ ] Others (Specify): ___________________________  

7. Normally what is the media used to contain in particular the Census data when you get it?

Please mark or check only one:
- [ ] Paper, photocopy, hardcopy or print-out
- [ ] Diskette, Bernoulli, Syquest or tape
- [ ] CD-ROM, Zip or harddisk
- [ ] Digital or softcopy downloaded from the Internet or BBS

8. If you have to contact the Census bureau (NSO) in your country, is the office or the address (email or postal) easy to reach/find?

Please mark or check only one:
- [ ] Yes
- [ ] No
- [ ] I don't know the address
- [ ] Not Applicable

9. Do you have to pay for acquiring the Census data?

Please mark or check only one:
- [ ] Yes, at full amount
- [ ] Yes, but discounted
- [ ] Only the distribution/copying fee
- [ ] No

10. In what form are the Census data organized, disseminated or presented when you get it?

Please mark or check only one:
- [ ] Plain Text
- [ ] Charts (e.g., pie or bar graphs)
- [ ] In tables
- [ ] Thematic or statistical maps

11. Do you need expert help or an knowledgeable person to guide you during the process of inquiring and/or requesting for the Census data?

- [ ] Yes
- [ ] No

12. Where in your home country do you have access to computer(s)?

Please mark or check all that apply:
- [ ] At home
- [ ] At work (office)
- [ ] School/Library
- [ ] Internet or computer café/shops
- [ ] Somebody else’s computer, rented, or borrowed computer
- [ ] Others (Specify): ___________________________
13. Where in your home country do you have access to the Internet/WWW?

Please mark or check all that apply:

☐ At home
☐ At work (office)
☐ School/Library
☐ Internet or computer café & kiosk/shop
☐ Others (Specify): __________________________

14. Please rank honestly the level of your knowledge in computers by checking or marking only the appropriate box below.

☐ Expert
☐ Average
☐ Beginner

15. Does it happen to you that you cannot view the information or image on the Internet/Web on the computer you are using most of the time, not because of the Internet connection?

Please mark or check all that apply:

☐ Yes, because it needs programs/software/plugins to be installed in the computer first
☐ Yes, because the computer needs re-configuration
☐ Yes, sometimes but don’t know the cause
☐ Yes, because the computer is old
☐ No
☐ Others (Specify): __________________________

16. Are you free or allowed to install software programs or tinker/configure the setup of the computer you are using most of the time?

Please mark or check only one:

☐ Yes, anytime
☐ Yes, but through a computer administrator
☐ No, not at all

17. To speed up the delivery of services, avoid office hours problems/constraints and waiting time for your request to be entertained at the Census bureau, would you like the idea of disseminating the Census data or catering services to the public through the Internet/WWW?

☐ Yes
☐ I don’t care
☐ No

If No, why?

Please mark or check all that apply:

☐ No budget, too ambitious, too expensive to put up a system infrastructure
☐ Too expensive to maintain such a system
☐ Not practical, there are still a lot who do not know how to use a computer or Internet
☐ Internet connection is expensive
☐ Others (Specify): __________________________

18. Would you prefer to be given flexibility or option to choose the method of retrieving or downloading the Census data, for example, print the data on paper or download to a local harddisk or diskette?

☐ Yes
☐ I don’t care
☐ No
19. Would you be interested in the possibility to only select data for a particular geographical area (e.g., for a particular province or municipality)?

☐ Yes ☐ I don’t care ☐ No

If so, in what way:
☐ by clicking or by drawing a box on a map
☐ by selecting the name of the area (e.g., from a drop-down list)
☐ by both methods

20. Would you be interested in the possibility to only select for a particular topic (e.g., migration, population, education)?

☐ Yes ☐ I don’t care ☐ No

If so, in what way:
☐ by selecting the name of the topic (e.g., from a drop-down list)
☐ by a keyword search
☐ by both methods

21. Would you like to be given flexibility or options to choose the format of how Census data be presented or organized such as tables, plain text document, graphs or statistical maps?

☐ Yes ☐ I don’t care ☐ No

22. Would you like to be given flexibility to interactively change the default presentation (table, plain text, graphs, maps) or design on-line your own output/presentation/visualization using the Census data without any need to install additional software/program/plugin in your computer?

