

10 Evaluation

Introduction

- 10.1 This General Report summarises the planning, conduct and results of the 2011 Census in England and Wales. It has noted that many aspects of this census were innovative and worked well. It also reports that there were, as with any census, a number of challenges and issues which ONS resolved and learned lessons from, to improve the planning of similar census operations in the future.
- 10.2 This chapter summarises the main conclusions from the evaluations of several major and innovative elements of the 2011 Census programme. Those issues relating to the evaluation of the response to, and quality of, the census data have already been covered in chapter 8.
- 10.3 The evaluations referred to in this chapter are not intended to provide comprehensive coverage of all the different elements of the census operation. The census evaluation reports published to date are available on our website⁷¹.

Highlights from the 2011 Census

- 10.4 There are many highlights from the 2011 Census which where relevant will be used and built upon for the next census and other related programmes. But the value of any census is determined by the quality and utility of its outputs, and the extent to which the anticipated benefits have been fully realised. One of the aims of the census was not only to maximise coverage across England and Wales but to also minimise variation in levels of response between areas within population sub-groups (such as between age/sex population groups, or and ethnic groups). The census design and operation was geared to ensure that this could be achieved by:
- the design of the field operation and accompanying processes such as publicity, public interface (being able to answer the public's questions), and online completion
 - maintaining the confidentiality of the information collected to ensure public trust and therefore public response, both for this and future censuses and for other ONS data collection exercises
 - stakeholder engagement to advise and support the census operation, particularly from local authorities and community groups
 - capture and processing of census questionnaires and responses, and the effective and efficient cleaning and validating
- 10.5 Ensuring good data quality was paramount to the next step of benefits realisation – making the information available and promoting it for the uses for which it was collected. Considerable effort was made before publishing the 2011 Census outputs to promote the results and ensure maximum use of the information, particularly by less experienced users of census data such as those in the voluntary sector, emergency services and citizen users.

10.6 The main successes from the 2011 Census were:

- better engagement with users and other stakeholders, particularly local authorities, which engendered higher levels of support for and confidence in the census
- inclusion of several new topics in the census questionnaire, including national identity, passports held, year of entry into the UK, main language, ability to speak English, second address, and type of central heating
- improvement in overall response, and exceeding the target for reducing the variation of non-response across local authority areas
- development of a purpose-built address register to facilitate mail-out of questionnaires and improve management of the field operation, including questionnaire tracking
- use of a reduced and more flexible and specialised field force, to enable more resource to be focused on achieving increased response rates in hard to enumerate areas
- introduction of a secure online census
- outsourcing of a range of support activities to specialist service providers
- more flexible dissemination and analysis of an increased range of census data via the ONS website and other means, including the development of innovative data visualisation techniques, and
- keeping costs within budget

Looking forward to the 2021 Census

10.7 Chapter 11 sets out the recommendation from the National Statistician for a 2021 Census and for more research to be put into developing alternative sources of population data for use in the longer term. Given the technological and societal changes that are likely to occur over the next decade, it will be important to build on some of the significant lessons from the 2011 Census in order to deliver a census of equivalent or better quality next time. This chapter sets out the more important lessons and considerations for a 2021 Census.

Programme management and organisation

10.8 The successful delivery of the 2011 Census programme provided a valuable opportunity for ONS and its partners to develop their expertise in managing and delivering large-scale, complex development programmes. Chapter 2 outlined how the programme was initiated, organised and governed through the various phases of the census cycle. Initiating and managing a programme the size of the census is challenging and the experience of the 2011 Census was no different. The following are the main lessons learned.

- **Planning:** detailed resource and activity planning must take place at the early stages of the programme. Planning activities should begin earlier both for development and delivery, and should include estimates of time and allocation of resources. Maintaining a full set of detailed plans from the start of the programme will give a clear overview of the census operation, and enable team leaders to understand their relationships with each other. The programme initiation/start up stage is critical for a successful programme or project and must devote time to the activities that move the

programme forward. For example, prioritising and planning initiation/ start up, and produce a project initiation document (PID) setting direction and priorities that is signed off and communicated to all levels. The PID should be reviewed at each major stage to ensure delivery is on course, and to re-plan accordingly

- Staffing/resource: the programme must ensure there are enough skilled people in post at the time they are needed, sufficiently trained/developed and capable of delivery
- Governance, controls and decision making: governance has to be clear right from programme initiation and where possible should avoid changes, particularly during programme initiation up to operations. Staff need to be clear on governance and decision making authority and responsibilities. Decision making should be prompt and avoid too many decisions being escalated
- Testing: the testing programme needs to be realistic for the timescales to which ONS needs to work. It may be better to have more smaller-scale tests, than to carry out a full-scale test at a time when systems and processes are still under development

Legislation and the parliamentary process

10.9 The legislation and parliamentary programme for a census in 2021 is likely to be broadly similar to that conducted for the 2011 Census. That is, before any census can be carried out, the primary legislation – the Census Act 1920 – requires two pieces of secondary legislation to be approved by Parliament: a Census Order (to be made in Council) followed by Census Regulations for both England and Wales. The (sometimes difficult) passage of these through Parliament is described in chapter 2.

10.10 In securing the necessary legislation for the 2011 Census, including the relevant Transfer of Function to Wales Order (which transferred the authority to make Regulations for the census in Wales to Welsh ministers) there were a number of lessons that should be considered for the next census.

- The Government's White Paper is a statement covering significant aspects of the census operation such as: the topics for which information is to be collected on the questionnaire; the arrangements for conducting the census in the field; the processing of data and disseminating results; the confidentiality provisions to protect the data; and requirements for the legislation necessary to implement these arrangements. This is a valuable document setting out plans for the census well in advance of the event, and becomes a useful reference tool in the run up to the legislation process and the census itself
- Close liaison and a good working relationship with stakeholders, particularly between ONS, the Welsh Government, the Cabinet Office Minister and officials, and their respective solicitor's offices, are essential to ensure the legislation's smooth progress through Parliament and the Welsh Assembly
- Involving experienced ONS staff who are aware of the detailed and unusual legislative procedures for the census, the Census Order and Census Regulations is beneficial
- Keeping up-to-date, detailed briefing materials, designed for multi-purpose use is critical. This ensures the necessary preparation of timely, consistent

and clear briefings at short notice, making the passage of the legislation smoother; and

- When dealing with ministers, government departments, Parliament and the Welsh Assembly, the timing of planned activities and events can easily be disrupted by procedural delays and other circumstances beyond the control of ONS. Therefore, a clear plan with good risk mitigation to minimise delays is crucial to ensure legislation is approved by the deadlines

Address register

10.11 As noted in chapter 2 an address register was central to the operational design of the 2011 Census. The register developed for the 2011 Census enabled ONS to address and uniquely code every census questionnaire before distribution. As plans for the 2021 Census are developed with the primary form of response being online, the address register will be even more central to a good design and successful operation.

