

Census 2001 Review and Evaluation

Output Production: Evaluation Report

ONS is carrying out a review and evaluation of the 2001 Census in England and Wales which will culminate in a Data Quality report and a General Report being published.

Plans for individual reports on specific aspects of the Census operation and a timetable for release have been published.

Each report is written in isolation and is subject to amendments as processing progresses and further information comes to light.

Reports will be released on the ONS website in the form of a high level Executive Summary and a more detailed Evaluation Report.

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Project Objective

To release a comprehensive and accurate set of statistics from the data collected in the 2001 Census held on 29 April 2001, in a number of products in a range of media.

This would be achieved in two main stages. Firstly, the research into new developments in methods of creating and supplying statistical products using a wide range of formats, both printed material and electronic output (e.g. Internet, CD-ROM) to meet known and projected customer requirements. This included:

- proposing methods of analysing 2001 Census data and discussion with Users during 1998, 1999 and 2000;
- implementing and testing the agreed recommendations; and
- procuring and acceptance testing of installed systems for the production of outputs.

Secondly, to deliver the results in formats agreed with customers in the most timely and accurate manner possible. This included:

- organising and managing work associated with the production of standard outputs; and
- supporting systems for production of non-standard outputs.

Background

The project began in April 1995 and was set up to work in conjunction with the **Census Output Policy and Dissemination Project (OP&D)** in the identification of strategies for producing and disseminating the results of the 2001 Census. In 1999 the Office for National Statistics (ONS) made a successful bid to the Treasury Invest to Save Budget (ISB) which funded a third project, Census Access, to enhance the dissemination of census output.

The key point recognised in the Output Strategy and the Census White Paper published in March 1999 was that the investment in the Census is only justified (and realised) if the results meet users' requirements and are

made accessible. This is reinforced by commitment to responsiveness to users and to an innovative approach throughout the cycle of the Census.

One of the key objectives of the project was to provide more of the results in electronic format, moving away from the largely paper based reports of the 1991 Census. Printed reports, however, were still to play a significant part in disseminating 2001 Census output such as the reports to the Westminster Parliament and the National Assembly for Wales.

The strategy of electronic dissemination was originally based on the assumption that by the time census results were released, most census customers would have access to personal computers with CD-ROM capability. The strategy had sufficient flexibility to enable ONS to take advantage of developments in dissemination technology. As the 2001 Census progressed, the internet became a strategic tool for the ONS and output on CD-ROM became a complimentary medium to web based delivery via the National Statistics (NS) website, specifically through the Neighbourhood Statistics Service (NeSS).

The project was divided into four main activities.

- Tabulation of the Census results, including commissioned tables.
- Producing supplementary geographic material for output.
- Producing supporting Information.
- Producing publication in print, CD-ROM and web.

Tabulation and publication required the procurement of suitable software and the training and development of staff to produce the results of the 2001 Census. The creation of geographic material required close liaison with teams in other areas who had responsibility for geography in census enumeration and ONS generally. A range of supporting information needed to be gathered from statistical areas to support the tabulations (meta-data) which had to be stored and prepared for inclusion with the data.

In the period between the publication of the White Paper and the beginning of output production in 2001, new policies evolved rapidly. There was almost

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continuous consultation on the output of the Census itself, and unprecedented policy interest in Government information and access to it through new technology.

The challenge has been to deploy new technology appropriately in the production of output and the services to disseminate it. The emphasis on flexibility and innovation in the Output Strategy has proved to be critical.

[This has been reflected both in Government wide initiatives and in activities in the Census organisations/ National Statistics that have impact on the Census, although significantly there are variations between the parts of the UK as a result of devolution.]

Impact of cross-government developments on Census Outputs

The general trend in government in policy relating to use of government information is away from restrictive terms and income generation towards better and freer access, particularly through the Internet, and on getting better value from the information that government holds.

Three initiatives since March 1999 had a particular impact on census plans.

- A bid to the Invest to Save Budget (ISB) - a scheme to provide new funds (described as 'venture capital' by Treasury) for projects in England to promote modernised joined-up government, particularly through new technology, initiated in 1998 with further rounds in successive years. ONS' bid was successful, in the 1999/2000 round, for funding the Census Access project to boost the services for customer funded output. This funding ensured that all standard census outputs could be provided free at the point of use.
- The neighbourhood renewal/social exclusion programme - particularly the Policy Action Team report (PAT18) on Better Information in mid-2000, which recommended that neighbourhood level statistics should be freely available to assist the renewal process. A service to provide Neighbourhood Statistics via the National Statistics website, including census output, has been implemented by ONS, initially for England.

