

# PC-Axis Family Software

## A Consortium for Dissemination of Statistics

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### I. Introduction

PC-Axis is a suite of software created to serve as a platform for coherent, efficient, and user-friendly dissemination of official statistics. It is ideal for national statistical offices and other organisations engaged in dissemination of social and economic statistics. The suite supports the whole specter of dissemination products: Comprehensive on-line databases, off-line electronic products like CD-ROM's, and publications on paper or on the web.

The PC-Axis software family is the result of a long tradition of statistics dissemination in machine-readable form from Statistics Sweden and other statistical offices in the Nordic countries. The development emerges from the thesis from the early 70<sup>s</sup> by Dr. Bo Sundgren concerning the use of many-dimensional matrices in output databases. These ideas were first implemented in the mainframe system Axis used since the beginning of 80<sup>s</sup> for commercial databanks at Statistics Sweden and from the mid 80<sup>s</sup> at Statistics Denmark for the same purpose. For the 1990 Swedish Population Census PC-Axis was developed, to be used by the main users of the results from the Population Census. The **PC-Axis file format** (see below) is a file format in plain ASCII that mirrors the ideas used in the Axis system. This file format is very metadata rich. From 1997 the same ideas are implemented in a relational output database that supersedes the Axis system. This output database can be accessed on the Internet <http://www.scb.se/indexeng.asp> or internally by the PC-Axis SQL extension. The PC-Axis file has the extension PX, which explains the names of some of the products in the PC-Axis family.

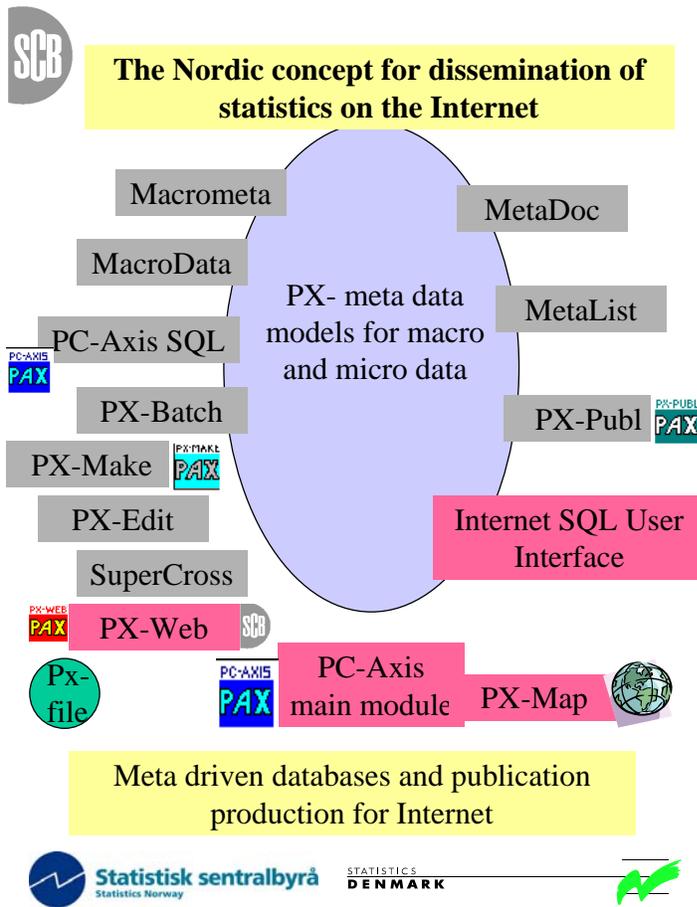
### II. The main features of the software in the PC-Axis family

Keywords to describe the PC-Axis family are (with relevant piece of software mentioned within parentheses):

- Dissemination of statistics online (PX-Web or PX-Web components) and off line (PC-Axis Main module)
- Dynamic tables – pivot function (PX-Web and PC-Axis Main module)
- Conversion to different file formats (PX-Web and PC-Axis) i.e. Excel, Lotus, txt, etc. and for PC-Axis only Gesmes/TS (and XML when a DTD is available)
- Output database (PC-Axis database and/or SQL database)
- Many dimensional Matrices/Cubicles/Boxes (PC-Axis files and SQL database)
- Metadata rich data model in SQL and in the PC-Axis file format
- Windows (PC-Axis) and Internet (PX-Web)
- PC-Axis files in a catalogue structure forms a PC-Axis database and is accessed without using SQL (PC-Axis Main module and PX-Web)
- SQL-extension (Sybase/Oracle/MS-SQL-Server) for a SQL database structured according to the common macro meta data model (PC-Axis SQL and in some cases

PX-Web components and PC-Axis/PX-Batch components in Internet User Interface to a macro database)

- Grouping facilities (PC-Axis and PX-Web)
- Graphs (PX-iGraph under development)
- Maps (PX-Map and PX-iMap)
- Production of PC-Axis files from different sources (PC-Axis SQL, PX-Batch, PX-Make, PX-Edit and the Australian SuperStar/SuperCross)
- Tables direct from a SQL or a PC-Axis database inserted into MS-Word or MS-Excel (PX-Publ)



Below follows descriptions of the different main programs in the PC-Axis family.