10.12 Since the 2011 Census was held GeoPlace has been launched. This is a joint venture partnership between Ordnance Survey and the Local Government Association to develop an AddressBase database to provide one definitive source of accurate spatial address data, combining the best features of the National Land and Property Gazetteer (NLPG) and Address Layer 2. ONS welcomes this initiative, and will be working with Ordnance Survey and GeoPlace to share some of the main lessons to ensure that this new service will meet the address requirements of any future census design. The issues include:

- continuing to work and build new relationships with stakeholders to maximise the quality of the address register and identify new information that may also be relevant to addresses and the census operation (for example, whether a property is vacant)
- further work will be needed to research and test the business rules that decide which addresses should be included in the census or excluded. The hardest judgement is balancing the risk of under-coverage with the risk of over-coverage
- an ONS field check to identify new addresses should be used as a last resort of any requirement for the manual reviewing of individual addresses should fully explore automated or office-based checking rather than use field checkers
- more effort should be focused on building a list of communal establishments. Any source products need to be thoroughly understood in terms of coverage, definitions and whether they contain overall/shell or sub-addresses. The task should not be divorced from compiling the residential list because this increases the risk of duplication between the lists. The residential and communal establishment lists should be linked and maintained in tandem, and
- addresses change all the time. It is impossible to get a perfect address list, so it is essential to clearly define and communicate quality goals at the start. It is important to be aware of the weaknesses of address lists used and how these will impact the field work, the public and other processes, ideally with targeted testing in the field

Stakeholder management

10.13 A census has an exceptionally large number of stakeholders with differing degrees of influence and interest in the various aspects of the census operation. Managing the complex interactions with these stakeholders is essential to a successful operation, achieving good coverage and realising the benefits of the census through the use of the census results. For the 2011 Census, ONS implemented an approach to provide consistency in communicating with stakeholders as a whole.

10.14 ONS recognised that the many stakeholder groups would require different methods and degrees of approach, so different modes of engagement were developed to reflect this. Overall the engagement process can be considered a success and was a major factor in assisting ONS in reaching its response rate targets and the utilisation of its outputs.

Local authority engagement

10.15 The local knowledge and intelligence provided by stakeholders (particularly local authorities and community groups) helped ONS to target and tailor its field operation and communications more effectively. In looking ahead ten years, a more diverse society can be expected, suggesting that building on the successful 2011 engagement programme will be crucial to delivering a successful census. Some of the significant successes were:

- the census advisory groups and working groups who helped ONS significantly to refine and improve detailed aspects of field operations planning. This led to improvements such as:
 - local authority employees seconded to fill some area manager posts
 - development of the community adviser role
 - refinement of local census partnership plans, and
 - guidance on supporting the field operation

10.16 Local authorities contributed significant resources to support the 2011 Census: ONS estimates these to be worth more than £10 million. This included staff costs (CLM/ACLM posts, address anomaly resolution and feedback, and questionnaire completion events), and budgets for local publicity and media coverage.

Lessons learned

10.17 ONS identified the following lessons from its liaison with local authorities in 2011. These not only helped to inform the programme of census outputs but were shared with other ONS business areas to help the continual improvement of ONS's wider stakeholder management strategies:

- The local authorities' network of census regional champions worked well and helped to secure high-level commitment and resources from councils
- Earlier engagement with local authorities, and earlier guidance on the support they could provide, would help councils to plan and allocate resources more effectively; and
- ONS did not fully exploit the potential of county councils in England, and consideration should therefore be given as to how to better engage with county councils in future

Community liaison programme

- 10.18 As noted in chapter 2, the 2011 community liaison strategy was designed as a result of the success of the 2001 Census liaison activities. Proactive engagement was recognised as an essential part of the 2011 Census process, and this began three years earlier than for 2001. In support of the strategic aims and objectives of the 2011 Census, the strategy supported the active engagement of communities at national, regional and local levels to increase the overall response rates in their areas.
- 10.19 The community liaison programme clearly played a part in helping ONS to achieve its 2011 Census target response rates but there were other tangible achievements resulting from the engagement with local communities. These can be summarised under three main categories.

Developing strategic partnerships with stakeholders

- 10.20 The development of strategic partnerships with stakeholders resulted in:
- hints and tips on best methods of engagement, and data regarding different population groups and their motivation and sensitivities to participation
 - access to current, established and effective networks and communication channels set up by independent, interested bodies such as 'umbrella' organisations in the voluntary sector
 - assistance in the development of community engagement toolkits and methodologies for the local engagement phase, and in the development of training and instructions manuals for census field staff
 - questionnaire completion advice events being run by community groups, who provided translators and assistants
 - access to well used and recognised local venues (such as Polish Orthodox church halls) for census presentations and completion events to help hard-to-reach groups, or access to secure computer terminals for completing online questionnaires as part of a national approach
 - fast-track access to important and respected contacts in local populations, where other forms of engagement were shown not to be working well

Innovative techniques

- 10.21 Innovative techniques and approaches included:
- establishing community panels for in-depth consultations with specialist community networks, gatekeepers and umbrella organisations for advice, consultation, and partnership, regarding awareness and barriers (including literacy and learning disabilities) or issues for questionnaire completion
 - designing tailored approaches to best suit different groups (for the Traveller community, for example); presenting and interacting at the main gatherings of community leaders of some hard-to-reach population groups

Major investment by communities

10.22 Communities, networks and organisations that had a strong sense of citizenship and motivation conducted many additional engagement activities themselves, such as the:

- British Chinese community, who sponsored Chinese media events, ran stalls at high level events such as the Chinese New Year, and funded a Chinese 'Purple Bus' tour to cities with high Chinese populations
- British Ravidassians, who produced more than 10,000 leaflets, gave national presentations (in English and Punjabi), provided online videos and Facebook/Twitter campaigns, conducted community TV debates, and organised a census engagement ceremony by national leaders at the House of Commons, and questionnaire completion events at every temple
- partnership with influential and strategic organisations including RNIB, Deaf Connections, People First, Scope, Citizens Advice Bureau at national and local levels that resulted in targeted information campaigns and helping respondents to find census helplines and other completion facilities.

Lessons learned

10.23 Notwithstanding the success of the programme, a number of important lessons were identified:

Supporting material

- It is important to provide community information packs – or at least supporting publicity materials – as early as possible in a census programme. This gives time for community organisations to tailor these for their own presentations with local messages and then cascade them through their networks

Face to face contact

- The most effective engagement is achieved in person. ONS should ensure that the balance between direct or indirect engagement is considered. Direct engagement can really make a difference to a particular section of the population

Strategic planning

- Develop an approach where engagement activities that prove successful at national level are then rapidly planned into regional and local strategies. This will give local networks proven ideas for initiatives that can be exploited locally in good time

Understanding leads to motivation

- Ensure that there is sufficient dedicated resource to engage with stakeholders to understand the potential barriers to participation to enable solutions to be implemented

The importance of local knowledge

- Gather information on how local barriers, local issues, and local geographies will affect the census enumeration. This knowledge will provide valuable benefits, particularly if it is based on the real experiences of people in the area.