☐ Yes, definitely
☐ Not really, I have my own special software/program ☐ I don’t care
☐ No

23. Sometimes, graphic images/pictures are intuitive or informative in nature.
A scenario:
Population density is defined as the number of people living per square meters or kilometers (i.e., population - area). Compare Table 1* and Figure 1* on the next page, in terms of the population densities. Which of the two you can easily draw or point to the growing population? It’s the figure which shows two different years of population densities in thematic or statistical map form, right? With this figure, you can easily compare the trend of the population densities from 1970 to 1995. How about analyzing the trend using Table 1? Not easy or not that quick, right?.

In this respect, would you appreciate to have the functionality of producing or designing maps on-line using the Census data?

☐ Yes ☐ I don’t care ☐ No

*Table 1 and Figure 1 are extracted from “The Mountains of Cebu and Their Inhabitants: Measurements and Estimates” by Plegar and Cari, 1998.
Table 1. Area, Population and Population Densities in Metro Cebu, by Barangay: 1970 & 1985

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cogon, Compostela</td>
<td>3.14</td>
<td>934</td>
<td>3294</td>
<td>297</td>
<td>1049</td>
</tr>
<tr>
<td>Subahbasbas, Lapu-lapu City</td>
<td>2.24</td>
<td>1227</td>
<td>1809</td>
<td>410</td>
<td>677</td>
</tr>
<tr>
<td>Catuban, Lapu-lapu City (Open)</td>
<td>0.14</td>
<td>1349</td>
<td>1912</td>
<td>994</td>
<td>10657</td>
</tr>
<tr>
<td>Aqs. Lapu-lapu City (Open)</td>
<td>3.67</td>
<td>1539</td>
<td>5240</td>
<td>410</td>
<td>1455</td>
</tr>
<tr>
<td>Caw-as, Lapu-lapu City (Open)</td>
<td>0.37</td>
<td>661</td>
<td>1002</td>
<td>1784</td>
<td>2709</td>
</tr>
<tr>
<td>Loco, Lapu-lapu City (Open)</td>
<td>2.86</td>
<td>3200</td>
<td>6780</td>
<td>1118</td>
<td>2373</td>
</tr>
<tr>
<td>Pangan-an, Lapu-lapu City (Open)</td>
<td>0.46</td>
<td>807</td>
<td>1229</td>
<td>1881</td>
<td>2660</td>
</tr>
<tr>
<td>Baring, Lapu-lapu City (Open)</td>
<td>0.76</td>
<td>1061</td>
<td>2903</td>
<td>1383</td>
<td>3140</td>
</tr>
<tr>
<td>Pangratungan, Mandaue City</td>
<td>1.38</td>
<td>0</td>
<td>817</td>
<td>0</td>
<td>4640</td>
</tr>
<tr>
<td>Talason, Mandaue City</td>
<td>1.25</td>
<td>764</td>
<td>1400</td>
<td>511</td>
<td>1120</td>
</tr>
<tr>
<td>Pakna-an, Mandaue City</td>
<td>1.77</td>
<td>1067</td>
<td>12764</td>
<td>1777</td>
<td>7211</td>
</tr>
<tr>
<td>Ibajao-Estancia, Mandaue City</td>
<td>0.55</td>
<td>3288</td>
<td>7019</td>
<td>6976</td>
<td>10683</td>
</tr>
<tr>
<td>Banilad, Mandaue City</td>
<td>2.64</td>
<td>1439</td>
<td>14947</td>
<td>546</td>
<td>5662</td>
</tr>
<tr>
<td>Sincin, Cebu City</td>
<td>0.06</td>
<td>1898</td>
<td>1898</td>
<td>138</td>
<td>209</td>
</tr>
<tr>
<td>Palti, Cebu City</td>
<td>3.19</td>
<td>736</td>
<td>1133</td>
<td>231</td>
<td>357</td>
</tr>
<tr>
<td>Hiteodnemo, Cebu City</td>
<td>0.80</td>
<td>7095</td>
<td>9305</td>
<td>7972</td>
<td>10456</td>
</tr>
<tr>
<td>Lao, Cebu City</td>
<td>0.24</td>
<td>2756</td>
<td>1315</td>
<td>11396</td>
<td>66483</td>
</tr>
<tr>
<td>Babaj, Cebu City</td>
<td>2.92</td>
<td>909</td>
<td>2705</td>
<td>311</td>
<td>920</td>
</tr>
</tbody>
</table>

