Statistics New Zealand
TATAURANGA AOTEAROA

Future New Zealand censuses: Implications of changing census frequency or adopting other models

Christine Bycroft

newzealand.govt.nz

This information paper is one of several that look at how to meet future information needs for social and population statistics. Statistics New Zealand is not committed to adopt any findings, methodologies, or recommendations outlined in the papers.

All papers are available from The future approach to social and population statistics page on the Statistics NZ website (www.stats.govt.nz).

Citation
Bycroft, C (2011). *Future New Zealand censuses: Implications of changing census frequency or adopting other models.* Wellington: Statistics New Zealand

ISBN 978-0-478-37738-5 (online)

Published in November 2011 by
Statistics New Zealand
Tatauranga Aotearoa
Wellington, New Zealand

Contact
Statistics New Zealand Information Centre: info@stats.govt.nz
Phone toll-free 0508 525 525
Phone international +64 4 931 4610
www.stats.govt.nz

Contents

List of tables and figures

Tables

Figures

Abstract

The New Zealand Census of Population and Dwellings forms the cornerstone of population and social statistics in New Zealand. The primary purpose of a census is to provide an authoritative count of the population at a given point in time. The other unique role of the census is to provide comprehensive information on the characteristics of small geographic areas and local communities, and for small populations such as iwi, Pacific peoples, older New Zealanders, and migrant communities.

Having an accurate understanding of population size and other basic characteristics, including housing, is fundamental to the efficient functioning of a modern economy. In many countries, including New Zealand, census information also underpins the electoral system and is the basis for fair representative democracy.

Censuses have been held in New Zealand since 1851, for the most part on a five-yearly cycle that is required by legislation. The New Zealand census provides information of high quality and high value, and is well supported by the public. However, the cost of holding a census is high.

The purpose of this paper is to help inform discussion about changing our approach to how the principal census information is gathered in New Zealand.

Internationally, the most common method of taking a population census is a 'full-enumeration survey', although a small, but increasing, number of countries produce their census information largely using administrative sources. Government has expressed interest in changing the census frequency from the current 5-yearly interval to 10-yearly, as an option for reducing costs. This interest drives an emphasis on census frequency in the paper, and on the consequences of various frequency options.

The uses and users of census are wide-ranging. The five-yearly census is now well embedded in wider government systems. Accurate population statistics, reliant on the five-yearly census, are critical to the neutrality of government resource allocation and to accurate costing of government programmes. Population projections are also reliant on the census and are vital to long-term future planning across many areas. Information about local areas and small population groups is critical to much decision-making by central and local government, community groups, businesses, and iwi authorities.

The census does not sit in isolation, but is part of an integrated statistical system that also includes sample surveys and administrative data. The census provides essential 'infrastructure' for the household sample survey programme and is integral to the effective use of a range of administrative data. The census also provides a frame for surveying small populations such as Māori and people with disabilities.

Out-of-date census information or poor quality population statistics can lead to a shifting of costs to government departments and others who rely on census.

Different approaches to census-taking involve trade-offs between overall quality of census information, the cost, complexity and timeframes required for change, and long-term across-government costs. The paper provides a high-level overview of these trade-offs for six particular census models. Discussion at this stage is indicative only and serves as a guide to determine the most likely directions for further work. A national address register stands out as one administrative component that is clearly beneficial whichever direction is taken long-term.

1 Introduction

The purpose of this paper is to help inform discussion about the potential for adopting different approaches to census-taking in New Zealand. Statistics NZ is developing the strategic direction and investment for official social and population statistics for the next decade and beyond. This paper forms one part of broader work covering household surveys and administrative data as well as the Census of Population and Dwellings.

The paper describes the information needs dependent on the census and outlines the main features of international approaches to census. Government has expressed interest in changing the census frequency from the current 5-yearly interval to 10-yearly, as an option for reducing costs. This interest drives an emphasis on census frequency in the paper, and on the consequences of various frequency options.

Different approaches to census-taking involve trade-offs between overall quality of census information, the complexity and timeframes required for change, and long-term across-government costs. The discussion at this stage is indicative only and serves as a guide to determine the most likely directions for further work. A formal cost-benefit analysis is beyond the immediate scope of this paper, but would be a necessary next step to any formal proposal to Government.

Why census is important

The census is part of an integrated national statistical system, which also includes sample surveys, registers, and administrative data. Census information gives a detailed picture of the population and dwellings in a country, and provides information at high levels of accuracy about the characteristics of small populations. Understanding the size and characteristics of the population and how these factors change over time is fundamental to the efficient functioning of a modern democracy and economy. The United Nations' *Principles and Recommendations for Population and Housing Censuses* sum up the importance of censuses like this:

> The most important capital a society can have is human capital. Assessing the quantity and quality of this capital at small area, regional and national levels is an essential component of modern government.
>
> Aside from the answer to the question "How many are we?" there is also a need to provide an answer to "Who are we?" in terms of age, sex, education, occupation, economic activity and other crucial characteristics, as well as to "Where do we live?" in terms of housing, access to water, availability of essential facilities, and access to the Internet. The answers to these questions provide a numerical profile of a nation which is the sine qua non of evidence-based decision-making at all levels (United Nations, 2008).

Almost every country runs a census. The United Nations (2010) reports that 229 countries or areas have scheduled or already conducted at least one census in the 2010 census round (the decade 2005–14). Only five countries will not hold a census during this time. Census is important, but is also expensive and complex. Internationally, a variety of approaches are taken by different countries and census-taking continues to evolve and adapt to new circumstances, driven by cost and quality issues as well as changes in technology (UNECE, 2009).