Census Coverage Survey

- 10.24 As in 2001, ONS carried out a Census Coverage Survey (CCS) soon after the main census fieldwork was completed. This is described in chapter 4. The main purpose of the CCS was to measure and adjust for both undercount and overcount; this was done by gathering information about a representative sample of the population and comparing it with the census responders.
- 10.25 The CCS was a successful field operation in that it completed on time, was £0.3 million under budget and, most importantly, achieved a combined interview rate for England and Wales of 90.4 per cent (including self-completion questionnaires which were left at households that had not been contacted by the end of the field period). This exceeded the target set by ONS of 87 per cent and was roughly equivalent to the 2001 interview completion rate of 91 per cent, despite a sample more biased towards harder areas.
- 10.26 In any future CCS there should be a review of the sample that may provide further changes/improvements to the measurement of coverage. In addition, in the light of the main lessons learned from the 2011 CCS, a number of recommendations have been proposed for consideration in any future similar exercise, as follows.
- As was done in 2011, consider promoting the CCS in all publicity material for the main census, to raise its profile as an essential part of the census process
 - Ensure that the CCS is put high on the agenda of local authorities. ONS should build on the relationships established with local authorities for the census itself, while being careful to assure the independence of the survey
 - CCS managers should not be expected to train staff. This distracts them from their main function, especially when new recruits start late. The training model used for the main census field workforce is a proven alternative
 - Review the householder interview methods, particularly for hard-to-contact householders, to understand possible alternative methods for achieving increased contact and interviews earlier in the CCS

Data collection and the field operation

- 10.27 The collection of responses from over 20 million households is the most challenging aspect of the census and is critical to delivering robust, high quality census statistics. Data collection covers a number of different activities that are heavily inter-related to ensure that the public are aware of the census, can easily respond to it, and can access the additional information or support they need to complete their questionnaire.

- 10.28 Ensuring that this takes place requires the recruitment, training and management of a large field force of 35,000, a complex logistical operation to give them relevant materials and payment systems, and an online completion facility for the public.
- 10.29 Planning for the field operation of the 2011 Census began in 2003, alongside other elements of the programme. The issues encountered in 2001 informed a number of major design decisions that led to further fundamental changes to the structure and management of the large field force.
- 10.30 ONS assessed these design decisions through many small tests covering a few hundred to a few thousand households, a large-scale field test of some 100,000 households in 2007, and a rehearsal with more than 130,000 households in 2009.
- 10.31 The decision following the 2007 Test to make the 2011 Census the first one to deliver questionnaires primarily by post enabled the size and structure of the field force to be based on the effort needed to follow up non-responding households, rather than on the effort needed to deliver questionnaires. Two fundamental design changes resulted from this. The first was that field staff would work as a team in an area and could be flexibly deployed within that area (rather than, as had previously been the case, having each field staff worker allocated one specific enumeration district). The second was that the amount of staff effort needed in each area was determined primarily by how hard it was expected to be to get a response, and the anticipated amount of follow up activity, rather than how long it would take to deliver questionnaires. The savings from using post-out rather than hand delivery meant that the focus of effort shifted to follow-up, with considerably more hours being spent on follow-up activities compared with 2001.
- 10.32 Recruiting, paying and training the field force was outsourced as a package for the first time. While there were some issues the approach worked well in most areas. Notable achievements were: improvement in the calibre and diversity of the staff recruited; the robustness and accuracy of the payroll function; and the implementation of required disclosure checks for all field staff.
- 10.33 However, there were some issues: some areas did not have all staff recruited in time, and in others some staff could not start because of delays in issuing identity passes. ONS had anticipated there would be some localised recruitment difficulties and so, to help manage the risk of under recruitment. Proactive management by the field managers, the recruitment agency Capita, and ONS, meant that there was no adverse effect on the follow-up operation.
- 10.34 Much emphasis was placed on field staff assisting people with completing their census returns. Local liaison work by field managers encouraged a positive response to the census. Field staff at all levels were involved in the running of hundreds of questionnaire completion events based on local intelligence about the groups in their area that needed support or advice.
- 10.35 More than 25 million questionnaires were successfully delivered by Royal Mail in the two weeks from 7 March – faster than anticipated. By the end of the follow-up operation Royal Mail had collected, receipted and delivered to the data capture centre more than 20 million returns.
- 10.36 The development of a questionnaire tracking (QT) system that could track each questionnaire was significant and provided important field information that was lacking in 2001. This system enabled ONS and the field managers to monitor and

manage the follow-up operations far more effectively. The questionnaire tracking system was updated daily as questionnaires were returned through the post or online. This information was used to direct staff to the areas of poorest response.

- 10.37 The enumeration of communal establishments, special accommodation sites and special population groups was improved by a greater focus on such groups and by the introduction of a specific field role – the special enumerator. Special enumerators received role-specific instructions, training and procedures that focused exclusively on the execution of the special enumeration, making them experts in their areas.
- 10.38 ONS concentrated on ensuring that the worst-responding areas in previous censuses achieved improved response rates, which would significantly increase the quality of census outputs. Resources were targeted on the hardest-to-count areas. It is clear that this approach worked: those local authorities with the lowest response rates in 2001 saw significant improvements. For example, response rates in inner London authorities increased by between 5 and 15 percentage points compared with 2001.
- 10.39 The 2011 Census has been highly successful in meeting or exceeding some very demanding targets. The follow-up field operation played a significant part in this success, despite the adverse trends of a changing society and lower response rates in survey-taking generally.
- 10.40 There were some generic lessons learned during the data collection phase that should be considered in the design and operation of the next census. However each census is unique, designed to take account of the societal challenges relevant at the time and to maximise the benefit of improved and increased use of technology. The next census will be no different.

Lessons learned

- 10.41 A significant issue for the 2011 field operation was the overloading of the co-ordinator's role (the co-ordinator was the line manager for the collectors). In particular:
- 1 the planned manager-to-staff ratios were too high. The original plan to keep the ratio between 1:10 and 1:12 was later amended to 1 co-ordinator to 15 collectors plus special enumerators. Some coordinators ended up with teams of more than 20
 - 2 late changes and new work was expected to be absorbed by the co-ordinators. The extent of their involvement in special enumeration tasks was not fully understood until close to the operation. The number of early collectors in some of the co-ordinator teams was also increased at a late stage, resulting in extra people and new tasks to manage
 - 3 there was no contingency built into the management roles to deal with unplanned operational issues and, as had been the case in 2001, there were many of these in 2011. Co-ordinators spent most of their time either dealing with the mechanics of operating their teams or fire-fighting problems (such as chasing up recruitment and supplies and managing workloads on the questionnaire tracking system)
- 10.42 As a result there was too little time for co-ordinators to provide quality team management. Debriefings with co-ordinators showed they felt that their job description was incorrect: the job was 'sold' as having an 80 per cent management/ 20 per cent administration split, but the reality was felt to be the reverse of this.