- The Treasury cross cutting review of the knowledge economy - initiated in March 2000 and completed in September 2000 with an announcement of UK wide recommendations covering charges for Government information and licensed re-use, particularly with the aim of helping the growth of e-commerce.

Impact of ONS Corporate Development on Census Outputs

Three ONS activity initiatives had a particular impact on the Output projects, and characterise the way the 2001 Census is now, unlike previous censuses, being integrated into one national statistical 'business'.

The initial dissemination policy for National Statistics - announced in June 2000 had a key commitment to making important information free on the Internet. Recent developments have been the initiation of, first, a relatively long term ONS Information Management Programme with dissemination as one component, and, second, a 12-18 month Information Age Access Programme to drive forward the development of the National Statistics Website(s) through, for example, a single content management system.

Neighbourhood Statistics - this service has been developed by ONS, and a sub-set of census area statistics at Output Area (OA) and ward level became a significant part of the services in 2003, when census OAs became 'building bricks' for Neighbourhood Statistics. ONS management saw a high degree of synergy between the two outputs at the dissemination stage, foreseeing common terms and means of access.

Methods and standards - ONS Methods and Quality Directorate were given wide ranging responsibility for developing common methods and standards for National Statistics, many of which such as 'harmonisation', small area estimates, and disclosure control have had direct and indirect impact on census output.

Project Management

The project needed rigorous management procedures and the Government's PRINCE2 (PRojects IN Controlled Environments) methodology were followed, using staff who were fully qualified in project management procedures. A Project Board was set up to oversee

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progress by the three UK Census Offices and to resolve any issues as they occurred. More information on this can be found in the **Programme Management Evaluation report**.

Methodology

Project Start Up

Having established an approach for the Project, Census Outputs embarked on a period of user consultation which involved public meetings to discuss issues relating to output and the distribution of sample material. These consisted of a series of consultation rounds on area statistics, covering Standard Tables/Key Statistics and Census Area Statistics. At later consultations copies of the table viewing and manipulating software, SuperTABLE, were distributed for customer familiarisation and feedback.

During this time, ONS evaluated output media used by other census organisations across the world, in particular websites and CD-ROM designed to deliver the results of recent censuses in New Zealand, Australia, USA, and Canada. The output teams assessed the developments in electronic publishing, and the feasibility of web delivery, in advance of such initiatives as Neighbourhood Statistics. A range of software was evaluated and procured in order to take advantage of technological development in tabulation and publication.

An external review was conducted by the Katalysis consultancy in 1999 to determine the value and potential of contracting with private sector organisations to assist in the production of the Census results. The review concluded that elements of the process could be conducted outside ONS. Further investigation showed that none of these elements would be large enough to require open Government Procurement Agreement (GPA) procedures to apply, save that of procuring (and licensing for some years) specialist tabulation software required for the work.

An open procurement was conducted to obtain suitable tabulation software. Wherever possible, other elements of the processing system were designed to use the commercial desktop software already supported within ONS. One exception was the innovative **Output**

Area Production System, built within the team, which operated using basic census data and required direct monitoring during production running.

The first products contained tables, designed in consultation with users, supplied both electronically and in print. The delivery of material via the web employed the National Statistics Online and Neighbourhood Statistics systems developed within ONS, but with considerable private sector participation. The CD-ROMs were developed in partnership with a commercial organisation specialising in electronic media. Printed material was prepared in-house, with printing conducted by agents of The Stationery Office (TSO).

An appropriate balance was struck between the production capability and expertise of the project teams, and those external to the project. In doing so, risk was reduced, and cost efficiency and job satisfaction improved.

System Testing

In all Output Production plans there was a critical emphasis on fully testing all systems before actual production, and further emphasis on links to parallel work at corporate levels in the Census organisations and on the study of best practice elsewhere.

The SuperSTAR tabulation software was procured in 2000 and thorough testing took place between May 2000 and June 2002. A simulated version of the 2001 Key Statistics report was developed for demonstration during customer consultation.

The prototype Output Area Production System for England and Wales was tested using data from the 1999 Census Rehearsal and the 2001 Census itself. A final production version was prepared whilst liaison took place with Ordnance Survey over a derived data agreement to cover third party use of output geography.