Census frequency

Frequency, or periodicity, is one of the defining characteristics of a census.

The United Nations (2008) recommends:

> …that a national census be taken at least every 10 years. Some countries may find it necessary to carry out censuses more frequently because of the rapidity of major changes in their population and/or its housing circumstances.

The question of census frequency is usually interpreted as 'how often is a census run?' While this definition still holds in New Zealand and most other countries, new approaches mean that the question of census frequency is more appropriately asked as 'how often is census information updated?'. The most common census frequencies are 5-yearly and 10-yearly. A census may also be held at irregular intervals. In some new models, census information is updated every year.

Census data are of greater value if they can be compared internationally. The United Nations recommends conducting censuses in years ending in zero or as close to these years as possible. The years 2010 and 2011 are in fact the peak years for census-taking in this 2010 round (see the figure in appendix 1).

The first New Zealand census was held in 1851. The interval was set at three years until the Census Act 1877 required censuses to be held every fifth year. Since 1881, censuses have been held every five years, apart from 1931 during the Depression and 1941 due to the World War II (Statistics NZ, 2006). The five-year interval was continued in the Statistics Act 1975. The recent decision not to hold the 2011 Census due to the major earthquake in Christchurch is only the third interruption to this long series.

The major driving factor behind the five-year census interval is the high rate of external and internal migration in New Zealand (chapter 3), resulting in rapid population change. The five-yearly census is now well embedded in legislation and government systems within New Zealand, including major uses such as the setting of electoral boundaries, decile ratings for schools, population-based health and transport funding formulae.

Changing the census model

The New Zealand census is successful in terms of the public support it receives, the good data quality, and the high benefit derived from the very wide range of areas in which census data is used. The problem is cost. Although the cost of New Zealand's census compares well internationally (see table 4 in appendix 2), it requires the outlay of significant sums of public money over a census project lifecycle.

As we look to census-taking in the future, change to the current census model needs to demonstrate that future information requirements will be met, and that efficiency across the government sector is improved. Any new approaches to census in New Zealand must seek to balance cost and quality trade-offs, given the particular opportunities and constraints in New Zealand. Because census is a large operation and the costs of failure are high, any planned change to current methodologies requires sufficient time and money for development, testing, and evaluation.

Outline of paper

The remainder of the paper is organised as follows. Chapter 2 describes the information needs uniquely dependent on the census. Chapter 3 briefly outlines a variety of approaches to census-taking internationally from a frequency perspective. Chapters 4 to 6 analyse the impact of census frequency on the uses of population statistics and information about small groups, and on the wider statistical system. Next, in chapter 7, we introduce quality dimensions and discuss three aspects of quality (frequency, accuracy, and relevance) for six potential census models. Chapter 8 presents quality and cost trade-offs for these models. The paper finishes with a summary and discussion giving recommended areas for further investigation.

2 Information needs dependent on the census

This chapter describes the type of information collected by the census, and how the census interacts with sample surveys and administrative data. Uses of census data are briefly outlined before considering the prioritisation of census information and how this is affected by different census models.

The New Zealand Census of Population and Dwellings is a snapshot of the whole New Zealand population at a given point in time, and underpins the validity of a wide range of other data sources. However a census is undertaken, census information can be broadly characterised into two groups.

- **Counts of dwellings and people, and of households and families, down to small geographic areas**. These census counts form the basis for official population statistics, which are updated between censuses and used for projections of future populations.
- **Socio-economic information for the whole population**. The census provides a range of socio-economic characteristics, at high levels of accuracy for small subpopulations and for small geographic areas.

The census is part of an integrated national statistical system, which also includes surveys, registers, and administrative data. The census provides a solid framework for developing sampling frames for surveys, and is integral to the effective use of a range of administrative data. Together, these data sources meet the enduring information needs for social and population statistics. Information needs cover four broad areas (Brown, 2010). The census plays an important role in each of these.

- **Population statistics** describe the **reference population** and are fundamental to all other social statistics, and for per capita calculations for many economic applications. They include projections of population size and structure into the future.

  The census is critical for producing population statistics. In between censuses, population change is estimated using administrative sources for births, deaths, and migration. Errors accumulate over time, particularly at subnational levels, and the population base is re-established using the census.

- **Monitoring social outcomes and overall well-being** measure **what** is happening, across social domains and in an overall sense.

  The census monitors core social outcomes across a range of domains, and provides this information to fine levels at high accuracy.

- **Distributions and inequalities** describe **who** is affected; they show how an outcome is spread across the population, and measure the gaps between different groups.

  The census has a particular strength in providing essential distributional information to fine levels at high accuracy for both geographical areas and population subgroups.

- **Understanding causal relationships** is analysis that goes beyond the descriptive, and attempts to answer the question – **why** do we see this outcome?

  The census improves understanding of causal relationships when census data is integrated with other data such as the Deaths Register.

Examples in New Zealand where census is the only reliable source of information include:

- the basis for ongoing population estimates and population projections, including internal migration patterns
- comprehensive information on dwellings and the housing stock in New Zealand
- the number, type, and distribution of households and families
- comprehensive information about sub-population groups; for example Māori and iwi, Pacific, Asian and other smaller ethnic groups, older New Zealanders, external migrants, single parent and other household and family types, occupation groups, crowded households
- comprehensive information about subnational areas; examples include electoral boundaries, territorial authorities, district health boards (DHBs), and local communities
- detailed and very local information derived from census variables at meshblock level,[1] for example school deciles, transport patterns, relative disadvantage (NZ deprivation index)
- information to a very detailed level on some variables, for example occupation, country of birth, language spoken.