10.43 ONS consequently had to pay large amounts of overtime to co-ordinators throughout the operational period. ONS employed many experienced staff, but lost the opportunity to fully utilise the management and motivation skills they possessed.

10.44 Arising from these, the recommendations for any field operation for the 2021 Census are to:

- reduce the staff-to-manager ratios. The numbers will depend on the final census design, but for most teams 1:10-12 would seem to be a more practical span of control
- build considerable contingency time into the field management roles. For this type of operation it is a fair assumption that there will be unplanned operational issues to deal with, and contingency should be allowed for these in the task analysis
- make sure that the management roles include time to manage: coaching, developing and motivating their teams is an important task that, if done properly, should optimise the value of the field operation
- consider the need for additional field team roles; administrative support for essential but less skilled tasks would have helped, as would a separate manager for special enumeration work
- avoid late operational changes if possible, or at least be realistic as to what the operational impact might be, and work harder to mitigate potential problems

10.45 The main enumeration challenges that were encountered in 2011 look set to remain relevant for the next census, such as:

- second homes/holiday homes
- new developments
- gated communities
- complex multi occupied housing, and
- particular hard to count communities

To deal with these ONS stuck with a tried and tested method: if a response was not received, a member of field staff was despatched to find out why. This could result in persuading a reluctant householder to take part, or in the field staff completing a short dummy form that describes the non-responding address to the best of their knowledge. The field work required to complete dummy forms was quite labour intensive, and often involved collectors making educated guesses as to what lay behind front doors. Greater use of administrative information may provide alternative ways to obtain the information contained on the dummy form in the next census.

10.46 Using area managers and co-ordinators to gain local contacts and knowledge to help with address and enumeration problems (through the local authority and community liaison programmes) proved to be really useful. Some of their solutions and suggestions came quite late in the cycle, and could be further developed for 2021. The LA liaison work carried out by area managers in the eight months leading up to census day might be built on to provide more advanced knowledge of the problematic addresses, perhaps by involving them with more local contacts such as housing associations and developers. It proved difficult to find managers who excelled at both the local liaison work and the operational management of their team. ONS may therefore have been expecting too wide a skill set in its area managers and may need to consider separate roles.

- 10.47 More forward planning should have been undertaken in areas where address problems were clustered together – in, for example, massive new developments or holiday areas. Tasking early collectors on this work helped, as did additional letter drops in areas with high volumes of second homes. However more detailed contingency plans for these types of areas, with more preparation, could have made this part of the enumeration more effective and efficient.
- 10.48 Clear and simple processes that field staff understood from the start, and were properly trained for, would maximise the effectiveness of their procedures. A modern census is intrinsically, complex with large numbers of inter-related teams, systems and processes. Field staff tasks need to be simple enough to enable training en masse in a relatively short period, and easily understood in order that they are done effectively.
- 10.49 The recommendations for use of field resources for the 2021 Census are to:
- build on the 2011 strategy of using field staff to identify and resolve local enumeration problems. For example having a local presence to investigate address issues that are hard to resolve centrally could bring much value before and during the operational period. This should be considered early as part of the overall fieldwork design
 - review the effectiveness of the dummy form as a way of getting information about non-responding households. In some cases administrative data, or work done on the address register, could perhaps provide more accurate information more cost effectively
 - consider procedures to cope with the clustering effect of the 2011 enumeration challenges such as second homes in central London. There may be a need to prepare different field strategies for different types of hard to count area
 - balance the cost savings of recruiting less specialised staff (who could do several jobs at different stages) with the efficiencies of having staff with the right skill sets to do specific jobs
 - develop contingencies early for all enumeration problems, so that their effectiveness can be optimised. A guiding principle is to avoid late changes unless they are really necessary, and attempt to keep field processes simple.
- 10.50 One aspect of data collection that creates significant risk if not tackled properly is the design of the field staff employment contracts. A lack of understanding of all the operational requirements did result in some contractual gaps.
- Lack of clarity on which field staff role could be done on top of other full- or part-time work caused issues at the recruitment and operational stages. In particular, ONS allowed co-ordinators who already had full-time jobs to continue their existing employment. This became impractical by the time the enumeration period started
 - Some collectors completed their work earlier than expected and were retained as special enumerators. However this involved last minute negotiations to resolve contractual issues.
- 10.51 One strength was the contractual requirement for collectors to work 60 per cent of their time at evenings and weekends. This might vary for 2021, assuming that a fair proportion of visits might be needed to support members of the public who are not

able to complete the census online. However, it is worth being very precise in the contract about such requirements.

10.52 Recommendations for field staff contracts are to:

- ensure that there are good levels of field operations and employment contract law experience amongst the teams negotiating the field staff contracts
- make greater use of the experience of ONS social survey staff to determine how the detail of field staff contracts will work in an operational environment

10.53 Field staff experienced serious problems in getting all the supplies they needed to do their jobs. Issues ranged from inadequate supplies for new recruits, and delays in restocking essential supplies of questionnaires, to a shortage of printer cartridges for co-ordinators to print out their follow-up lists. Although many of these issues were only relevant to the circumstances in 2011, it should be noted that there were also considerable problems caused by supplies and logistics failures in the 2001 Census. Some of these issues may therefore still be relevant for 2021.

10.54 The key lessons to learn regarding supplies and logistics are:

- getting the right supplies to the right people at the right time remains a high risk on the success of any field operation. The field operation will always be a vast and complex logistical process with the potential to cause a good deal of error and delay; and
- as well as creating practical problems, failure to deliver supplies has a big effect on field staff morale and on their confidence in ONS.

10.55 The main recommendations regarding supplies and logistics.

- Provide local stores to hold field supplies. Although there are likely to be fewer paper questionnaires issued, additional hubs could help alleviate other supply issues. It is especially critical to have a logistics store for London
- Put as much effort into monitoring the amount and location of field supplies as is put into monitoring response rates
- Undertake more contingency planning to establish the processes if supply routes break down
- Test field staff support processes, systems and any contractors as fully as possible. This part of the operation presents significant risks if it is not done well

10.56 The field force was managed and supported by an HQ based team, consisting of regional managers and their administrative support. The regional management team (RMT) faced a number of significant issues.

- Many of the team had no previous census experience, and delays with recruitment meant that they received only minimal training. Some RMT staff joined ONS only two months before census day. Many managers did not understand the organisational structure or know anyone outside their team
- The scale of the main operation magnified problems to an extent that could not be rehearsed. The RMT was therefore overwhelmed with a large

number of calls and emails throughout the operational period (up to 1,000 a day at the peak period). The most frequent problems were supplies and logistics, recruitment concerns, and technology issues

- The RMT was trying to carry out too many functions. The main tension was whether the RMT's role was to manage and direct, or to support. Many of the area managers were very experienced, and were used to working at a senior level. Remote management is challenging at the best of times, but it was difficult for many of the HQ based regional managers to provide leadership, particularly because they were effectively the same grade. Some of the regional teams proved much more comfortable providing an administrative support/problem solving role than offering real management direction
- The RMT was very large (60 plus) in order to cope with the volume of work, but this made it difficult to communicate with them and ensure that every member of the team was dealing with issues in a standardised way.