In the figure the elliptic area represents the metadata model used for the output database. The names in the squares touching the ellipse are the names of pieces of software directly using the metadata model. The software not touching the ellipse is just using the PC-Axis file and can be used without a metadata base. The PC-Axis file format is focal and is developed in harmony with the development of the data model used in the Meta database. The PC-Axis file can be downloaded on Internet and is also used as temporary files inside the Internet SQL User Interface using components from the **PX-Web** system.

Clients downloading files from the database on Internet use the **PC-Axis main module**. It is also used for CD-ROM products. These CD-ROM products also include the **PX-Map**

software developed at Statistics Norway. PC-Axis files can be retrieved as mentioned above on the Internet, but internally they can also be produced by the **PC-Axis SQL** addition as well as the batch version of that software named PX-Batch. Other ways of making PC-Axis files are using **PX-Make** (from Statistics Denmark), **PX-Edit** (from Statistics Finland) or SuperCross (from Space Time Research in Australia). **PX-Publ** delivers tables from the output database into MS-Word or MS-Excel using macros developed by Statistics Denmark and produces ready-to-print statistical publications.

There are different conditions concerning the data entry of metadata and data at different NSI's. The NSI's has their own history concerning how they handle metadata, classification and documentation. The following are used at Statistics Sweden and are not transferable, although UN/ECE have picked up some inspiration from the programs. **Macrometa** is an interactive program for entering the metadata. The **Metalist** program makes listings from the

Meta database. **MacroData** is a program to load the data into the database according to the descriptions in the Meta database. For description of individual micro data in registers another data model exists. That metadata can be entered using the Metadok program.

The screenshot shows the PC-Axis main module window. The title bar reads "PC-Axis - [c:\cd2003\Database\Sweden\Agriculture, forestry and fishery\Fishery\J001...". The menu bar includes File, Edit, Calculate, View, Window, and Help. The toolbar contains various icons for file operations and calculations. The main area displays a table with the following data:

	A	B	C	D	E	F	G	H
1	<b>The yield of sea-fisheries by species of fish, period and type.</b>							
2		1997		1998		1999		2000
3		1000 kg	1000 SKR	1000 kg	1000 SKR	1000 kg	1000 SKR	1000 kg
4	Eel	931	50 816	533	27 404	594	31 214	447
5	Salmon	495	8 337	498	10 848	363	8 288	435
6	Trout	30						
7	Other freshwater fishes	546						
8	Plaice	537						
9	Dab	23						
10	Flounder	894						
11	Other flattfishes	812						
12	Cod	30 256						
13	Ling	56						
14	Haddock	1 321						

A text box overlaid on the table contains the following text: "PC-Axis is a Windows program that can be linked to a web browser as a helper application. PC-AXIS provides rich information on the statistics, restructuring of a table, converts tables to other file formats and can establish a well-structured local database on your PC."

### PC-Axis main module

The PC-Axis main module looks like this. It has options to change between stub and heading (pivot function), put the present table into other software like MS-Excel, it brings footnotes on different levels, it can make simple diagrams and has a link to the map program PX-Map.

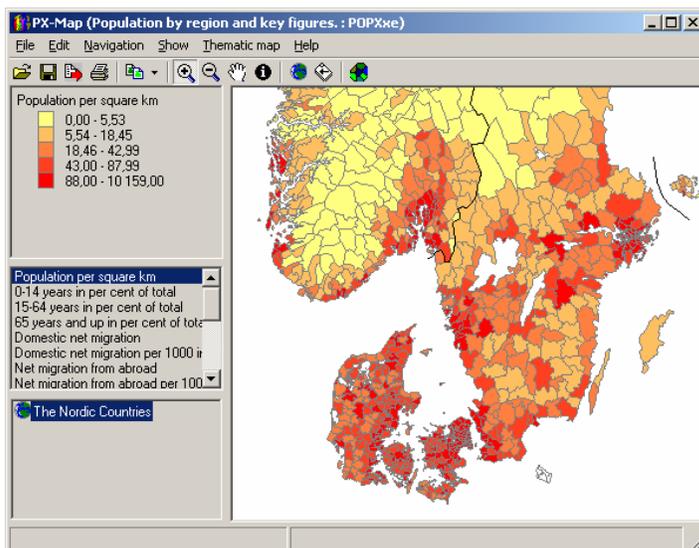
### PC-Axis file format

The screenshot shows the "J001E.px - Anteckningar" window. The text content is as follows:

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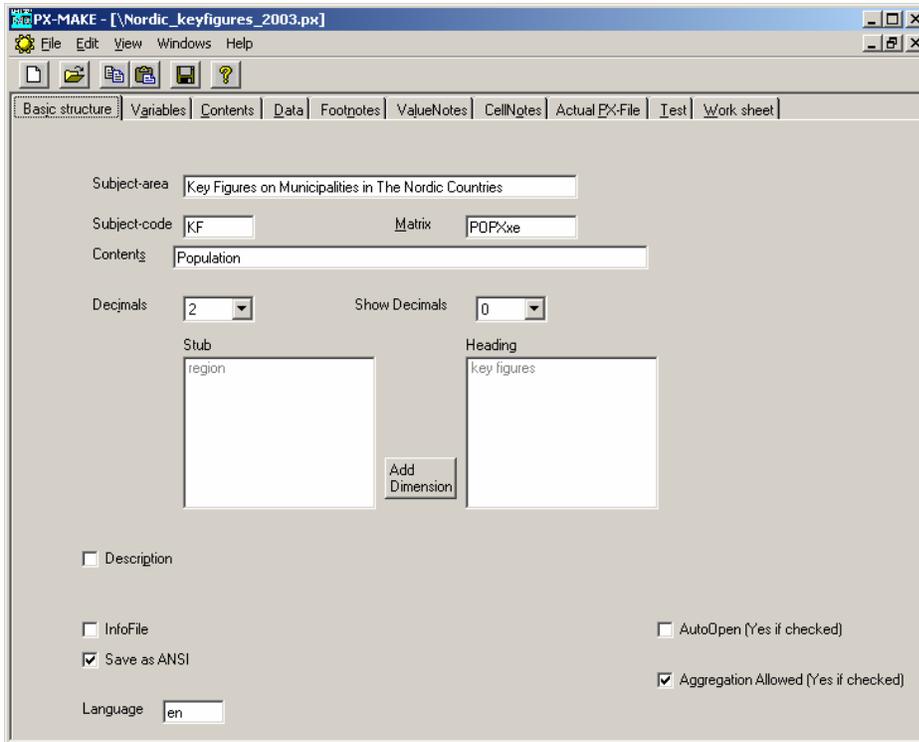
CHARSET="ANSI";
AXIS-VERSION="2000";
CREATION-DATE="20030428 16:10";
SUBJECT-AREA="Agriculture and forestry, fishery";
SUBJECT-CODE="J0";
MATRIX="J001E";
TITLE="The yield of sea-fisheries by species of fish, period and type.";
CONTENTS="The yield of sea-fisheries ";
UNITS="1000 kg,1000 SKR";
STUB="species of fish";
HEADING="period", "type";
VALUES("species of fish")="eel", "salmon", "trout", "other freshwater fishes", "plaice", "dab", "flounder", "other flattfishes",
"cod", "ling", "haddock", "saithe", "pollac", "whiting", "hake", "other gadiforms", "herring and Baltic herring", "sprat",
"mackerel", "other marinefishes", "industrial fish", "liver and roe", "crab", "lobster", "Norway lobster", "prawns",
"molluscs", "total";
VALUES("period")="1997", "1998", "1999", "2000", "2001";
VALUES("type")="1000 kg", "1000 SKR";
PRETEXT("species of fish")=0;
PRETEXT("period")=0;
PRETEXT("type")=0;
DECIMALS=0;
SHOWDECIMALS=0;
SOURCE="Statistical Yearbook of Sweden. ";
DATA=
931 50816 533 27404 594 31214 447 19021 443 23297

```



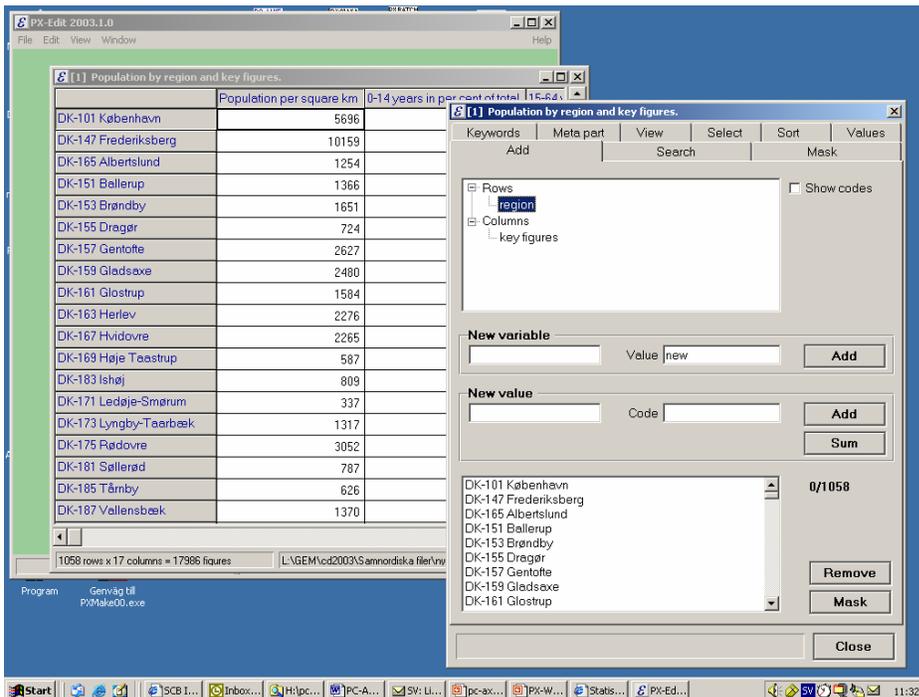
### PX-Map

PX-Map can make Choropleth maps and symbol maps from PC-Axis files. PX-Map is developed at Statistics Norway. PX-Map is also available in a Web-version called PX-iMap.



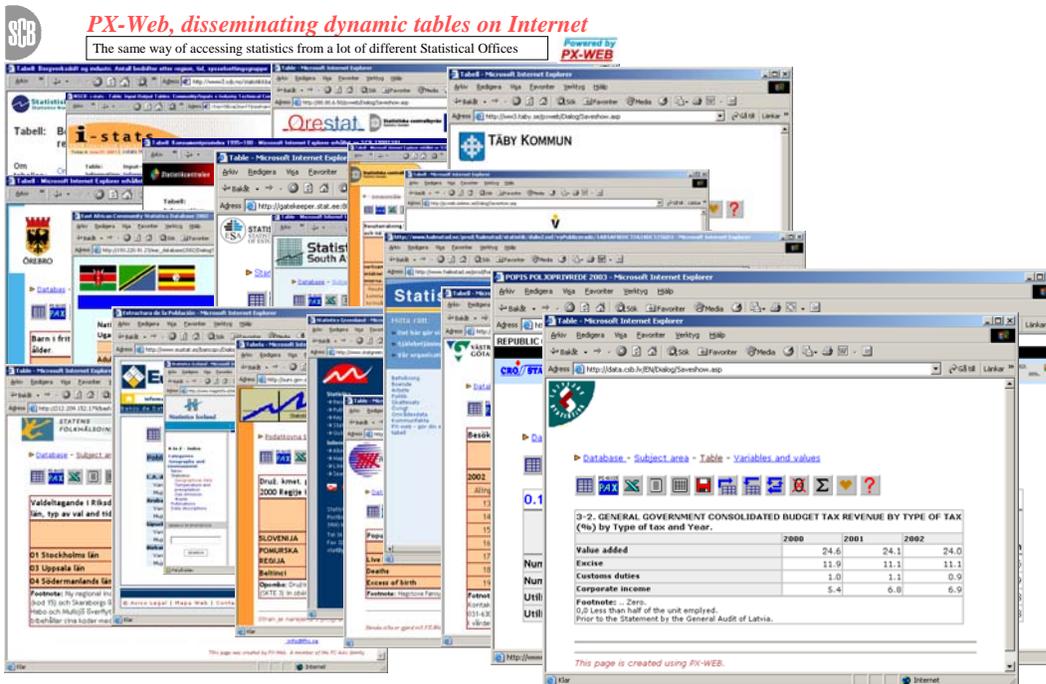
### PX-Make

With PX-Make you can produce PC-Axis files from Excel or any table in a grid under Windows. The Meta data is entered interactively using cut and paste from any source including the use of other PC-Axis files. PX-Make is developed at Statistics Denmark.



### PX-Edit

PX-Edit is used for editing of very large PC-Axis files. PX-Edit is developed at Statistics Finland.

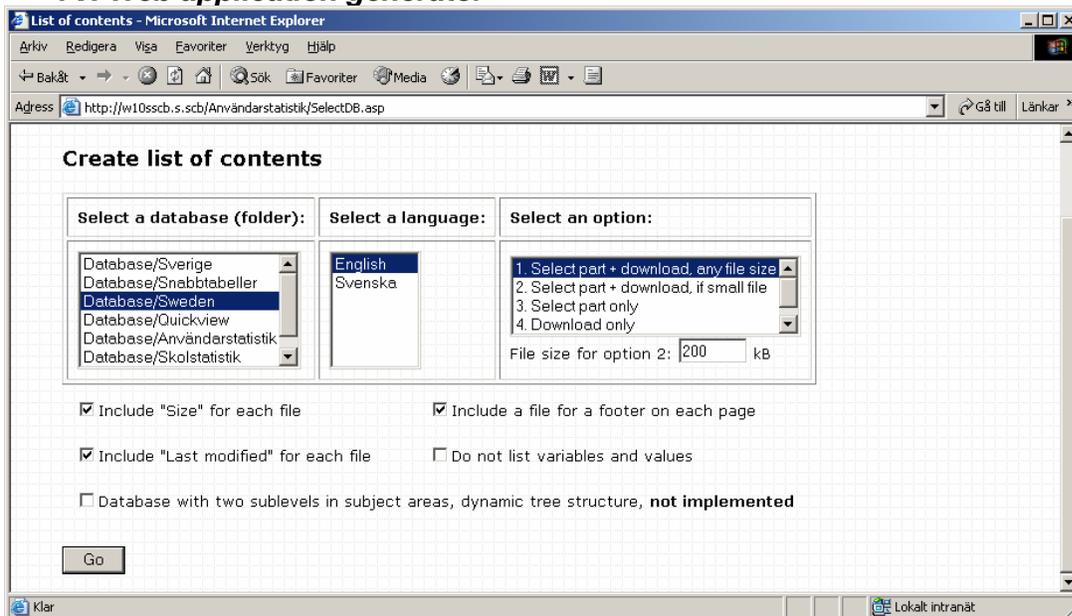


## PX-Web

PX-Web is used to establish dynamic tables on Internet from PX-Axis files on an MS-Internet Information Server. It is used at more than 30 statistical agencies

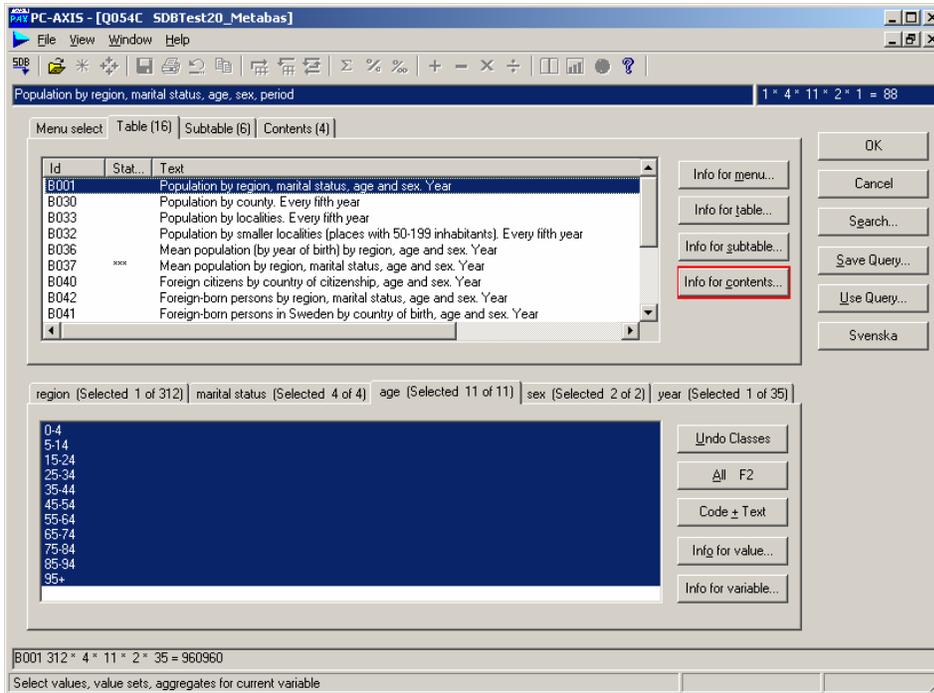
all over the world.

## PX-Web application generator



The PX-Web applications are generated automatically from a PC-Axis database i.e. a catalogue structure containing PC-Axis files. See above how you just select a database, language and options for how the PX-Web application shall appear. By using style sheet technique the application will fit into most website layouts.

## PC-Axis SQL Macro

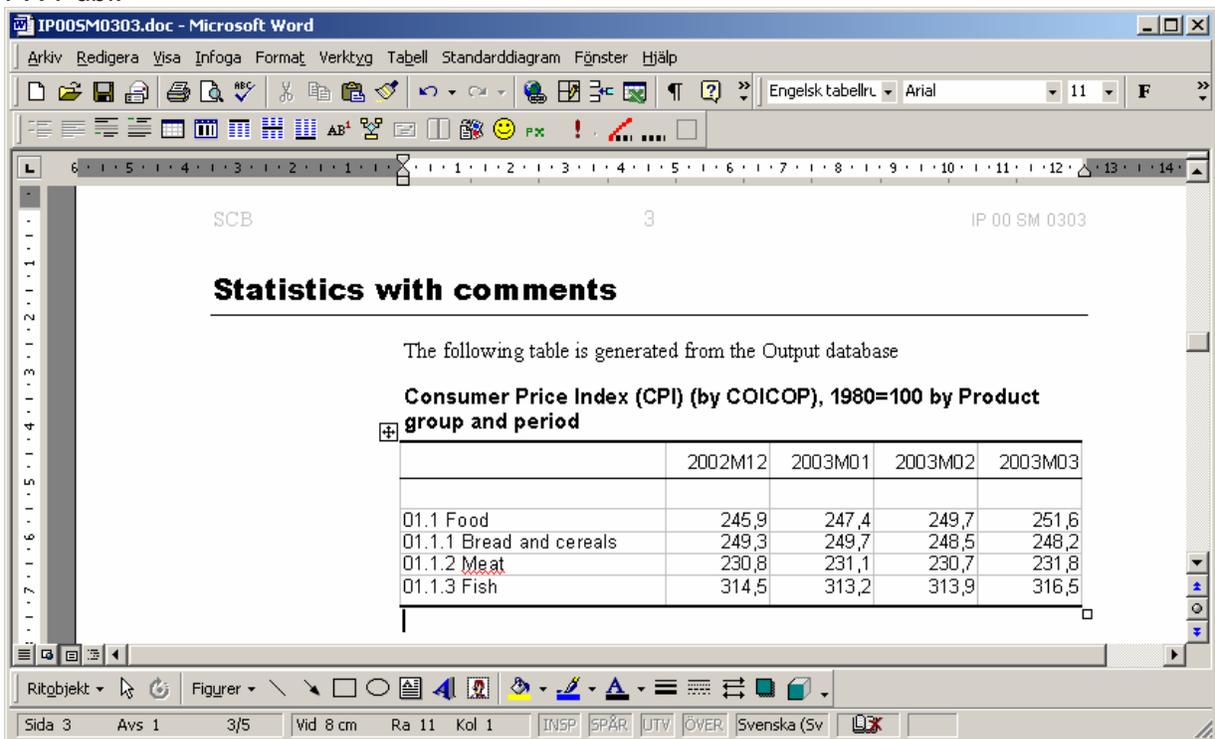


PC-Axis SQL Macro accesses the relational database containing metadata in the process of selecting statistics from the output database. The same user interface is used from the PX-Publ when accessing the output database from MS-Word as can be seen below. By using the option Save Query the selection can be used later online or

in batch in the software PX-Batch