Figure 1. Population Densities in Metro Cebu, by Barangay

Thank you very much for your cooperation!
Appendix B
Summary of responses from the user requirement surveys

1. What is your country of origin?

<table>
<thead>
<tr>
<th>Country</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Bhutan</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Brazil</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Cameroon</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Colombia</td>
<td>2</td>
<td>N.A.</td>
</tr>
<tr>
<td>Egypt</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>India</td>
<td>2</td>
<td>N.A.</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2</td>
<td>N.A.</td>
</tr>
<tr>
<td>Israel</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Japan</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Malawi</td>
<td>3</td>
<td>N.A.</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Mexico</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Mongolia</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Netherlands</td>
<td>6</td>
<td>N.A.</td>
</tr>
<tr>
<td>Philippines</td>
<td>21</td>
<td>50</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>South Africa</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>2</td>
<td>N.A.</td>
</tr>
<tr>
<td>Uganda</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Vietnam</td>
<td>2</td>
<td>N.A.</td>
</tr>
<tr>
<td>Zambia</td>
<td>1</td>
<td>N.A.</td>
</tr>
<tr>
<td>Total</td>
<td>56</td>
<td>50</td>
</tr>
</tbody>
</table>

2. What is your line of work or profession in your country? (Multiple response)

<table>
<thead>
<tr>
<th>Role</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Researcher/Scientist</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>Student/No profession yet</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Manager/Director/Administrator</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Development Planner</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Environmentalist</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Social Worker</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Engineer</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Health/Medical practitioner</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Sales/Businessman</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Public/Religious servant</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Others</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>
3. Please identify the type of your organization in your country.

<table>
<thead>
<tr>
<th>Type of Organization</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/Education</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>Government</td>
<td>32</td>
<td>20</td>
</tr>
<tr>
<td>Non-Government</td>
<td>35</td>
<td>7</td>
</tr>
<tr>
<td>Research</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Commercial/Business</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Medical</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Religious</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>None/Self-employed</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

4. Since when have you been using Census data?

<table>
<thead>
<tr>
<th>Duration</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than a year</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>1 – 2 years</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>2 - 5 years</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>more than 5 years</td>
<td>32</td>
<td>31</td>
</tr>
<tr>
<td>I have never used Census data before, but I am planning to do so</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

5. Particularly where is the Census data applied to or why do you need this data? (Multiple response)

<table>
<thead>
<tr>
<th>Application</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching/Education</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>Planning/Decision-making</td>
<td>47</td>
<td>23</td>
</tr>
<tr>
<td>Marketing</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Health</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Budget/Funding allocation</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Engineering works or Infrastructure</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td>Research</td>
<td>28</td>
<td>23</td>
</tr>
<tr>
<td>Community services or Outreach</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Information/News</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Publication</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>GIS</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>Small projects</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

6. Does the national statistics office or Census bureau in your country maintain a website?

<table>
<thead>
<tr>
<th>Option</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>37</td>
<td>32</td>
</tr>
<tr>
<td>No</td>
<td>16</td>
<td>2</td>
</tr>
<tr>
<td>Don’t know</td>
<td>2</td>
<td>16</td>
</tr>
</tbody>
</table>

7. How do you acquire the Census data? (Multiple response)

<table>
<thead>
<tr>
<th>Method</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downloading the data directly</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>Request or order by mail</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Request or order by phone</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Request or order through Bulletin</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Board System (BBS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Request or order through the Internet</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>by personal/direct appearance</td>
<td>25</td>
<td>36</td>
</tr>
<tr>
<td>from published books/materials</td>
<td>29</td>
<td>12</td>
</tr>
<tr>
<td>obtained from elsewhere</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
8. Normally what is the media used to contain in particular the Census data when you get it?