10.57 The main recommendations regarding HQ management and support structure for the 2021 Census.

- Enable the different RMT functions (support and query resolution, line management and communication) to make sure they are carried out effectively. It would make sense to use a call centre type technology to properly log, prioritise and deal with field staff queries and requests. An obvious solution is to use the public call centre to support field staff as well, and have a small team of HQ experts who can be consulted for technical queries
- A smaller HQ-based RMT could then focus on managing the field staff rather than supporting/dealing with their problems
- Having a communications expert responsible for all communications to field staff would ensure consistent, well written messages
- The workload for the head of the RMT was too large, consider splitting this role
- Attempt to rehearse these support systems as closely as possible before the census, to ensure working systems are in place, even though the volume of issues will not be comparable

Data processing

10.58 Future requirements and implementation of data processing may be very different because of an increased use of online completion, changes in output requirements and the methods of dissemination. Therefore it is likely that a number of the more detailed lessons learned from processing the 2011 Census will not be relevant. However there are some strategic lessons that are important to heed for the 2021 Census and this section seeks to highlight them.

Data capture and coding

10.59 Chapter 5 reported that the accuracy levels of the data capture and coding processes more than exceeded the targets set. However, the setting of targets, the training of coders, and the quality checks around this work will need to be freshly reviewed in the light of new and improved methods for capturing this information and the relevant output requirements. The following are examples.

Workplace coding

10.60 An important use of census data is the analysis of workplace statistics and information on commuting patterns. Although the levels of accuracy achieved were higher than the targets, some small, localised issues meant that some areas' commuting patterns looked implausible. The coding of this information has always been problematic because respondents often do not know either their own workplace address or the workplace address for others in the household. This situation is not likely to change, but more needs to be considered in the design of the online questionnaire, the capture and coding of responses, and data processing to improve the accuracy of the information collected. Checks should be built in to identify the more obvious anomalies found in 2011 (for example Newport in Wales or Newport on the Isle of Wight).

Date of birth capture

10.61 A respondent's age, derived from the date of birth they give, is critical to later statistical processing and is an important constituent of almost every census output. Despite the very high level of capture and coding accuracy, some issues were associated with the scanning information. There was evidence that the numbers 6 and 7 were sometimes scanned as a 1. For the vast majority of errors this has a negligible and unnoticeable effect, but in this example instances where year of birth of 1961 was captured as 1911 was noticeable because the numbers of centenarians is small – resulting in a disproportionately larger impact on a particular age group.

Downstream processing

10.62 As shown in chapter 5, the systems and processes that cleaned, validated, adjusted and protected the data largely worked as intended within the overall timetable for outputs. Again, given developments in technology and online data capture, this is an area likely to undergo significant change for the next census. However, there are a number of over-arching strategic design and methodology lessons that should be considered for future census design.

Timetable

10.63 Consultations with census data users identified that they would prefer 2011 Census results to be provided 'right first time', even if they took longer to produce. The first results were produced on 16 July 2012, nearly 16 months after census day. The speed of the release of results from the census depends on how quickly the information can be processed, validated, quality assured, tabulated, and made ready for publication. This date met the target that was set for the census and was, in fact, a small improvement on the equivalent date in 2001.

10.64 To speed up production of the initial outputs would rely on a number of factors, and in particular on an increase in online responses. This can significantly reduce the time required to capture and code the responses. The two major statistical processes of coverage assessment and adjustment, and edit and imputation, were designed to be carried out sequentially, area by area. If it was possible to clean and adjust the data accurately without relying on the processing of an entire area to complete, this would significantly speed up the production of outputs.

Systems and system development

10.65 One of the main difficulties experienced in downstream processing was that, prior to live processing, the systems were not completely tested with data from census type scenarios. The effect of this was that there were:

- a large number of requests for change that needed to be implemented to ensure that the processing would work in an automated, robust manner, and
- delays within individual processes had knock-on effects on later processes. This created pressure on the operational teams, and reduced time for some other activities, such as quality checking

10.66 For the next census the design and development of downstream processing systems need to be ready earlier, so that they can be rehearsed as part of the census rehearsal. This was an aim for both the 2001 and 2011 Censuses, but was not achieved in either.

Methodology lessons

10.67 There are many detailed lessons about the methods employed that should be reviewed for the next census. Many depend on the systems employed, the content of the questionnaire and output requirements, but strategically there are areas where methods for the next census should be reviewed and improved if relevant.

Edit and imputation

10.68 As in previous censuses and as noted in chapter 5 the primary objective of the 2011 item editing and imputation strategy was to produce a complete and consistent database by replacing all missing and inconsistent data with imputed values using a robust statistical method that estimates the distributional properties of the missing/inconsistent data as accurately as possible.

10.69 In general, the 2011 Census item-level edit and imputation strategy was successful in meeting all of its main aims and objectives. On reflection, one of the most important decisions contributing to this success came from the early development phase of the project where the decision was made to design and develop a processing strategy based on the already tried and tested methodological software platform, CANCEIS. Investing time and effort into optimising the parameters of the CANCEIS platform rather than building a bespoke system as in 2001, clearly contributed not only towards the delivery of a complete and consistent Census database, but also to several advantages over the 2001 Census edit and imputation strategy. The system was faster and more efficient, but perhaps more significantly, there were a number of improvements to the quality of statistical outcomes. A more detailed overview of the 2011 objectives and how the CANCEIS based system performed compared to the 2001 system can be found in chapter 5.

10.70 Although the 2011 Census edit and imputation strategy met all of its aims there were a number of issues that were not identified until evaluation of the imputed 2011 Census data began in the early stages of live processing. A detailed review of these issues can be found in the 2011 Census edit and imputation evaluation report. Without exception, all of the issues arising during 2011 processing could fundamentally be attributed to unexpected characteristics of the 2011 Census data and how these factors influenced the end-to-end edit and imputation processing strategy. In general, adjustments were required for all key processing stages. For example,

- In the pre-imputation editing phase, at first, the complex reciprocal relationships between people in households with more than four people could not be resolved efficiently or accurately through the original design of the edit and imputation strategy. To resolve this, a deterministic editing process based on triangulation rules between people in a household had to be implemented prior to statistical imputation
- During the imputation phase, in addition to those already anticipated, new edit rules had to be designed and implemented to prevent the propagation, or worse, the removal of rare characteristics by the imputation process. For instance, there were fathers in the data who were more than 65 years older than their children. While there is no reason to remove such rare characteristics from the data it would not be appropriate for similar characteristics to arise due to the imputation process
- Also during the imputation phase, adjustments had to be made to the donor selection parameters of the CANCEIS system to ensure the statistical accuracy of the imputation. For example, based on 2011 Census data and questionnaire design the CANCEIS donor selection parameters could not account adequately for the complex relationships arising through the routing/skip patterns in the 2011 Census questionnaire, the complex relationships between student-age, working-age, marital/civil partner-age and parent-age, and the patterns of non-response related to these variables. Before amendments were made this led to an over estimate of 15 year old and an under estimate of 16 year old students in the imputed data