## PX-Publ

Notice the extra tool bar in this template where all the extra facilities for a proper table presentation are available. One of the options is the access to the Output database using PX-Publ.



## List of software in the PC-Axis family

Software name	Origin	Transferable	Documents in English
PC-Axis Main module	SCB	Easy for new languages	Users and systems manual
PC-Axis SQL Macro	SCB	Easy for new languages	Users and systems manual
PC-Axis SQL Micro	SCB	Easy for new languages	Users and systems manual
PX-Batch	SCB	Easy for new languages	Users and systems manual
PX-Web	SCB	Easy for new languages	Installation instructions
PX-Check	SCB	English	No
PX-Publ	SCB	Easy for new languages	Describing the SCB installation
PX-Publ Macros	DSt	Not so easy	No
PX-Make	DSt	English	Users manual, also Spanish
PX-iGraph (to come)	DSt	Easy for a new language	No
PX-Map	SSB	Easy for a new language	Users and Producers manual
PX-iMap	SSB	Easy for a new language	No
PX-Edit	SC	English	Users manual
<b>Outside the family but used in SCB</b>			
Macrometa	SCB	Swedish, not easy to transfer	No
Metalist	SCB	Swedish, not easy to transfer	No
Macrodata	SCB	Swedish, not easy to transfer	No

### III. Users of the PC-Axis family software

As mentioned above different NSI 's are using PC-Axis software in different extensions. Some offices are only using PC-Axis main module internally, while others are using the SQL-extensions and also have the PX-Web for the Internet access to the PC-Axis database. Outside Sweden the following sites are licensed to use the PC-Axis family software: Algeria, Basque country, Bolivia, Brasil, Croatia, Denmark, ECE/Geneva, East Africa Community, Estonia, Faroe isles, Finland (9 sites outside Statistics Finland), Greenland, Iceland, Kuwait, Latvia, Lithuania, Namibia, Norway, Philippines, Slovenia, South Africa, Spain, Taiwan, Uganda and close to join is Slovakia. Within Sweden 13 sites outside Statistics Sweden.

One can say that the PC-Axis family consists of a Nordic kernel and the other users of PC-Axis. The Nordic kernel consists of Denmark, Norway and Sweden that are working very close to each other developing the common Meta data model. The model that is used together with PC-Axis SQL and PC-Axis components in Internet user interfaces to the macro database. These databases can be accessed on the following addresses: [www.dst.dk](http://www.dst.dk) , [www.ssb.no](http://www.ssb.no) and [www.scb.se](http://www.scb.se) . They are all free of charge.

Other institutes using the SQL parts but not yet on the web are CSO of Ireland, Slovenia, Croatia and UN/ECE Statistics Division in Geneva. The heaviest users of the PC-Axis file level of the concept are Statistics Finland and INE Spain. Then we have all the NSI 's using PX-Web for dissemination of statistics on the Web. Institutes using PX-Web and where the applications are accessible from outside their office can be found and studied from the PC-Axis website [www.pc-axis.scb.se](http://www.pc-axis.scb.se)