The potential for a range of ancillary geographical products was recognised and considerable research was carried out to determine their content and format, and the means of their delivery.

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Tabulation of the Census Results

Acquiring the Right Tools

In 1998 and 1999 a thorough and wide-ranging review of fast tabulation tools was carried out specifically to assess their potential for use in the tabulation of 2001 Census results. In 1999 a formal procurement exercise took place and tenders from a number of software suppliers were considered. An advertisement was placed in the Official Journal of the European Community (OJEC) on 22th September 1999 and an Operational Requirement was released to interested suppliers at an open meeting held on 20th October 1999.

In May 2000, after a rigorous evaluation of a number of companies and their software, ONS purchased the STR product, SuperSTAR, in conjunction with the General Register Office for Scotland (GROS) and Northern Ireland Statistical Research Agency (NISRA).

Use of SuperSTAR

This software suite has two major components that were used by the Census:

- SuperCROSS

The tabulation software used by ONS to process enormous numbers of records at high speed. Individual records are held on a database component called SuperMART which is then interrogated by SuperCROSS.

- SuperTABLE

This is distributed free to users on CD-ROMs and allows manipulation of information.

ONS IT staff wrote a series of programs to allow the transfer of data from the processing database into SuperMART and these were rigorously tested. A number of data extractions took place at varying intervals. Initially, sufficient data was extracted to enable the First Results to be tabulated and published in September 2002. In order to produce more complex tabulations a series of additional extracts took place to enable a more comprehensive set of databases to be built.

The tables were specified in detail by statistical teams and presented to programmers who used SuperCROSS to develop the tables, but they were limited by the lack of real data against which to check the table build. The programmed tables were examined by the statistical teams before being populated.

Once populated, the tables were closely examined by a Quality Assurance team. A series of checks took place which ensured the correct geography and variables were used in the tables, and all areas and labels properly presented. Counts were extracted from the processing database and stored in an Access database for comparison with the SuperTABLE files.

The software was enhanced to incorporate an adjustment method that ensures the confidentiality of the results. For more information, see the **Disclosure Control** Evaluation summary report. This required the tables to be run twice prior to publication. The tables needed to be run without disclosure routines in order that the counts could be compared, and then re-run with the disclosure routines enabled. Considerable care and a number of failsafe checks were employed to ensure only the correct data was released.

An engineer from STR was assigned to ONS to support the Census and ONS generally. This had the advantage of ensuring technical queries were dealt with quickly by highly skilled support staff.

The SuperTABLE software was made available on the CD-ROM supplements to reports and in-house products containing SuperTABLE files. Early releases of SuperTABLE enabled Key Statistics to be managed effectively, but limitations were discovered when using the software with the more complex multi dimensional Standard and CAS tables. Consequently ONS and STR worked together to seek ways to enhance the software and overcome these limitations.

Table Types

The tabulated results of the 2001 Census fall into five categories.

- Key Statistics

Key Statistics were presented as a set of 30 tables,

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providing a summary set of results for areas with populations above a threshold of 40 households and 100 people.

- Standard Tables

More detailed cross tabulations were created in Standard Tables for areas with populations exceeding 400 households and 1000 people.

- Census Area Statistics

Census Area Statistics provided cross tabulated data for smaller populations. These were created for the same areas as the Key Statistics.

- Area Profiles & Headcounts

Headcounts were created for all areas, either within the tables themselves, or separately where areas contained populations too small to allow for any other information to be released. Area Profiles provide general information for most areas, and also for areas where populations were small and more detailed output would call for disclosure of confidential information.

- Commissioned Tables

Commissioned tables are created in response to customer request when the standard set of output cannot provide the data required. Confidentiality constraints are rigorously applied and some requests therefore cannot be met.

all Local Authority Districts within a County would be presented in a single HTML file.

For some products this meant a huge number of HTML files had to be created, checked and managed which needed a team of staff to manipulate the SuperTABLE files. For example the Key Statistics for Local Authorities on CD-ROM contained 3,000 HTML files, i.e. each table split into 100 files per geographical area.

The resulting files were rigorously checked following strict procedures, prior to delivery to the contractor employed to develop and prepare master CD-ROMs.

Comma Separated Variables (CSV) for Use in Customer Databases

ONS also recognised the requirement to provide data in a format which could be loaded into databases. Meetings were held with a range of customers and a working party assembled to take forward the technical solutions. ONS staff worked overtime to meet this requirement.