10.71 As the parameterisation of the end-to-end edit and imputation strategy for 2011 was primarily based on 2001 Census data it is perhaps no surprise that adjustments to several aspects of the 2011 strategy were required once the system was set to treat live 2011 data. Undoubtedly, the detailed record of adjustments made to the 2011 Census edit and imputation system will serve as lessons to carry forward into preparations for the 2021 Census. However, it is also important to recognise that data-driven processes are very difficult to fully specify up front. With data collected 10 years on from that used to define a data-driven system it will always be likely that last minute changes to processing methods will be required. With this in mind, perhaps the most important lesson to be drawn from application of the 2011 Census edit and imputation strategy is related more to the way the strategy was integrated into the overall processing operation.

10.72 In general, a requirement of the overall processing operation was that the edit and imputation process had to be programmed into a semi automated IT system along with all of the other steps associated with processing census data. However, the initial edit and imputation prototype based on 2001 data delivered for the census processing environment required more tuning and adjustments than had been anticipated and this need had not been sufficiently recognised during the planning of the census processing timetable. As a result, the overall processing system had not been set up to receive updates and changes to edit and imputation parameters easily. This meant that the changes that had to be made during live processing were difficult and time consuming. Once resolved, processing was generally smooth and efficient. There are a number of recommendations that can be carried forward that would serve to minimise problems like this in future:

- The design of the edit and imputation strategy should be developed in relation with the development of other census outputs and processes such as data dictionaries, derived variables, rule based editing

strategies, and the development of rules serving to maintain consistency in the data

- Sufficient time for analysing the live data in order to identify unexpected issues and find solutions to remedy them
- The edit and imputation process looks across all relationships between characteristics in the entire data for the first time. As a result it often finds errors in earlier processes
- The overall census production system needs to be far more flexible in terms of making frequent updates or changes to the edit and imputation methodology or parameterisation of the strategy; and
- As edit and imputation is an iterative process the overall processing system should also be designed to allow data to be fed back easily into earlier stages of the edit and imputation process

10.73 Processing was generally smooth and efficient; however, there were some challenges in implementing and running the methods in an automated production environment.

- The development and implementation of the method was more iterative than originally planned. Future development would benefit from considering an iterative design and testing approach with robust review cycles but accepting that some flexibility in the final system during live operations is required to manage outliers and unexpected change
- The timetable needs to consider dedicated time to optimise the criteria for selecting donors and therefore minimising the failure of records to impute successfully first time. These criteria are specific to the characteristics in the data and require a number of iterations.

Coverage assessment and adjustment

10.74 The primary objective of the coverage assessment strategy was to identify and adjust for the number of people and households not counted in the 2011 Census. A secondary objective was to identify and adjust for the number of people and households counted more than once, or counted in the wrong place, in the 2011 Census. The strategy was to build on the 2001 methods, using it as a platform to develop an improved methodology. The methods and results are detailed in chapter 5.

Sample design

10.75 The sample design for the Census Coverage Survey (CCS) was one of the main improvements made to the methodology, and it proved to be successful in providing the data for measuring coverage patterns across local authorities and by age and sex. It also contributed to the aim of reducing the variability in quality of estimates between areas by allocating a larger sample to harder-to-count areas.

10.76 The improved methodology for deriving the hard to count (HtC) index proved successful, as it worked extremely well in both the census fieldwork and the CCS design in reducing the variability in census response rates and quality of the estimates. Using up to date information reduced the risk of having poor samples, although it was not removed entirely (see below). The use of the HtC index was important, and the skewed nature of the index improved the design compared with the 2001 version. This was particularly true in large cities, which contained the top 10

per cent of the hardest-to-count areas. With the additional data obtained in the 2011 Census it may be possible for any future index to be refined further.

10.77 There were a few issues with the design as implemented.

- In drawing the sample, the information used from the Postcode Address File (PAF) underestimated the number of households in the postcodes. This led to more households being selected than planned, which resulted in larger workloads for interviewers. However, this had been identified in advance as a risk and was mitigated by interviewers flexibly working additional hours. For any future survey a better estimate of the number of households in each sampled area would make implementation easier
- A method to boost the sample was developed to increase the sample size in areas where census response was lower than expected. This was intended to help reduce variability in the estimates. However, implementation issues limited the size of the boost, so it was of limited value. The indications are that it made little difference to the variability of the estimates due to its small nature, and also given that the areas that were boosted tended to have fairly large sample sizes without the boost.

Matching

10.78 The overall matching strategy worked well, although there were some issues with its implementation. The automatic strategy was good and the methodology worked flexibly and extremely well. Constrained by the requirement for no false positive matches, the automatic matching made exact and very high probability matches for 60 per cent of households and 70 per cent of persons. This was despite the quality of the capture of names from both the census and CCS being lower than expected, mainly due to poor handwriting.

10.79 The main issue with the matching implementation was the structure of the clerical matching. The system specification was very rigid in an attempt to achieve near perfect accuracy. This included enforced triple checking of all unmatched records (one by one) by experts and supervisors. The system as specified did ensure accuracy, but affected timeliness. There was no flexibility within the specified system to adjust the matching strategy.

10.80 To help meet the original deadline additional short-term staff were recruited to increase throughput. It is estimated that the hours worked by the matchers were 30 per cent greater than anticipated, and the estimated quality levels in terms of matching accuracy were 0.2 per cent false negatives and 0.06 per cent false positives. The false negative rate was higher than the target (0.1 per cent); while this will have inflated the initial population estimates slightly (by causing a positive bias in the dual system estimator) the adjustments for bias in the estimates will have dampened the impact.

10.81 In summary, the lessons learned from this were that:

- systems involving a large element of manual work are more challenging than the underpinning methodology, particularly where high quality is essential
- operational procedures require significant time and resource to develop, test and refine, and

- large operational activities such as matching teams should be run by the census operational management

Estimation

- 10.82 The estimation methodology worked well to provide a consistent analysis of census coverage. The outcomes met prior expectations, and provided a rich source of information on patterns across the country and within each estimation area. The improvements to the methodology worked as expected and were integrated into the processing procedures; these included the use of simpler ratio-based estimators, improved bias adjustments, and bootstrapping for variance estimation. The Dual System Estimation (DSE) bias adjustment was successful, and the adjustments made were plausible, based on the alternative household estimate.
- 10.83 There were some issues with elements of the estimation methodology. Most importantly, the method for measuring coverage within household bias, using social survey data, did not detect any bias. This did not mean it did not exist, and any residual bias was included as part of the national adjustment process. Some form of administrative data may be a helpful source for checking this in the future.