### IV. Function of the PC-Axis consortium

The structure of the "Consortium" can be described as follows:

- Statistics Sweden as the leading country managing the cooperation

- The PC-Axis International Reference Group for all parties outside Sweden using PC-Axis as a dissemination tool
- A Nordic kernel for cooperation in the output database area where Denmark, Norway and Sweden are using the same data model
- A Swedish user group for the use of PX-Web applications in other organisations in Sweden
- An internal user group at Statistics Sweden
- A board where some of the main end users are consulted concerning the development of Sweden's Statistical Database
- A steering committee for the Data Base Project at Statistics Sweden, where PC-Axis constitutes one of the important ingredients

The first three instances above are described more in detail below.

1. Statistics Sweden is the origin of the PC-Axis file format and the PC-Axis software. After presentations on different international conferences, other NSI's became interested in the product. Since Statistics Sweden has no funds for supporting other NSI's that are interested in or are using PC-Axis, it was decided to charge other organisations using PC-Axis for dissemination of statistics.

After negotiations with the first interested countries a kind of pricelist for an annual license fee took its form. Since Statistics Sweden is a non-profit organisation and is also using the software, the price has become rather low.

The contract for the license for another NSI is also covering the right to disseminate the software on the Internet or CD-ROM together with statistics. It also gives the right for the NSI to sublicense other organisations in the geographical area it covers, to use the product for dissemination of statistics. The NSI may also charge for its redistribution of the software or decide not to charge. This all together is the background to have a differentiated price list.

The license fee is covering the cost for the administration of the customer contacts, part of the development of PC-Axis at Statistics Sweden, arrange the annual PC-Axis Reference Group Meetings and the other meetings and contacts with the different groups mentioned above.

2. The *PC-Axis International Reference Group* was established in 1992. It uses to meet once a year.

- The first day morning session is focused on exchange of experiences in the field of dissemination statistics in electronic form and the use of the PC-Axis family software. The hosting organization has a more deep presentation of its work and plans in the field.
- The first day afternoon is devoted to demonstrations and presentations of news in the field. It is developments at the different organizations where the main development takes place at Statistics Sweden.