Census and sample surveys

Sample surveys cannot provide this kind of detailed and cross-referenced information below national levels. This is especially true in New Zealand, where sample surveys are relatively small compared with larger countries. Sample surveys do provide national level estimates for many census variables, with more depth than census, and at a level of accuracy that monitors change at a national level. While sample surveys can produce information for large regions or broad subgroups, accuracy rapidly diminishes as the subgroup size decreases.

However, sample surveys rely on the census in several ways.

- The census provides population counts and distributional information used as the basis of the areal Household Sampling Frame.
- Sample surveys use population estimates (based on the census) to improve the accuracy of survey results.
- The census can sometimes be used as auxiliary information to increase the level of detail available from sample surveys.
- The census is used as a frame for surveys targeted at specific sub-populations, for example Māori, or people with a disability.

Census and administrative data

Administrative data depends on census and population estimates for the relevant reference population. For example, births data is used with the number of women of childbearing age to calculate fertility rates. Similarly, population estimates serve as denominators for rates of health measures (such as cancer and heart disease rates), for education participation, for rates of crime, and many other applications. Treasury use population projections in the TaxWell fiscal model. Population breakdowns by age, by sex, by ethnicity, and by geographical area are all used in deriving these various rates.

[1] Meshblocks are the smallest administrative areas used by Statistics NZ, with a median of about 87 persons in 2006.

Uses of census information

The uses and users of census information are extremely widespread. The electoral system depends on census data to determine the number of seats and for setting electoral boundaries. Allocation of large amounts of government funding through health, education, social welfare, housing, and transport portfolios, and by local government is based on census information.

Census information is also used to inform and evaluate policy and for future planning, particularly where small areas or small population subgroups are concerned. Businesses, industry organisations, real estate markets, local community groups, iwi, non-government organisations, and many others depend on the census to provide accurate information about local areas and their own interest groups.

Prioritising census information

Assessment of alternative census models needs to consider both the priorities of the topics to be covered by a census and the level of detail required. Alternative census models will require greater attention to prioritisation of the variables which are considered essential to a 'census'. Models that involve sampling also need to assess accuracy versus cost for small areas and small subgroups.

Not all census information is of equal value. The provision of accurate and detailed population statistics is the single most important reason for holding a census, given their critical use in so many areas. The United Nations states:

> The main objective of a population census is to provide a reliable basis for an accurate count of the population of a country at a point in time. An accurate population count is essential for the efficient planning and delivery of services, distribution of resources, defining of boundaries for electoral representation and policy development (United Nations, 2008, paragraph 2.17).

The census Māori descent population is also critical because of the central role it plays in the New Zealand electoral system.

Māori as tangata whenua (the indigenous population) have a unique relationship with government which is set out in the Treaty of Waitangi. Statistics NZ recognises Māori as tangata whenua through the provision of relevant high quality information for Māori, including information being available at iwi and hapū level. The Pacific population groups within New Zealand are also a significant factor in population-related policy.

Geography is a crucial element because much of central and local government policy and service delivery is absolutely concerned with the nature of places (Martin, 2006). The greatest variability between areas occurs not at regional or territorial authority level, but at the local community level – city suburbs, small towns, and rural communities. The standard 'area unit' geography approximates local communities, and has an average population size of just over 2,000 people, well beyond the capacity of existing sample surveys.

The socio-economic variables that characterise small groups are not all equally important. Recognising this, the census operation implements a three-tiered system of quality management to ensure that the highest priority variables are produced to the highest quality.[2]

[2] The top two quality levels include the most essential census outputs. While variables at the third level are titled 'supplementary' variables, they are very important for certain purposes. The variables meet minimum quality standards to ensure output data is fit for use.

Priorities and alternative approaches to census

Because the population count and information about small subgroups of the population is the *raison d'être* of a census, approaches to census create a list of the dwellings and individuals in the population and obtain certain characteristics about those dwellings and individuals. In the current New Zealand approach, the majority of the census budget is spent in enumerating the entire population in order to accurately count people and dwellings. Once these highest priority questions have been included in a census questionnaire, additional questions can be added at relatively small marginal cost.

Extensive multivariate analysis of census data output is possible because all variables derived from census questions are available for each individual and household. Because population statistics are based on geography, these socio-economic characteristics can also be provided at whatever geographic level is required, subject only to confidentiality constraints. These variables on the characteristics of the population together tell the story about local communities throughout New Zealand and provide a rich data source for researching and analysing the social structure of New Zealand. They represent high value at low cost and cannot be obtained for small areas in any other way apart from a census.

The marginal cost of collecting particular census variables, over and above the core population and household counts, can change. For example, if Internet forms substantially replace paper forms, processing costs would be reduced. If the population list is compiled from administrative sources, then the variables available from administrative data would be low cost, while other variables could become comparatively high cost.

Similarly, the marginal cost of collecting small area information and information about small population subgroups can change with different approaches to census. For example, if a large sample survey is used for information about small groups, then the trade-off between cost and accuracy will need to be considered explicitly.

3 International approaches and census frequency

This chapter introduces different approaches to census-taking seen internationally, and presents them from a frequency perspective.

The United Nations (2008) describes the main features of a census as:

- individual enumeration
- universal coverage of the population
- conducted at a single point in time
- defined periodicity.

Many different approaches to census-taking can be seen internationally and are still considered a 'census' according to United Nations standards. Only brief outlines are provided here. Several sources provide in depth commentary and comparison of different approaches, for example UNECE 2007 and 2009, and United Nations 2011.