Adjustment

- 10.84 The basic imputation methodology worked well to provide a database that was fully adjusted to take account of the measured coverage, adding wholly missed households, and persons within existing households.
- 10.85 However, the implementation of the methodology was challenging. The main issue was with the calibration process which derived the household weights for imputing wholly missed households (and the people within them). The method attempted to calibrate the household weights to both household estimates (tenure and household size) and person estimates (age-sex group, activity last week and ethnicity). The issue was that while it was guaranteed to obtain the correct weighted total of households by tenure, it was not always close enough to the person estimates by age and sex. The development work had not highlighted this as an issue, although further simulations might have done so. A solution was delivered which allowed the adjustment process to proceed but with delays that impacted later processes.
- 10.86 The main lessons learned from the adjustment system problems were not to leave development and testing of the most complex part of the methodology until last, and to ensure there are sufficient statistical resources to deal with any unforeseen methodological problems.

Conclusions

- 10.87 It was a considerable achievement to improve, implement and apply the methodology to produce census estimates that are of extremely high quality, and that were delivered to time. The evaluation has provided lessons to be learned for other large-scale statistical developments and processing operations, but has also demonstrated that the framework first laid down in 2001 provided a platform on which to build a more robust methodology. It has also provided a way of developing new methodology and accompanying systems that can be harnessed for the 2021 Census.

10.88 In summary, the most significant lessons learned from the coverage assessment project were that:

- Investment in sufficient resources during the development phase, which allows sufficiently robust testing of methods, will help to mitigate the risk of having methodological problems during the operational phase
- Complex methodological components should not be developed late, as this hinders the proper understanding of complex components that is needed to inform decision making during the live operation
- Transparency is important, and the ongoing stakeholder engagement provided assurance to users and helped guide the research. This worked well; the events held to explain the methodology were well attended and good feedback was received. Information papers published as part of the first release (and subsequently) fully explained the methods and adjustments made

10.89 Statistical developments and operations such as this must have flexibility in their development and implementation, allowing planned time for the methods and systems to be updated when real data are available. Development using historic data did not tease out all issues, and not all results can be predicted.

10.90 The main points from the evaluation that will assist future developments are that:

- working groups, involving relevant experts and business areas, and external reviews are critical to ensuring that high quality methods are developed to provide the basis for engaging with stakeholders, and
- transparent communications are important to help users understand complex methods

10.91 There were a number of lower level recommendations for any future methodological development and implementation.

- Any future hard-to-count index can be refined using the data obtained from the 2011 Census
- It is important to consider the possibility that any sample can be, due to random chance, unbalanced so a mitigation strategy (such as a specific adjustment) is important
- Construction of a good estimate of the number of households in each sampled area would make the implementation of any future area-based survey easier
- A sample boost strategy should be considered early in the planning process, and consideration given to only using such a strategy if it can be shown to significantly improve the estimates to balance against the risk to data collection
- For any future assessment of within-household bias in a DSE, some form of administrative data may be the only source that could be used for this; and
- In any future coverage adjustment development, more resources are required to give more attention to lower level variables

Statistical disclosure control

- 10.92 The record swapping measures described in chapter 6 proved satisfactory for protecting the statistical confidentiality during data processing, but did create some difficulties during later stages of output production. The level of detail available was slightly less in many tables (in terms of number of rows and columns) compared with equivalent outputs in 2001, and this may have disappointed some users, but it did have a distinct advantage of providing considerably more detail in terms of small counts.
- 10.93 This was not apparent to users at first and, in hindsight, ONS might have assisted users more by demonstrating clearly how the advantages outweighed the perceived disadvantages. One of the main alternative disclosure control options considered (a form of cell perturbation developed by the Australian Bureau of Statistics) had shown considerable promise, and would have allowed both small counts and the detail. However there was insufficient confidence in being able (a) to test the method within the tight timescale, and (b) convince users that a method that gave rise to inconsistent counts, albeit rarely, was better.
- 10.94 ONS was mindful of the users' well-voiced dissatisfaction with the 2001 small cell adjustment methodology weighed heavily on ONS's shoulders, and record swapping was regarded as a safe option, compared to the relatively untried Australian method. Engagement with users was quite strong, but the user community were pushing for assurance that ONS was *definitely not* going to use small cell adjustment again.
- 10.95 The statistical disclosure control (SDC) evaluation and development work started at around the same time as the statement made by the National Statistician and Registrars General (RsG) of Scotland and Northern Ireland in November 2006. In this they agreed to aim for a common UK SDC methodology for 2011 Census outputs, and considered that, as long as there has been systematic perturbation of the data, the guarantee in the code of practice would be met. It was therefore agreed that small counts (0s, 1s, and 2s) could be included in publicly disseminated census tables provided that:
- uncertainty as to whether the small cell is a true value has been systematically created, and
 - creating that uncertainty does not significantly damage the data
- 10.96 Though pre- and post-tabular methods were considered, the National Statistician and RsG expressed a preference for pre-tabular methods, provided there was no undue damage to the data.
- 10.97 Subsequent to agreeing the UK SDC policy, the Statistics and Registration Service Act 2007 (SRSA) came into force, Section 39 (2) of which defined 'personal information' as information which relates to and identifies a particular person, or body corporate. It specified what constitutes a disclosure of information and the sanctions that may apply for any breach of confidentiality.
- 10.98 The UK SDC policy was in line with Section 39 of the SRSA. However, in hindsight, there was confusion as to what was meant by 'uncertainty' and, particularly, the level of uncertainty that would be acceptable. It would have been advisable to have obtained a clear statement at this point as to what was the appropriate level, how to measure it, and any related legal issues.

10.99 The main lessons to emerge from the 2011 Census experience were that in any future census:

- a record key/ cell key perturbation method should be considered in order to provide small counts and greater detail in tables. The challenge will be to persuade users that the presence of a small number of slight inconsistencies between tables is acceptable
- ‘real’ test data should be used for the development of methods and systems
- any census test or rehearsal should test the whole of the process from start to finish, including SDC processing and outputs
- a UK wide disclosure control working group should be set up during the evaluation and development phases
- a clear steer on legal issues should be obtained early in the evaluation, and
- the measures of ‘doubt’ should be revisited

Quality assurance

10.100 Quality assurance of the 2011 Census was more rigorous and comprehensive than in previous censuses. An independent review of the QA approach led by Professor Ian Plewis from the University of Manchester, concluded that:

‘...many lessons have been learned from the Census in 2001 (which was itself a considerable improvement over the 1991 Census). We have been impressed by the scope and depth of the methodological investigations initiated by ONS, by their willingness to discuss with a wide range of interest groups concerns about coverage and Quality Assurance (QA), and by the procedures that are in place to use field staff flexibly...’