Provision of Data For Delivery via Neighbourhood Statistics Service

NeSS was to be the main delivery mechanism for census data. However, it was not possible for SuperTABLE files to be supplied via the web other than as downloadable files.

A team was set up to manage a program that dismantled SuperTABLE files and placed the counts into a file format (.dat) for use by NeSS. These files were used to populate databases that provided the source data for dissemination on the web using Beyond 20/20 software.

Census Results in Other Formats

Hyper Text Mark Up Language For Easy Access

ONS recognised the customer requirement to view census data without having to install the SuperSTAR software, SuperTABLE specifically for that purpose. ONS identified a solution for use with CD-ROMs that was ratified by an independent consultancy conducted in the second quarter of 2002.

ONS determined to provide the data in an HTML form in order that users of CD-ROMs could view the data using a standard internet browser. To maximise the effectiveness of the HTML pages, each SuperTABLE file was recreated in segments. For example, results for

Output Geography

Each type of table produced was available for a number of geographies:

- Local Government Areas, e.g. Wards.
- Health Administrative Areas, e.g. Primary Care Trusts.
- Parliamentary Constituencies (including Area Profiles for all Westminster constituencies).

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- Postal Sectors.
- Parishes.
- Urban and Rural Areas.
- Output Areas.

ONS developed a system for automatically creating census Output Areas (OAs). These are small sub-ward areas that form the building blocks for larger geographical areas. The system was designed and programmed with the substantial assistance of Professor David Martin of Southampton University.

The Output Areas were created such that the homogeneity of housing and population characteristics within each was maximised.

A prototype system generated sample output for consultation purposes. ONS sought feedback on this automated system, and in the following years worked closely with Local Authorities, in particular Kerrier and Pembrokeshire, to further refine the system. A series of Roadshows were conducted in order to introduce the system to census customers and generate dialogue.

Key customer concerns were the quality of source material for OA production, the criteria for determining homogeneity, the opportunity to quality assure the boundaries in advance, and the relationship between OAs and changing ward boundaries.

The OAs were to be built automatically using the 2001 Census. Hence, there was only a small window in which to create the areas without adversely affecting the output timetable.

Further information regarding Output Areas can be found in the **Census Geography** [evaluation report].

Supporting Information

Metadata

A large amount of information, collectively known as metadata, is required by customers to enable them to understand the Census results. Information can vary from evaluation reports, such as this, to detailed clas-

sifications and glossaries. ONS has gathered, stored and categorised this information in internal databases, and manipulated this material using internet based software in order to disseminate it via web and CD-ROM. ONS also used a range of publishing software, such as Adobe Indesign 2, to prepare text for inclusion in printed reports.

A metadata editor was appointed and worked with Output Policy and Production to prepare a coordinated, comprehensive and timely set of metadata for access principally through electronic means.

In August 2000 a consultant was commissioned to look at the way in which census metadata could be delivered to customers. The consultant looked at various ways of delivering and disseminating metadata, these included, Adobe Acrobat, HTML, Verity on CD-ROM, Lotus Notes and RoboHelp. It was agreed that RoboHelp would be used for the creation of published metadata products.

A data 'warehouse' was created in Lotus Notes, from which all metadata was drawn and taken into the dissemination software.

Geography metadata

A host of supporting information about the geographies used in the Census was prepared for release in tandem with the results. In the main, this consists of Output Area boundaries in digitised form and look up files which describe the relationships between these areas and other areas such as Parliamentary Constituencies and Parishes.

Publications

2001 Census output is available via NeSS. This free to use, publicly available website, brings together the 2001 Census output with local statistics from a range of other government sources. It allows ready access to the statistics along with associated interactive mapping, enabling a user to be able to search and view the area of interest. The website also allows easy comparison between areas. Output from the 2001 Census has been a major component of NeSS, with Census Output Areas being the building brick geography for the longer-term future of the system.

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A team was assembled with specific responsibilities for print and web delivery. This team was later enhanced to incorporate the management of CD-ROM development by a contractor. The team managed the assembly and formatting of all tabular, map based and supporting material for inclusion in 2001 Census printed reports. Most importantly, the team prepared print ready files for external printing to specified timetables, to be laid before parliament and available for purchase by customers.

Printed Reports

Planning for production of 2001 Census printed reports was based upon the experience gained from the 1991 Census. New and experienced staff were trained thoroughly in the Desktop Publishing (DTP) software used commonly within ONS at the time.