- The second day is completely devoted to discussions on the development that will take place the next coming year on the PC-Axis file dependent software.
- The third day is focusing on the SQL extensions related to the PC-Axis family software. Experiences are exchanged and desired development discussed.

### 3. The Nordic kernel of *Cooperation in the field of Output databases and the PC-Axis family software*

The development work is nowadays as mentioned above distributed on some of the users of the PC-Axis family software. It is Statistics Denmark, Statistics Norway and Statistics Sweden that use to meet once a year for planning purposes and discuss the development. The concept is divided into the common **Meta data models**, the common **PX-Main programs**, the common **PX-components, groups of cooperation** and other **groups for cooperation linked to the database activities**. For the common Meta data models and the PC-Axis file format certain common rules are stated for how it must be used as well as for the creation of new versions. This is to make sure that the users of the data model not should come to a dead end. In a similar way there are rules for the common PX-Main programs and PX-components. A sketch showing the structure of the PC-Axis family is available as an attachment to this document.

## V. The use of the PC-Axis family software in developing countries

As an example how the PC-Axis family software can be used in a developing country, some fragments from a report from a mission to Tanzania in June 2004 to disseminate the result of the census from the latest population and housing census in Tanzania are quoted below. [Ulrika Arver, June 2004]

### 1. **Background**

The Central Census Office (CCO) conducted the 2002 Population and Housing Census. The Census has been successfully completed and part of the result have been converted into a Super Cross database. A dissemination strategies handbook has been developed describing the vision and mission statement of the dissemination process. "To discover and then meet the expressed needs of data users by producing, promoting and disseminating easily acquired, user-friendly and accurate data products in a timely and service oriented manner".

A dynamic, comprehensive and user-friendly tool for dissemination of the census results in a timely manner was needed.

### 2. **Mission objectives and particulars**

The objectives of the mission were to make the census results available on the Internet using PX-Web. PX-Web provides a dynamic and user-friendly way to extract tables according to the users specific needs. It creates tables that easily can be printed or exported to various formats e.g. Excel.

The mission would result in a prototype PX-Web database for the census results as well as making sure the associated tools for creation of the database and the files were mastered.