<table>
<thead>
<tr>
<th>Media Description</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper, photocopy, hardcopy or print-out</td>
<td>34</td>
<td>40</td>
</tr>
<tr>
<td>Diskette, Bernoulli, Syquest or tape</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>CD-ROM, Zip or Jazz disk</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Digital or softcopy downloaded from the Internet or BBS</td>
<td>9</td>
<td>4</td>
</tr>
</tbody>
</table>

9. If you have to contact the Census bureau (NSO) in your country, is the office or the address (email or postal) easy to reach/find?

<table>
<thead>
<tr>
<th>Response</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>36</td>
<td>44</td>
</tr>
<tr>
<td>No</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>I don’t know the address</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Not Applicable</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

10. Do you have to pay for acquiring the Census data?

<table>
<thead>
<tr>
<th>Payment Details</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, at full amount</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Yes, but discounted</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Only the distribution/copying fee</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>No</td>
<td>23</td>
<td>18</td>
</tr>
</tbody>
</table>

11. In what form are the Census data organized, disseminated or presented when you get it?

<table>
<thead>
<tr>
<th>Form Description</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain Text</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>in Tables</td>
<td>45</td>
<td>28</td>
</tr>
<tr>
<td>Charts (e.g., pie or bar graphs)</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Thematic or statistical maps</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

12. Do you need expert help or a knowledgeable person to guide you during the process of inquiring and/or requesting for the Census data?

<table>
<thead>
<tr>
<th>Response</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>12</td>
<td>23</td>
</tr>
<tr>
<td>No</td>
<td>44</td>
<td>27</td>
</tr>
</tbody>
</table>

13. Where in your home country do you have access to computer(s)? (Multiple response)

<table>
<thead>
<tr>
<th>Location</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>At home</td>
<td>28</td>
<td>22</td>
</tr>
<tr>
<td>At work (office)</td>
<td>52</td>
<td>45</td>
</tr>
<tr>
<td>School/Library</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>Internet or computer café/kiosk/shop</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Somebody else’s computer, rented, or borrowed computer</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

14. Where in your home country do you have access to the Internet/WWW? (Multiple response)

<table>
<thead>
<tr>
<th>Location</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>At home</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>At work (office)</td>
<td>52</td>
<td>43</td>
</tr>
<tr>
<td>School/Library</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Internet or computer café/kiosk/shop</td>
<td>25</td>
<td>33</td>
</tr>
<tr>
<td>Somebody else’s computer, rented, or borrowed computer</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
15. Please rank honestly the level of your knowledge in computers by checking or marking only the appropriate box below.

<table>
<thead>
<tr>
<th>Level</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Average</td>
<td>44</td>
<td>37</td>
</tr>
<tr>
<td>Beginner</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>

16. Does it happen to you that you cannot view the information or image on the Internet/web on the computer you are using most of the time, not because of the Internet connection? (Multiple response)

<table>
<thead>
<tr>
<th>Reason</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, because it needs programs/software/plug-ins to be installed in the computer first</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Yes, because the computer needs re-configuration</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Yes, sometimes but don’t know the cause</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Yes, because the computer is old</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>No</td>
<td>25</td>
<td>12</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

17. Are you free or allowed to install software/programs or tinker/configure the setup of the computer you are using most of the time?

<table>
<thead>
<tr>
<th>Permission</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, anytime</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Yes, but through a computer administrator</td>
<td>21</td>
<td>23</td>
</tr>
<tr>
<td>No, not at all</td>
<td>5</td>
<td>12</td>
</tr>
</tbody>
</table>

18. To speed up the delivery of services, avoid office hours problems/constraints and waiting time for your request to be entertained at the Census bureau, would you like the idea of disseminating the Census data or catering services to the public through the Internet/WWW?