A useful characterisation for this paper is to group census models into three broad categories:

- periodic full-enumeration census
- continuous measurement census
- administrative census.

These categories differ principally through their frequency and source of data. The traditional approach is a periodic census that enumerates everyone at the same time. The frequency is every five years or longer. A periodic census is survey-based, that is, every person is asked to complete a questionnaire. A continuous measurement approach is also survey-based, but the survey is conducted every year, not at wide intervals. In an administrative or register-based census, information is obtained (for the most part) from registers and other administrative data, not directly from respondents. Again, information may be updated annually, not just at longer intervals in designated census years. Any of these approaches may include a degree of sampling as part of the census.

In practice, a combination may be the best solution for a given situation. In Chapter 7, we will come back to a discussion of six distinct census models across these categories, considering their quality and cost. First, given government's expressed interest in a 10-year census interval, we will look at frequency options for a periodic, full-enumeration census. We then describe newer census models that can produce updated census information every year.

Frequency and a full-enumeration census

Non-standard frequencies

Intervals other than regular annual or 5- or 10-yearly censuses are unlikely to provide real alternatives for future New Zealand censuses.[3]

In some ways, a three-year interval between censuses might be seen as a good idea in New Zealand. A three-year interval could mesh with the updating of electoral sets for the three-yearly election cycle as well as the three-yearly reporting requirements for local government. However, a full-enumeration census every three years would be likely to cost more than at present, and impose a higher respondent burden.

[3] Apart from exceptional circumstances such as the Christchurch earthquake.

A key disadvantage of a seven- or eight-year cycle is the loss of alignment with the international United Nations guidance of conducting censuses as close as possible to years ending in zero. International alignment is important so that New Zealand can produce comparable data for international tabulations. Having a census in the same year as other countries benefits cross-country comparisons. It is particularly important for comparisons with our major trading partners and for understanding international migration flows. Alignment with the Australian census is a key consideration.

New Zealand also benefits from developing census within similar timeframes to other countries. Close working ties have been established with Australia and Canada in particular. Joint development of the Internet census is a recent example of the close synergies between these three countries.

Irregular or uncertain intervals between censuses are clearly poor options. The United Nations states that censuses should have a defined periodicity. Stability and certainty are important for all parties concerned in the census. Users of census data build their own processes around known release dates. The large amount of funding involved and the long lead time for planning and census development, mean that census dates need to be fixed well in advance for both funding bodies and agencies conducting the census. Legislated periodicity, as occurs in New Zealand, is the most effective means of achieving this.

No census of any sort is an option, but is usually seen only in nations in crisis such as a civil war or breakdown of government. The United Nations reports that only five countries or areas will not conduct any census during the decade 2004–15.[4] This compares with the 2000 census round, which "was characterized by challenges in its implementation. As a result, 26 countries or areas did not carry out a census during that period. Censuses were not conducted for a variety of reasons, including political instability, lack of funding and inadequate planning and management of the census operation" (United Nations, 2011).

Five-yearly interval

New Zealand has held a census every five years for over a century. A key reason for the five-yearly census has been the high rate of change in the population, both through external migration and movements between areas within New Zealand. Large movements of people can result in a rapidly changing population and society, and consequently a need to monitor those changes more frequently than for a stable population.

High population flow is very much a part of the story of New Zealand. Flows of migrants into and out of New Zealand are among the highest in the world. The 2006 Census reports that 23 percent of people usually living in New Zealand were born overseas.[5] New Zealand has the fourth highest level of foreign-born population in the OECD, behind Luxembourg, Australia, and Switzerland. New Zealand is second only to Ireland in the percentage of the population born in New Zealand that is living in another OECD member country (Dumont and Lemaître, 2005).

Levels of internal migration are also high, with around half the population moving address in the five years between the 2001 and 2006 Censuses (see table 5 in appendix 3).

Australia, Canada, and the Republic of Ireland, all countries with high levels of external migration, also conduct a five-yearly census.

---

[4] At 20 October 2011, United Nations lists Iraq, Lebanon, Somalia, Uzbekistan, and Western Sahara as having no census scheduled in the 2010 round.

[5] In 2006, 22.9 percent of people usually living in New Zealand (or 880,000 people) were born overseas, compared with 19.5 percent in 2001 and 17.5 percent in 1996 (Statistics NZ, 2007b).

Other countries conducting two censuses during the 2010 census round include Japan, Korea, Mexico, Iran, and several Pacific Island nations.

Ten-yearly interval

Many countries conduct a census every 10 years. With this frequency, new census information is available less often, and is 11 or more years out of date by the time the next census is available. In comparison, a five-yearly census has a lag of about six years. As a consequence, estimates of the population between censuses using administrative data must be sustained over the longer time interval, and information about the characteristics of small populations becomes increasingly out of date.

Hong Kong uses an intermediate approach. Hong Kong runs a full census every 10 years, and a Population By-census in the intervening five years. The By-census is a large sample survey (a 10 percent sample) on a broad range of socio-economic characteristics of the population.

The United Kingdom (UK) has run a 10-yearly census for 200 years, and is undertaking a complete review of possible approaches to census-taking beyond the 2011 Census. Obtaining good information on UK migration is difficult. The 10-year time lag between censuses means there is a high degree of uncertainty in subnational population statistics and difficulty monitoring socio-economic change at local levels. The “Beyond 2011” project describes the need for change:

> The dynamic nature of population change, advances in information technology, cost constraints and demand for more frequent and more detailed statistics are driving changes in methods for the provision of population and socio-demographic data in the UK (Office for National Statistics, 2011).