In early 2002 a DTP software evaluation was conducted to compare 2 new packages with the one then currently in use. The objective was to identify the tool best able to process the large amounts of tabular data and the long document structures required for census printed reports. The evaluation recommended Adobe Indesign 2 which has been used for the production of all census printed reports, and subsequently became the standard DTP tool in use throughout ONS.

In mid 2002 an exercise to develop a house style for use in Census printed reports was completed by ONS publications unit and Census Output Production. The final iteration adhered to ONS styling as closely as possible whilst allowing the flexibility required for specific Census content, and is used in all printed reports. This process also included the development by the ONS design unit of the templated report cover designs, and the new 2001 Census outputs logo that has been used on all forms of Census Output across all media.

Production schedules and structures for each volume were developed, and modified in response to changes in product specifications and changes in the overall release programme.

CD-ROM supplements to the Printed Reports

To complement the printed reports, a range of CD-ROMs and DVDs have been produced which provide the tabulations in SuperSTAR formats along with free software to view and manipulate the tabulation. Many of the CD-ROMs are supplements to the Reports to Parliament and are provided with an easy to use interface that enables tabulations to be interrogated using only a web browser, provides the user with search and navigation facilities, and enables access to the SuperTABLE files for manipulation.

Early in the project ONS recognised that it would require skills and expertise that lay outside of ONS to develop the interactive CD-ROMs envisaged as supplements to the printed Reports to Parliament. Having validated the technical options through independent assessment by a specialist company procured via the S-CAT scheme, ONS sought a supplier to develop and master the CD-ROM. Census contracted with CTPi, a publishing company with a significant pedigree in electronic publishing and the management of sensitive data.

In consultation, CTPi designed a generic interface for the CD-ROMs that enabled a user to select tabular data by area, navigate to data by maps, search by area and topic, and view data in their web browser. The interface enabled the software, SuperTABLE, to be installed and used to access low level data and manipulate the results. It also provided maps and web access to the Neighbourhood Statistics Service on NS-Online for interactive mapping.

The programming language used was largely HTML in order to make the CD-ROM as simple to use as possible, and perform on a variety of systems. Wherever possible, the interface was developed to be used on Apple Mac machines as well as PCs. Government restrictions on software, such as Java, were taken into account.

A series of user consultations took place to ensure the interface was as intuitive as possible. ONS used specialist consultants to manage trials, and a range of potential customers were invited to test the interfaces as they developed.

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A suite of software programs were developed which linked together all the related SuperTABLE files, HTML files, maps and supporting information such that they can be accessed from a grid which appears on the main screens of the CD-ROM. The grid enables selection of tables by area.

Once the generic design and software were in place, a series of CD-ROMs were produced to supplement the printed Reports to Parliament. Each required some changes to the interface to best present the data to the customer.

Other Releases in CD-ROM and DVD format

ONS produced a range of additional CD-ROM and DVD products. These were mainly to deliver more complex tables at low area levels in SuperTABLE and CSV formats.

For example, a ten DVD set of Census Area Statistics (CAS) tables was produced in late summer 2003 that contained detailed results in about 100 tables for all output areas in England and Wales. Results for Output Areas in each Government Office Region was presented on one DVD, along with the full set of CAS for Wards and local authorities in England and Wales.

ONS used its own publishing teams to create simple, easy to use, interfaces that facilitated access to the SuperTABLE files and enabled the software to be installed. Experience gained from working with CTPi was put to good use in the development of the ONS interface and some design elements were re-used from the CD-ROM supplements. All the discs were mastered in-house, and their duplication and delivery was managed within ONS by Census Customer Services. All packaging and accompanying booklets were developed by the publication team and printed using a local contractor.

All 2001 Census results are available in the CSV format especially designed for loading into customer's own databases. ONS designed and developed the interface which accompanies this output on CD-ROM and DVD, and the discs were mastered by the publication team with duplication, print, and delivery managed in the same way as the SuperTABLE CD-ROMs and DVDs.

Timetable

Results of the 2001 Census have been released to a challenging timetable, with more than half the products being released between September 2002 and September 2003. Descriptions of all existing and planned census products can be found in the **Census Output Prospectus**, which includes direct links to all of the Census data available online.