<table>
<thead>
<tr>
<th>Option</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>50</td>
<td>49</td>
</tr>
<tr>
<td>I don’t care</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

If No, why? (Multiple response)

<table>
<thead>
<tr>
<th>Reason</th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>No budget, too ambitious, too expensive to put up a system infrastructure</td>
<td>0</td>
<td>N.A.</td>
</tr>
<tr>
<td>Too expensive to maintain such a system</td>
<td>0</td>
<td>N.A.</td>
</tr>
<tr>
<td>Not practical, there are still a lot who do not know how to use a computer or Internet</td>
<td>0</td>
<td>N.A.</td>
</tr>
<tr>
<td>Internet connection is expensive</td>
<td>0</td>
<td>N.A.</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>N.A.</td>
</tr>
</tbody>
</table>
19. Would you prefer to be given flexibility or option to choose the method of retrieving or downloading the Census data; for example, print the data on paper or download to a local harddisk or diskette?

<table>
<thead>
<tr>
<th></th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>52</td>
<td>49</td>
</tr>
<tr>
<td>I don’t care</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

20. Would you be interested in the possibility to only select data for a particular geographical area (e.g., for a particular province or municipality)?

<table>
<thead>
<tr>
<th></th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>54</td>
<td>49</td>
</tr>
<tr>
<td>I don’t care</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

If so, in what way:

<table>
<thead>
<tr>
<th></th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>by clicking or by drawing a box on a map</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>by selecting the name of the area (e.g., from a drop-down list)</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>by both methods</td>
<td>43</td>
<td>33</td>
</tr>
</tbody>
</table>

21. Would you be interested in the possibility to only select for a particular topic (e.g., migration, population, education)?

<table>
<thead>
<tr>
<th></th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>49</td>
<td>49</td>
</tr>
<tr>
<td>I don’t care</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

If so, in what way:

<table>
<thead>
<tr>
<th></th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>by selecting the name of the topic (e.g., from a drop-down list)</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>by a keyword search</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>by both methods</td>
<td>42</td>
<td>27</td>
</tr>
</tbody>
</table>

22. Would you like to be given flexibility or option to choose the format of how Census data be presented or organized such as tables, plain text document, graphs or statistical maps?

<table>
<thead>
<tr>
<th></th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>47</td>
<td>48</td>
</tr>
<tr>
<td>I don’t care</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

23. Would you like to be given flexibility to interactively change the default presentation (tables, plain text, graphs, maps) or design on-line your own output/presentation/visualization using the Census data without any need to install additional software/program/plug-in in your computer?

<table>
<thead>
<tr>
<th></th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, definitely</td>
<td>44</td>
<td>46</td>
</tr>
<tr>
<td>Not really, I have my own special software/program</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>I don’t care</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
24. Sometimes, graphic images/pictures are intuitive or informative in nature. In this respect, would you appreciate to have the functionality of producing or designing maps on-line using the Census data?

<table>
<thead>
<tr>
<th></th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>46</td>
<td>48</td>
</tr>
<tr>
<td>I don’t care</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

25. Would you be willing to participate in a user test of the effectiveness of a prototype of a new website for the dissemination of Census in the Philippines? The test will be at ITC in December 2001 or January 2002.

<table>
<thead>
<tr>
<th></th>
<th># of respondents from the on-line survey</th>
<th># of respondents from the local survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>26</td>
<td>N.A.</td>
</tr>
<tr>
<td>I don’t care</td>
<td>21</td>
<td>N.A.</td>
</tr>
<tr>
<td>No</td>
<td>6</td>
<td>N.A.</td>
</tr>
</tbody>
</table>
Appendix C

Common statistical/thematic map types:

London Underground: A sample of a nominal point and line symbol map

Chrochromatic map
Combination of choropleth and dot density maps

Combination of choropleth and diagram (pie chart) maps
Prism map (stepped statistical surface)

Choropleth map

U.S. Median Income By State, 1990

LEGEND
- $32,300 to $41,800 (11)
- $28,800 to $32,300 (13)
- $26,000 to $28,800 (14)
- $20,100 to $26,000 (13)
Common chart types:

- **XY (scatter plot) chart**
- **Line chart**
- **Bar chart**
- **3D bar chart**
- **Pie chart**
- **3D Pie chart**
HLC Chart with 18-day moving average, volume, and trend line.