Continuously updating census information through surveys

Conducting a census every five or 10 years or at other intervals is, however, only one type of consideration of a potential change to frequency. Variations found internationally include some countries using surveys to provide census-type information more often.

The United States and France have changed their census model specifically to address the problems associated with the long time-intervals between their censuses.

The United States now runs an annual large-scale sample survey as part of its 10-yearly census, and Switzerland runs a similar large sample alongside a Population Register. France conducts a ‘rolling census’ every year. These are examples of a ‘continuous measurement’ approach to providing census information.

United States

The United States census is held every 10 years. In the past, a short form was completed by everyone, and a more detailed long-form answered by a 10 percent sample. From 2010, the 10-yearly US Census is now a short form only – ‘10 questions’ – focused solely on producing accurate population counts.

The long-form sample has been replaced by the American Community Survey, a large annual sample of around 3 million households (US Census Bureau, 2008a). The survey provides detailed demographic, social, economic, and housing characteristics (as in the long form), but is updated annually. Because of the smaller sample size compared with the census, information for small areas is aggregated over three or five years and released as moving averages.

While not a cost-saving measure, the annual sample has the advantages of producing more up-to-date information, and smoothing out costs and workload. Estimates from the annual sample have proved to be somewhat less accurate than that collected through the previous census 10 percent sample. However, the more timely information is still preferred.

France

In France, a 'rolling census' has been implemented (INSEE, 2006). In small municipalities, a full census is conducted in one-fifth of the areas every year, covering all small municipalities over five years. In large municipalities, an 8 percent sample is conducted every year. Information is released every year as moving averages. The method is unique to France, and was introduced to improve the frequency of data releases and to even out the financial costs and workload of a census. The emphasis on the need for more frequent information was strong:

> The need for fresh data was being voiced ever more explicitly by INSEE's clients. With general censuses getting ever further apart – nine years between the last two – it was becoming increasingly difficult to keep track of changes in France's population, whether shifts in society and the family, trends in peri-urban settlement, or urban developments (INSEE, 2006, para 21).

As in the United States, the sample designs are complex, and the concept of moving averages may be difficult to explain to public officials and to the general public.

Continuously updating census information using registers

Many countries, especially in Europe, are looking to avoid the costs of a full-enumeration census by obtaining census information from registers and administrative sources.[6] One of the advantages of censuses based on registers is the ability to produce census information more frequently. Censuses based on population registers can produce results every year.

Nordic and other countries have established censuses based on population registers and other linked administrative data.[7] The Netherlands' 'virtual census' relies on sample surveys to supplement information not available from their population register or other linked administrative data.

The 2010 Census in Switzerland is a combination of register-based and sample surveys. Existing person data registers are integrated with a suite of sample surveys, which are carried out and evaluated in an annual cycle (Swiss Federal Statistical Office, 2008). Benefits cited are: increased frequency, more timely information on a wider range of topics, and an "excellent cost/benefit ratio".

> The availability of the latest data on an annual basis will improve the ability to monitor important, politically relevant, socio-cultural topics on a regular and systematic basis (Swiss Federal Statistical Office, 2008).

---

[6] The United Nations 2009 survey results list the costs of censuses reported for the 2010 round in table 4. "The cost of the census is cheaper for those countries that rely on administrative registers. The costs shown in the table are only the direct costs associated with the population census and do not take into account the cost of creating and maintaining registers which are of course also used for other purposes" (UNECE, 2009).

[7] Globally, a register-based census is the main source of census data in 15 countries or areas: two in Asia (Bahrain, Singapore), 12 in Europe (Austria, Belgium, Denmark, Finland, Germany, Iceland, Netherlands, Norway, Slovenia, Spain, Sweden, Switzerland) and one in Northern America (Greenland) (United Nations, 2011).

4 Implications of census frequency on population statistics

Having seen how census frequency can vary from annual, to 5-yearly, to 10-yearly (or longer) depending on the approach, this chapter examines the impact of census frequency on population statistics. In particular, moving from a 5-year to a 10-year interval has implications for the electoral system and the likely accuracy of population statistics. A selection of examples illustrates the impact of deteriorating population estimates and projections. Key dependencies for any shift to a 10-yearly census interval emerge from this discussion.

The single most critical use of census data is as the basis of population statistics. **Census counts** are often used directly, including in the electoral system. **Population estimates** are derived each year in between censuses, and **population projections** signal the future.

In New Zealand, a point-in-time census provides a base for highly accurate population statistics in the census year. From this census base, administrative sources are used to calculate national-level population figures every quarter and detailed subnational estimates annually. These intercensal population estimates decline in accuracy over time. The national level population is now maintained over a five-year period with relatively good accuracy because births, deaths, and external migration data directly measure population change between censuses. Subnational populations are both more critical and more difficult to estimate since New Zealand has high mobility but no accurate measures of movements within New Zealand.

Ideally, population statistics would be updated annually with high accuracy. Perhaps the only means of achieving this ideal would be through a universal and accurate population register system that includes timely, updated address information. A rolling census produces accurate updates for parts of the country every year, but never provides the same level of accuracy for the whole country at the same time. A continuous measurement sample survey would not normally produce population statistics, but instead relies on independent population data to improve the sample estimates.

A 10-year interval between censuses has to sustain intercensal population estimates and projections for twice as long as a 5 year interval, and also affects the electoral system.

Impact on the electoral system

The Electoral Act 1993 requires the number of Māori and general electoral districts to be recalculated after each census, and boundaries to be revised so that each electorate represents a fair proportion of the population. With a five-yearly census, and three-yearly electoral cycle, electorates remain in place for one or two elections. With a 10-yearly census, there would be no changes to electorates for three or four elections. This could affect the introduction of additional Māori or general districts, or could result in some electorates having a larger or smaller share of the population, outside the tolerances set by legislation.