### 3. **Activities**

#### 3.1. **Using the Super Cross database to get PC-Axis files**

The results from the census was to be transferred from the IMPS file format into the Super Cross database. At this point in time only 10 % of the results had been added to the Super Cross database. Data extractions was done from the database and then saved in the PC-Axis file format.

#### 3.2. **PC-Axis**

..... We created value sets from the variables in the files. From the value sets we could continue to create aggregates. Aggregates were mainly used for the geographical variables, age and citizenship.

#### 3.3. **Editing PC-Axis files saved by Super Cross using PX-Make**

All the files were edited and completed using PX-Make. The main changes that needed to be made were editing the subject area and content as well as adding a subject and matrix code. The elimination function was also used to simplify the selection process for end users. This enables the file creator to choose a default value. When a user selects no value this one will automatically be selected. Normally this is the total value.

### **3.4. Setting up a prototype of a PX-Web database for the census data**

A light prototype was done before arriving in Dar es Salaam and this version was used for demonstrating the process of setting up a functioning web based database. The different files and their diverse functions were explored as well as the needed adjustments to customize them for individual needs. The other available PX-Web solutions from different countries were explored for ideas and inspiration ([www.pc-axis.scb.se](http://www.pc-axis.scb.se)) The Swedish website and the Swedish databases were explored as well.

After this process a new version of the prototype was created using the results from the 10 % census results. The prototype was created extracting files from Super Cross, editing them in PC-Axis and in PX-Make.

## **4. Conclusion and recommendations**

### **4.1. Completed result**

During the mission Mrs. Minja created a prototype database. She now has the knowledge to create a database including generating and editing PC-Axis files.

### **4.2. Get the full results into the Super Cross database**

As only 10 percent of the census data is available in the Super Cross database it is essential for the future success of the project to get the complete data. Only when this is complete the true generation of files can begin.

### **4.3. Setting guidelines on how to set up the files in collaboration with a statistician**

It will be important when setting up the complete database to have a system developed for naming and coding all the files. Also the aggregates, totals, percent etc. should be standardized. It is probably a good idea to work with a statistician when doing this as footnotes also needs to be added correctly.