‘...the methods give confidence that the resulting final census population estimates will be better than any other method and will be suitable for use in resource allocation and planning’⁴⁵.

10.101 Every 2011 Census QA panel (described in chapter 5) considered a much wider range of evidence than those run for the 2001 Census. The evidence assessed included operational intelligence and information provided by local authorities, the diagnostics from the coverage estimation process and data from comparator sources. Administrative data were used extensively for core checks on all 348 local authorities in England and Wales. However, because there was limited time and resource available for supplementary analysis, this extra research had to focus on data discrepancies that were of particular concern. The high quality of the 2011 Census, together with work on an accurate address register and use of intelligence from administrative sources, ensured there were relatively few significant discrepancies.

10.102 The data and evidence for each local authority were reviewed at least twice, with some local authorities going through several iterations of the process.

10.103 The QA process gave ONS confidence that the census estimates were correct and the executive panel recommended acceptance of the census estimates for all 348 local authorities prior to publication.

10.104 The methods, procedures and participation in the quality assurance process were very successful in 2011, with some innovative use of people and systems to aid the quality assurance process. However not all aspects of the results were quality assured, and some issues arose after outputs were released and experienced users began detailed analyses; these highlighted the need for some additional checks in future. This will always be the case given the sheer volume of information to process and check (more than 8 billion census statistics have been published), and the difficulties with trying to automate the interpretation of rare events or respondent circumstances.

10.105 Some of the main issues to take forward for the quality assurance process .

- Maintain a high level of transparency and openness in the QA methods and process, involving experts from outside the census programme and ONS
- Further improve the tools to quality assure the results, using more visualisations of possible errors or implausibilities
- Consider how to look at changes over time using the previous census information to highlight significant and implausible outliers over time, particularly for small areas

10.106 In addition, the main QA panels required quite a lot of training and briefing around estimation issues so that they understood what could be achieved and what could not. The lesson here is that members of the QA panel should be trained and briefed using actual data and QA materials, to help their understanding and clarify expectations around the likely outputs and communications.

Output content, production and dissemination

10.107 A primary objective of the census is to produce easily accessible and reusable outputs and results that meet user requirements. The value of the census is not realised until the outputs are produced and used to inform decisions on the delivery of services and public debate on important social and economic issues. Census outputs are still being published. However, based on early user feedback and experience from developing, producing and disseminating census outputs since 2010, some of the main lessons are noted in this section.

10.108 Producing outputs from the census is complex. User needs must be balanced against protecting confidentiality of the information and the resource required to disseminate the results in a way that will maximise their use. Chapter 7 summarises the outputs and analyses that were produced from the census along with some examples of uses of the information. However, the production and dissemination of these outputs was not without its challenges.

10.109 One of the main challenges faced in the 2011 Census, and faced by most censuses was that output production is the end of the operational processes. Therefore consideration and development of these processes was also done last as the programme naturally focuses on earlier priorities. However some of the main interdependent decisions around dissemination approach, disclosure control methodology and user requirements were taken too late in the process. This left insufficient time for system development and testing ahead of the main output production phase. This resulted in a sub-optimal production system that was resource intensive. Output content was, in some instances, not to user expectations

from previous consultations. Managing this process was challenging and, at times, communication with users suffered, leaving them with some uncertainty about the output timetable.

10.110 Evolving dissemination techniques, supported by new methods for protecting the confidentiality of information will be available and will be important considerations for the next census. How these advances are incorporated into an overall outputs strategy for the next census will significantly affect how we deliver and maximise our outputs. The outputs strategy and the approach to dissemination for the next census should be decided early and should set the direction and tone for significant developments, primarily the disclosure control methodology and geographical detail. The outputs strategy/plan should steer and guide consultations with users on topics and questions. The strategy should consider and focus on the following important areas.

Approach to dissemination

10.111 There are effectively two approaches to disseminating census results:

- produce large numbers of small datasets
- produce small numbers of large datasets

10.112 The first is the approach taken in 2011 and for previous censuses, where more than 600 different datasets were produced, each available for one or more geographies. This approach sat more easily with a disclosure control methodology that enabled complete additivity and consistency within and among datasets (including small numbers in cells, such as 1s and 2s). But it did have drawbacks. It made the definition, production and checking for disclosure of the datasets lengthy and resource intensive. The dissemination of the results was inefficient and less accessible to users, particularly the multivariate datasets.

10.113 The second approach should be given serious consideration for a future census design. It can provide users with much easier access to the information and more flexibility for them to create bespoke datasets that meet their needs. It also makes it easier for the data to be reused in an open format and combined with other open datasets, which increases the benefits of the census. However, protecting the confidentiality of data in this approach is likely to involve some form of post-tabular perturbation, which could be complex to implement and may lead to inconsistencies between queries or to the loss of some small cell data.

10.114 Both approaches have their trade-offs, so it is important that the approach chosen for 2021 be decided early, giving enough time for the necessary system and methodological developments to be successfully implemented and tested. An early decision on the approach to dissemination is critical because this will provide clear requirements for developing the appropriate methodology, ie a post-tabular or pre-tabular method. An early decision will also assist consultations with users about the content of outputs, because clarity on the level of detail available from the new outputs will help them specify their requirements.

Disclosure control

10.115 Decisions on outputs and dissemination should be taken before decisions on disclosure control and geography. Choosing the method of disclosure control for protecting the content of future census outputs also requires early thought and development method. More on disclosure control is given in paragraphs 10.92 to 10.99.

Timing of outputs

10.116 The results from the 2011 Census were, on the whole, delivered more quickly than the previous census. Nonetheless the first results were available 16 months after census day, and the first set of detailed characteristics outputs were published nearly 21 months after census day. The development of an output strategy, in conjunction with a data processing strategy, should aim to deliver results earlier, and also complete the entire suite of census products earlier.

Benefits realisation

10.117 Chapter 7 outlined the excellent work done to promote the use of 2011 Census results and realise their benefits. Benefits realisation was highly successful both in broadening the use of the results and in understanding the uses of data that ONS was previously unaware of. Developing and promoting wider understanding of the applications of census data is an important activity to take forward into 2021.

Checking the quality of the outputs

10.118 Paragraphs 10.100 to 10.106 cover some of the successes of the quality assurance process and the main lessons to consider in future censuses. In addition the plausibility of the results needs to be considered as early as possible. There were no significant issues with the publication of the 2011 results, following the extensive quality assurance process. Future plans should consider using more visualisation techniques to help to check for plausibility at small areas, plausibility of change compared with the previous census and other complex outputs such as origin-destination.

Communicating with users

10.119 During the production and release of census outputs ONS took decisions on priorities considering trade-offs between user needs and ensure timely publication. Users were involved in informing some but not all of these decisions. With more user engagement during the production phase some of the output content could have better met user needs. Ongoing dialogue with users is important for understanding their changing needs and priorities, and for operational decision making. Consequently future censuses should consider how best to involve users during output production to understand their experiences and requirements.