The number of Māori and general electoral districts is calculated directly from census data and Māori electoral registrations, as specified in the Electoral Act 1993. Census data on the Māori descent population and the total population are used in the calculation of the number of electoral districts and to set the population quota for each electorate. Census counts and projections of future electoral populations are considered when assessing potential new electoral district boundaries. All districts are required to be within 5 percent of the set quota.

Following the 2001 Census, 62 general electoral districts were created. When reviewed after the 2006 Census, 30 of the 62 districts were found to be outside the 5 percent tolerance level of the new quota, and one new general electoral district was added. Of the seven Māori electoral districts defined after the 2001 Census, three were outside the quota tolerance after the 2006 Census. With a 10-year census, these discrepancies would have remained in place for the 2008 and 2011 elections, and would possibly have become more extensive across other electoral districts.

Impact on accuracy of population estimates and projections

National population estimates

National intercensal population estimates are generally close to the new population figures based on the new census after a five-year interval.

Some deterioration in accuracy is likely with a 10-year interval. For example, the relative error in national population estimates after a five-year period was 0.4 percent in 2001 (carrying forward 1996-base population estimates) and 1.1 percent in 2006 (carrying forward 2001-base population estimates).

By comparison, if the 1996-base population estimates had been continued to 2006 (without incorporating the 2001 Census results), the relative error of the New Zealand population estimate would have increased to 1.4 percent after 10 years. For many purposes, this level of national error is relatively minor, except when it influences large funding allocations that run to billions of dollars (such as those for health and welfare).

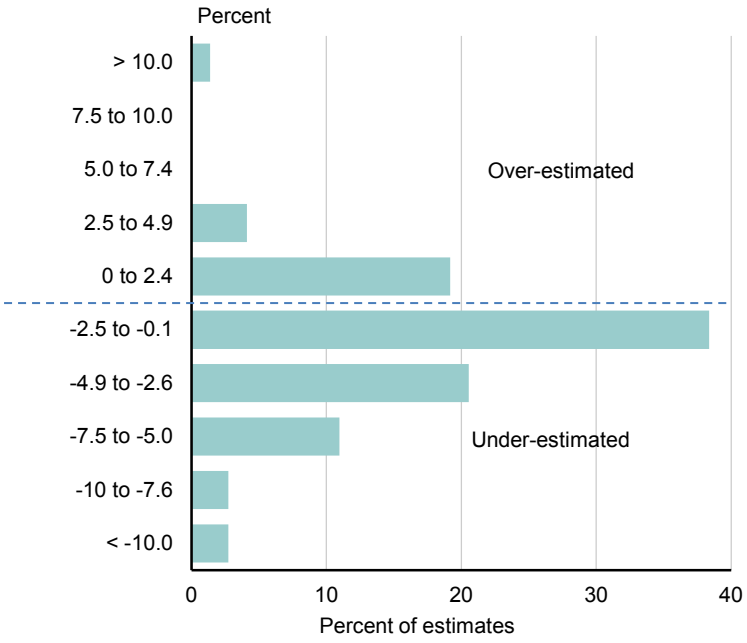
Subnational population estimates

National level error also creates an incorrect national constraint for subnational population estimates.

Population figures for subnational areas are much more difficult to estimate because there are no direct measures of internal migration (ie there are no data sources that accurately capture all the people who change their address within New Zealand). With existing methodology, subnational population estimates are seen to be just adequate at the end of the five-year period. Estimates published in 2006, based on the 2001 census, were mostly within 5 percent of the true value for population size of territorial authority areas (figure 1). However, there were substantial errors in some areas and for some age groups such as young adults, where migration rates are high.

Figure 1

Relative error of population estimates for territorial authority areas, with a 5-yearly census
2001-base estimates in 2006



Source: Statistics New Zealand

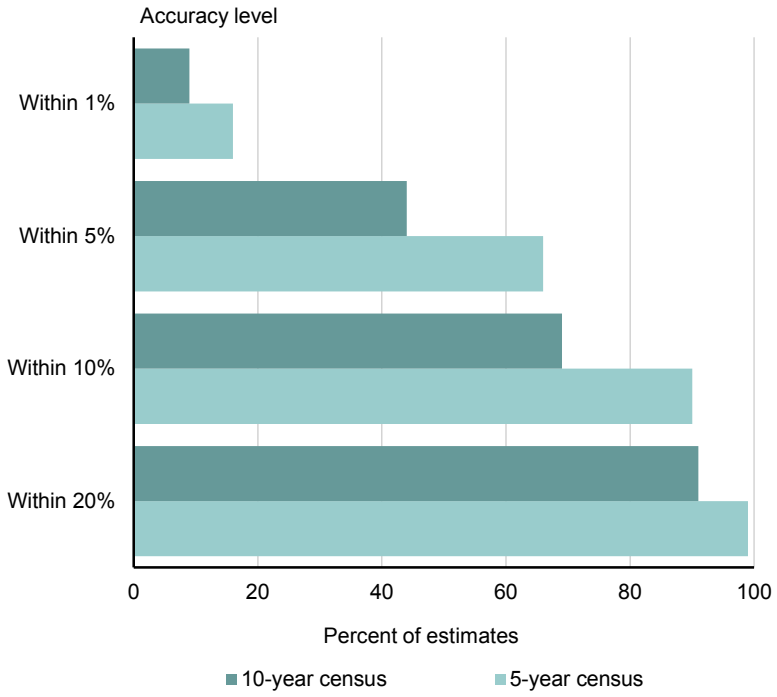
At present, the five-yearly census makes it possible to correct estimation errors on a five-yearly basis. With a less regular census, any potential adverse consequences of erroneous population estimates (eg on policy and planning, funding allocation, or research) would have a greater impact. In addition, while a less regular census would increase the need for accurate population estimates, there would also be less opportunity to assess and improve estimation methods.