### **4.4. NBS Website**

It is of greatest interest to get the new NBS website to work properly and to be published as quickly as possible. This will provide a forum for dissemination of all available statistics including the census. It also provides the place for the PX-Web database.

### **4.5. Extending the knowledge**

Having only one person who knows how to make updates makes the database very vulnerable. It is important to extend the knowledge so there is more than one person knowing how to add edit and add files into the database to ensure that new data is added as soon as it is available.

### **4.6. CD with PC-Axis files**

Sometimes problems with Internet connections arise around the country. To ensure that all the intended users can access the data a CD containing the data could be also created. PC-Axis would then have to be installed on the computer (from the CD) and the user can choose to work with the PC-Axis files from the CD or copy the files onto the computer.

### **4.7. Translation into Kiswahili**

Using PX-Web adding an additional language is a fairly easy task. In this case a suggestion for the future could be to add the language Kiswahili into the database. Translating the language section in the file `global1.asp` does this. However, the Meta data in the PC-Axis files need to be translated as well.

### **4.8. Add the PX-i-Map function**

The census data works perfectly for dissemination of data using maps. To use this function map files in the shape format are needed. As part of census data is displayed in a map format this type of files might already exist, and not a lot of additional work would be needed. The files required for doing so are included on the PC-Axis CD.

End of quote of the report

## **VI. Final reflections**

The use of PC-Axis in different NSI' s is based on the common macro Meta data model that is reflected in the PC-Axis file format as mentioned above. Some of the NSI' s are using only the PC-Axis file format while others are using also the macro meta data model in a commercial Data Base Management System, DBMS, like Sybase, Oracle or MS-SQL server.

***Stepwise development for dissemination of statistics on the web***

- A simple way of establishing an Internet based statistical Database is to make PC-Axis files using PX-Make and put them together with PX-Web on the website.
- A further step then can be taken establishing a SQL based output database using the Macro Meta data model.
- Internal use of the PC-Axis SQL additions making PC-Axis files for the PX-Web
- Make publications on paper or on the web using PX-Publ.
- Establish a SQL user interface using components from PC-Axis SQL saved queries, PX-Batch and PX-Web.

***Further information and questions***

For more information and references visit the website <http://www.pc-axis.scb.se/>  
Questions on the PC-Axis software family and the license conditions for the use of the software for dissemination of statistics can be put to [lars.nordback@scb.se](mailto:lars.nordback@scb.se)