Total Population by Age and Sex
Appendix D
User's guide of the prototype (opening page):

User's guide

You are about to explore the functionalities of the prototype of the thesis entitled "Disseminating Philippine Census Data Through the Web".

Click here to view the quick reference guide

or

click here to view the detailed user's guide.
Quick reference guide

Steps to retrieve the desired information:

Selection of the geographical/administrative area of concern (see item #1 in the figure)

Step #1: Configure the map layer(s) first from the "Administrative level/layer configuration" pane

Step #2: Select the area/object of interest either from the "Administrative unit names" pane or clicking on object/areas on the map using the "select object" tool 🗺️

Selection of the topics/subjects (see item #2 in the figure)

Step #3: Select a topic from the drop-down list of the "Select a topic/subject" section

Selection of the output format (see item #3 in the figure)

Step #4: Click one of the radio buttons for the output format in the "Select the output format" section

Step #5: Click the "Go" button
Detailed user’s guide

Contents:

- Census geo-database
- Geographic overview of the Philippines
- How to use the prototype
- Tutorial lessons

Census geo-database

There are six different administrative and legislative levels in the Philippine context, which conform the levels of data aggregation (see the table below):

<table>
<thead>
<tr>
<th>Level name</th>
<th>Level type</th>
<th>Aggregation information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire Country</td>
<td>Administrative</td>
<td>Highest level of aggregation</td>
</tr>
<tr>
<td>Region</td>
<td>Legislative</td>
<td>Group of provinces</td>
</tr>
<tr>
<td>Province</td>
<td>Administrative</td>
<td>Group of municipalities or districts</td>
</tr>
<tr>
<td>District</td>
<td>Legislative</td>
<td>A group of municipalities that constitute a congressional district</td>
</tr>
<tr>
<td>Municipality</td>
<td>Administrative</td>
<td>A cluster of barangay constitutes a municipality</td>
</tr>
<tr>
<td>Barangay</td>
<td>Administrative</td>
<td>Lowest level of aggregation</td>
</tr>
</tbody>
</table>

To test this prototype, only a subset of the census database is used. A list is provided below indicating (by a dot) the availability of the data in different aggregation levels:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Level of aggregation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of inhabitants in 1970</td>
<td></td>
</tr>
<tr>
<td>Number of inhabitants in 1980</td>
<td></td>
</tr>
<tr>
<td>Number of inhabitants in 1990</td>
<td></td>
</tr>
<tr>
<td>Number of inhabitants in 2000</td>
<td></td>
</tr>
<tr>
<td>Population density in 1970</td>
<td></td>
</tr>
<tr>
<td>Population density in 1980</td>
<td></td>
</tr>
<tr>
<td>Population density in 1990</td>
<td></td>
</tr>
<tr>
<td>Population density in 2000</td>
<td></td>
</tr>
<tr>
<td>Number of households in 2000</td>
<td></td>
</tr>
</tbody>
</table>

How to use the prototype

There are three important points to consider prior to retrieving the desired information. The following are:

- selection of the geographical/administrative area of concern (see item #1 in the figure)
- selection of the topics/subjects (see item #2 in the figure)
- selection of the output format (see item #3 in the figure)
The selection of a geographical/administrative area is influenced by the “Administrative level/layer configuration” pane where you see a hierarchical list of the different administrative levels (see Census geo-database section). The drop-down list on the left (indicated by “Select area”) lists the individual administrative level and on the right (indicated by “sub-level”) the list of its respective lower administrative levels.

For instance, if one is interested to view the regions including its provinces on the map prior to selection, one has to select “regions” on the left drop-down list first and then select “provinces” on the right drop-down list.

Any change on these lists updates the display of the map layers in the map image display panel.

With regards to selecting of objects (administrative units on the map image), the default selection is set to [All], which is shown as a faint grey message just above the “User’s guide” button. However, one can also select an individual object by toggling (on/off) the button (see the toolbar of icons located just above the map image) and then start clicking an object of concern on the map image. The object selected will be marked red. Only one object can be selected at the same time. Located at the lower right hand side of the page is a grey message showing the current selected object(s). [Note: An active button is indicated depressed]

An alternative to selection of objects/areas of interest is the “Administrative unit names” pane. Each drop-down list corresponds to the administrative level indicated in the “Administrative level/layer configuration” pane.