Recent modelling work (Bryant & Graham, 2010) has estimated the impact of a 10-year interval on subnational population estimates between censuses. Two hypothetical models were created to estimate the 2006 population. One model simulated a 10-yearly census interval using the 1996 Census as a base and the second mimicked the 5-year census interval based on the 2001 Census.

Model results were compared with the actual 2006 Estimated Resident Population (ERP) figures by age group and territorial authority (eg 15- to 19-year olds in Whakatane). Results showed that the 10-year census interval has an appreciable effect on the quality of subnational population estimates, even though the estimates continue to capture the main contours of population change (see figure 2). For example, under a 5-yearly census scenario, 66 percent of estimates would have fallen within 5 percent of their target. Under the 10-yearly census, the equivalent figure would have been 44 percent. Similarly, 90 percent of estimates would have been within 10 percent of their target under the 5-yearly census, but only 69 percent under the 10-yearly census scenario.

Figure 2

Effect of 5-yearly and 10-yearly census intervals on relative error of population estimates, territorial authority areas by 5-year age group



Source: Statistics New Zealand

In New Zealand, high demands are placed on the accuracy of subnational population estimates disaggregated by age groups and by ethnicity because many key policy decisions target these sub-populations. Errors of 5 percent may be generally tolerable, but errors of 10 percent or more have significant impact on many users. The consequences of the kind of errors that might be likely over a 10-year period could be severe, and come with a significant cost.

Population projections

Population projections underpin virtually all planning for the future. Examples where projections are used include: health care needs; school and tertiary education rolls; forecasting benefit expenditure; work force profiles and skills requirements; pathways for ageing among regions and communities; differential age profiles for ethnic groups; local planning for transport and housing; and future tax income models.

Errors for population projections also increase if the population base is updated every 10 years rather than every five years. For example, the absolute relative error for the mid-range 1996-base projections for New Zealand (released 1997) increased from 1.0 percent after five years to 3.1 percent after 10 years (Statistics NZ, 2008). Errors are higher for age groups and subnational projections. For example, the mean absolute relative error for the mid-range 1996-base projections for the 73 territorial authority areas (released 1997) increased from 3.0 percent after five years to 5.6 percent after 10 years. Where large budgets are involved, even small projection errors may have a major impact.

With a 10-yearly census, it is likely that current major users of census data (such as the Ministry of Health, Ministry of Education, Ministry of Social Development, and local government) would have much less confidence in the ability of official population statistics to support population-based funding allocations. These allocations are presently about $150 billion dollars over five years. Fair-funding allocation would become increasingly uncertain for district health boards, schools, local authorities, and others. Adjustments to funding at the end of the 10-year period could be large and have potentially significant impact on budget planning and allocation. See specific examples of the impact of deteriorating population statistics in the shaded boxes at the end of this chapter.

Dependencies for a 10-yearly census interval

The census plays a key role in the electoral system by providing independent and trusted population data, and this underpins representative democracy in New Zealand. Any change to a 10-yearly census interval (or to any other census model) would have to first ensure that the consequences for the electoral system are resolved. Interrelated work includes the referendum on the voting system to be held with the General Election in November 2011, and a Constitutional Review, which is due to report back to Responsible Ministers by September 2013 with advice on constitutional topics.

Another key dependency for any shift to a 10-yearly census would be improved methodology for producing intercensal population estimates and projections at detailed subnational levels. These estimates and projections remain a very significant ‘end-use’ of census data and should be central to any discussion about changing census frequency.

Work is continuing on developing new Bayesian models (Bryant & Graham, 2011) that will incorporate a wider range of administrative data sources for determining population estimates. If successful, these models can be expected to improve on the results obtained above for subnational population estimates and will offer benefits over current methods for the five-year census interval. It remains uncertain whether they would be sufficiently accurate over a 10-year period at the level of detail required.

Improvements in the ability to capture change of address through administrative systems would also provide a better basis for estimating population change between censuses. It would also be a strong requirement in the long-term if New Zealand was ever to move to a solely administrative census.

Examples of the impact of less accurate population statistics

Population estimates for local authority areas

Every five years, the Census of Population and Dwellings enables Statistics NZ to derive a new estimated resident base population and revise previously released population estimates.

For some territorial authority areas, large estimation errors have been identified and corrected in this revision process. For example, following both the 2001 and 2006 Censuses, it was found that the resident population of Manukau City had been substantially under-estimated, by 4,900 and 7,600 respectively. As a second example, between 2001 and 2006 it was estimated that the Central Otago district's population was growing at a rate well below the national average. The 2006 Census showed that this population had, in fact, grown at a considerably faster rate. The district's 2006 estimated resident population was revised upwards by 11 percent (or about 1,800 people).

Estimation uncertainties, and estimation errors, increase when sub-national population estimates are produced for smaller geographies (eg area units), or are disaggregated by age group and sex. For sub-national population estimates disaggregated by age group, estimation errors are greatest for the 20–24- and 25–29-year age groups. These population subgroups are highly mobile and thus particularly challenging to produce population estimates for. However, they are also subgroups of particular interest to many data users, including service industries, recruitment agencies, and organisations with an interest in understanding sub-national differentials in health, employment, crime, or electoral enrolment.