Following release of the first 2001 Census printed report First results on population for England and Wales on 30 September 2002, the next two major Census reports were developed and assembled in late 2002/early 2003. These two Key Statistics volumes, Key Statistics for local authorities in England and Wales and the bilingual Key Statistics for local authorities in Wales, were produced using the procedures and software outlined above. Populated table templates were assembled and combined with reference and thematic maps and supporting material, and provided print ready to the TSO appointed printer. The reports were laid before Parliament and published via TSO on 13 February 2003.

In order to provide a broad range of access to Census data, significant use of website delivery mechanisms was employed. The first results of the 2001 Census were released via NS Online on 30 September 2002. Age by sex counts for all Local Authorities (LAs) were published on the web and enhanced by the use of graphics such as '**population pyramids**'.

Later, census material became available from the Neighbourhood Statistics Service. However, other complementary web delivery systems continued to be employed. For example, the Key Statistics for local authorities in England and Wales was released on 13 February 2003, and involved the development of easily accessible web based summaries.

In addition, electronic 'pdf' versions of all Census 2001 printed reports can also be downloaded via NS Online, some of them accompanied by downloadable sets of tabulations.

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Assessment and Lessons Learnt

How well did it work

The major challenge was to meet the timetable for delivering the results. The tabulation software proved to be capable of meeting the requirements of the project, but a series of enhancements were necessary to meet the strategic and policy demands of the Census and ONS. These made the tabulation work more demanding, resource intensive and time consuming. In particular, a set of disclosure control measures, introduced after the software was selected, required significant changes to software and production procedures. Additional specialised staff were also needed.

The award of contract to CTPi for the production of interactive CD-ROM to supplement the Reports to Parliament proved to be productive and valuable, with lessons learnt on both sides of the partnership.

Most significantly the ONS flagship web dissemination system (NeSS) was used from February 2003 onwards to provide ready access to census results, and associated mapping, by all those with internet capabilities.

Over two billion counts were produced and supplied to customers on the web, on CD-ROM and in print, between September 2002 and September 2003. Over 5,000 files of data were released during that time.

The main Census reports to Parliament were released within two months of the target despite some upstream processing delays. First results were released in September 2002 (planned date August 2002); Key Statistics for Local Authorities in England and Wales were released in February 2003 (planned date December 2002); National Report for England and Wales was released in May 2003 (planned date April 2003); Key Statistics for Output Areas and above were released in June 2003 (planned date April 2003). Given the upstream processing delays, the revised release dates achieved were impressive but from the users point of view these were still delays to key outputs, however minimised.

The first results of the 2001 Census released via National Statistics Online on September 30th 2002, set a new record for the number of visitors to the **National**

Statistics website. The Key Statistics for local authorities in England and Wales released on 13 February 2003 set a further record. Levels of interest through the NeSS website have also been high, with a peak of over 50,000 visitors to the site on the day following press coverage of the release of Key Statistics to ward and Output Area level.

Census Area Statistics (CAS) were released from August 2003 and a programme of future releases of CAS and Key Statistics for area levels is in train. A review of disclosure risk in workplace tables coupled with some technical difficulties in the creation of some products, necessitated adjustments to the timetable for future releases.

The software was generally sufficient to generate the files for local authorities, but there were some difficulties at first. It also required support when dealing with different statistical areas, eg Health Areas and Parliamentary constituencies. These difficulties often delayed the distribution of CSV versions of the table, such that these were often released a week or so after the source SuperTABLE files.

Many technical challenges have been met and a robust production system is in place operated by a large number of skilled staff.

To date a total of 10 (including 3 bilingual) reports to parliaments have been produced within the specified release timetable deadlines. All reports are available via TSO bookshops, and electronic pdf versions of all volumes are also available for download from the National Statistics website www.statistics.gov.uk.

Lessons learnt

The results from the 2001 Census were delivered in a period of significant organisation and technological change in ONS. If there are policy changes during the 2011 programme, ONS needs to ensure the impact of these changes are fully appreciated at all levels in the organisation, particularly with regard to production processes, timetables and customer relations.

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The strategy for web dissemination was only partially achieved due to the challenge of dealing with large multi dimensional tables. Future specifications for any output systems need to ensure that there is a smooth interface between output production and dissemination, whatever the media.

Good communication with census users and approved suppliers meant that:

- ONS was able to respond, in some cases, to user requirements that became known at a late stage in the programme. A strategy to deliver census results to the latest possible administrative areas began with the decision to provide census results based on ward boundaries in place in 2003; and
- ONS was able to create data in CSV format specifically for a number of the major distributors of census data. The value of the CSV output was that it enabled wider distribution of information in parallel with delivery on CD- ROM with SuperTABLE.