Considering that the administrative layer is already configured to view “regions” including its “provinces” on the map, if one wants to select Cebu province, one has to select “VII” on the left drop-down list and “Cebu” on the right drop-down list.

The selection of topics/subjects is in a form of a drop-down list. The list depends on which aggregation level and administrative levels/layers are currently selected in the “Administrative layer configuration” pane.

For the selection of output format, three options are given in the form of radio buttons and a “Go” button to finally view the information based on the specifications provided by the user. The choices for output format are: Text, Table, Chart, and Thematic map. All these choices will bring the user to a different web page corresponding to the choice of output format made. There are download buttons seen at the upper right corner of each output format web page, for printing and saving the viewed information to a digital file. However, these buttons are not yet active. On the other hand, an active “Back to previous page” button is located at the lower right corner of the same pages.

[NOTE: Expect that sometimes not all the things you expect to see in the thematic map are there. Thematic maps are just prepared maps (not performed interactively based on the user’s specifications). However, with the use of the icons in the toolbar, one can examine closely the details of the map especially those maps that have overlapping proportional symbols]
Other aids to selection

Furthermore, as other aids to the selection of areas, a pane for "Place name search", a pane for "Zoom to name" and a pane for "Quick localational views" are provided (see the lower right hand side of the figure). These panes are collapsible to avoid the user from getting distracted during the process of selecting areas. Clicking on the drawing indicated by either the or on the pane's title bar collapses or expands the pane. These panes are just tools for finding objects or areas on the map layers and not for automatic selection of objects when found.

The "Place name search" pane contains an input box where one can type in a string pattern one wants to search for and a button to start the search process. Once the search process is finished, a small window pops up with a result. The function of this pane is to acquaint the user with the kind of administrative level the name (string pattern) that is being searched for. This way, one will know the proper map layer before we must specify in the "Administrative layer configuration" pane. It is possible that the name that is being searched for finds occurrences in several map layers or none at all.

For instance, if one wants to find out which administrative level a given name is (for example, NCR), a "Place name search" will give any occurrences of the given name in all the different administrative levels (for example, NCR is found to be a region). This way, one will be guided as to what administrative level one should select in the "Administrative layer configuration" pane.

The "Zoom to name" pane contains one input box for typing in the string pattern, a drop-down list, which contains the list of map layers from the "sub-level" or right drop-down list of the "Administrative layer configuration" pane, and a button to commence. As the name implies, the function of this pane is to bring the person to the location (zoom to fit the entire window) of the given name (string pattern) in the input box if found on the current map layer indicated on the drop-down list. If the string pattern is not found, nothing happens.

For instance, if the current layer configuration is set to view "Provinces" including its "Municipalities", the "Arc" drop-down list provides two possibilities of zoom and search, as a province or as a municipality.

The "Quick localational views" pane contains a drop-down list of prepared zooms of some objects (administrative area objects) based on the current map layer indicated in the "sub-level" drop-down list of the "Administrative layer configuration" pane. This pane provides a list of available object (administrative area) names that can be brought to focus when selected.

Toolbar of icons

Most of the icons in the toolbar perform similar tasks as the navigable icons in any GIS software. An active icon is indicated depressed except for the "zoom to full view" and "clear the current selection" icons wherein the icon that was last active will return active after the operation of the two former icons is finished. The "center area tool" icon performs like panning the map to a position that puts the location of the last click of the mouse on the center of the display area. These two icons, perform zoom in and out respectively. Whenver the mouse is clicked on the map image, that location will be used as the center of the zoomed area. Drawing a box or clicking on the map using these icons will perform in a similar way. The "zoom to full view" resets the current view of the map image to its full extent. The "object info tool" works in the same way as ArcView's Info tool wherein any information of the clicked (or selected) object on the map image will be displayed in a separate window. The "select object tool" performs the selection of objects on the map image by clicking on an area/object of interest. Whatever is selected will turn red and the faint grey message on the lower right hand side of the page will show the name of the currently selected object(s). As the name implies the "clear the current selection" icon will do the other way around.