This practise of good communication and cooperation should be used as a basis for any future operation.

The involvement of academic experts in the development of the Output Area Production System ensured a statistically sound methodology was embedded in the production process. A significant amount of customer evaluation of prototype systems enabled ONS to incorporate feedback and raise awareness of the system and its purpose. Census Output Areas are the current building block for a range of statistics supplied via NeSS, and further development is being conducted across ONS.

The full and wide ranging review of potential tabulation software was proved worthwhile; the tool selected has been very successful in producing a huge number of tabulations from a massive amount of data in a relatively short time. The software was later taken up for wider use throughout ONS. The choice of SuperSTAR as a tabulation software enabled dissemination via CD- ROM and DVD along with free software to view and manipulate the tabulations. There was a mixed reception to output on DVD, but in general most customers saw it as a forward looking venture with low implementation costs.

Commitment to a range of media for delivering the results was maintained, and a close eye was kept on potential web delivery mechanisms, especially in the academic sector with which there has been close involvement. Web development was therefore initiated and subsequently dovetailed with the corporate NeSS System.

The process of getting census data from SuperCROSS format to the format required for the website was, however, resource intensive as mechanisms had to be put into place to convert the data from the tabulation software SuperCROSS to the web dissemination software, Beyond 20/20 format, used by NeSS.

Liaison with Census customers who wish to add value to the data by loading it into their own database systems resulted in a specific data format being created and supplied free of charge by census. This facilitated the wider distribution and use of census results.

Due to delays in the production of data suitable for use by Census Output, and the introduction of additional confidentiality measures, some elements of the system were not fully tested when production began. Output Production therefore postponed the release of some results until both data and systems were complete. Such data included travel to work and workplace variables.

Resource allocated to output production for 2001 was reduced significantly from that allocated in 1991. Technological advances certainly warranted a significant reduction but with hindsight the reduction was probably too great and lead to under resourcing, particularly in quality assuring tables. The main impact was that work was generally done, in serial rather than parallel, which reduced flexibility and meant one delay had a knock on effect on subsequent outputs and on other projects. Although steps were taken to remedy this once it became apparent, it contributed to some of the timetable delays.

Conclusion

The production of census output is a massive undertaking. Developing and running a vast number of tables, ensuring that confidentiality measures have been applied and checking the validity of the output, has been a challenging task. The sheer scale of output production work cannot be over emphasised. An incredible two billion

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count cells have already been produced, with more to follow, providing both specialists and the public with an unrivalled information resource.

Rigorous evaluation of the software and hardware to be used for Census Output, and selection of the right tools has enabled an enormous amount of data to be processed as complex tabulations in a relatively short time.

Robust systems were put in place to ensure data was processed accurately and quickly. Staff have been well trained and highly motivated. However, there have been challenging periods when tabulations have been released to customers accurately and on time only by the teams working very long hours.

The needs of customers and the feedback from them was noted and incorporated where ever possible into the development of systems and products.

The full range of media, print, CD-ROM, and web, ensures that all types of customers are provided with data in forms that are accessible and easy to use, taking account of a broad range of skills and understanding of the data. Supporting information is provided in all media to assist the use of the statistics.

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Census Topics	Target Dates for Release
Legislation	Published
Non-Compliance (Executive Summary Only)	Published
Data Needs	Published
Geography	Published (Executive Summary)
Publicity	Published
Data Collection Development	Published
Data Collection Support	Published
Census Coverage Survey	Published
Processing	Published
Annex: Quality of Data Capture and Coding	Published
Downstream Processing	Published (Executive Summary)
Data Quality	
- Question non-response rates	Published
- Disclosure Control (Executive Summary only)	Published
- Data Validation (Executive Summary only)	Published
Edit & Imputation	Published
One Number Census	
- Quality Assurance	Published
- Lessons learnt (Executive Summary only)	Published
Output Policy	Published (Executive Summary)
Output Production	
- Part 1: Review of Output Released to date	Published (Executive Summary)
- Part 2: including Sample of Anonymised Records (SARs)/Origin Destination Matrices	Published
Census Access	Published
Programme Management	Published (Executive Summary)
Quality Report	Published
General Report	Published

Please note that the dates for release of individual evaluation reports noted above are target dates, and therefore subject to change. For the latest information please visit www.statistics.gov.uk/census2001/reviewevaluation.asp