Ministry of Social Development forecast benefit expenditure and policy costing

Small percentage errors in estimates of eligible populations can have a large impact on government finances in the Ministry of Social Development (MSD) environment. Extending the interval between censuses beyond five years would be likely to have a progressive impact on the accuracy of MSD’s forecasts of benefit expenditure and its costing of policy proposals.

Different payment rates apply for different age groups, family configurations, income levels and, in the case of accommodation assistance, areas of residence. Both forecasts and policy costing work rely on robust sub-national population numbers and population estimates. There is no sample-based source of New Zealand data that would substitute for the census at this level of disaggregation.

Expenditure on many social assistance programmes is not capped in the budget process – any applicants meeting entitlement criteria must be assisted. Even errors of 1 to 2 percent in the estimation of eligible populations can have budget impacts that are significant relative to the cost of a five-year census.

Monitoring demographic, social, and cultural change

Turbulence in population structures and dynamics requires careful monitoring. One area that seems to be critical is the change in regional dynamics and structures, not just demographic but also social, economic, and cultural. Only a census will allow us to analyse this change and formulate the key public policy measures to respond to them. It is even more urgent for our smaller geographic areas, especially the poorer and more isolated, where small population sizes make anything but census data analysis unreliable.

Examples of the impact of less accurate population statistics

Ministry of Health district health board population-based funding allocation

The population-based funding formula (PBFF) is the mechanism used to allocate the majority of vote health funding to district health boards. As the PBFF allocates funds based on a weighted population average, it is extremely important that population projections are accurate if funds are to be allocated optimally.

With annual funding of $9 billion (in 2008/09) allocated based on the PBFF, the Ministry of Health has considered a 1 percent error in total population to be a reasonable error rate. Under a 10-yearly census, errors in total population provided to the ministry are likely to be closer to 2 percent, which would erode confidence in the projections.

Errors are distributed unevenly across DHBs. The errors observed in 2006, five years after the 2001 Census, had the most impact on DHBs in areas that were growing at a faster rate than predicted, for example Counties Manukau. If these areas continued to grow over a 10-year period without correction, the cumulative shortfall in funding could be very significant.

The impacts of these variances on the funding of healthcare are complex and varied. Impacts include questions about equity of access to health services, as well as efficiency. Funding allocation out of balance with actual population erodes the monetary value of health funding, both in areas with positive errors and those with negative errors. Funding shortfalls also create the potential for reduced services and the possibility that capital investments would not be approved.

Transport planning

The Ministry of Transport and regional and local councils use census data extensively. Population, employment, and travel and transport data are particularly important.

Each year, central and local government spend over $3 billion maintaining and improving transport networks in response to community requests. Population and dwellings data are used to estimate transport demand.

Performance of land transport programmes is monitored on a three-yearly cycle. Information supporting transport decision-makers needs to also be on a similar cycle. A 10-yearly census is too long for any trend interpolation, and would need to be supplemented with sample surveys.

Local government reporting on community outcomes

Long-term council plans are also monitored on a three-yearly cycle. Under the Local Government Act 2002 local authorities are required to report every three years on community outcomes related to social, economic, environmental, and cultural well-being. Councils rely heavily on census data, which needs to be on a similar cycle. A 10-year census would mean that councils are likely to require extensive sample surveys to support their reporting obligations.

Projections and population policies

The purpose of projections is to inform government and the public of population changes they can expect in the future. Users include political parties wanting to promote policy that caters for the impact of such population change. A 10-year census would greatly reduce our ability to monitor the change and revise projections. This could result in ineffective policies, or worse still, policies having unforeseen consequences remaining in place for much longer.

Recent examples of population projections informing policy interventions include regional development programmes. Projections indicating a dramatic slowing of regional growth in coming decades will likely increase attempts to manipulate regional growth. We anticipate that in a low-growth environment, interest in, and challenges to, sub-national estimates and projections will increase.

5 Implications of census frequency on characteristics of small populations

This chapter examines the implications of census frequency on our ability to monitor changes in smaller population groups. Discussion focuses on the impact of changing census frequency from 5- to 10- yearly, and gives a selection of examples as illustration. Any change away from a 5-yearly census will require a reassessment of priorities.

Generally the demand is for more frequent information, not less. This is seen internationally in the new approaches to census. The need for more timely data is a primary driver for continuous measurement approaches, and is a valued benefit for administratively-based censuses.

Longer time intervals between censuses means that available information becomes increasingly ineffective at monitoring change in sub-populations and local areas. Census variables feed into the planning, monitoring, and evaluation of government policy programmes and services. As the diversity of society and the pace of change continue to increase, so too do the questions about what the future might hold. Formulating appropriate policy responses in an increasingly complex and changing world becomes more difficult. To counter this, more effective monitoring of change is needed.

While national sample surveys can monitor outcomes and change at national levels, this national picture does not represent the inherent diversity present at local levels. Only the census is able to provide data to monitor change for subnational geographies and smaller sub-population groups.

Moving from a 5-yearly to a 10-yearly census would mean that for the latter period, census data would be more out of date, and changes occurring at local areas and for sub-populations would not be monitored. Local government would have difficulty meeting government's requirement for three-yearly reporting of community outcomes.

Information on the impact of the 2008 financial crisis and subsequent global recession illustrate this issue. It is possible that some effect of the financial crisis and global recession will be reflected at a detailed level in the 2013 Census. With a five-yearly or more frequent census interval, this sort of information would be available for government policy and local interventions within a relatively short timeframe. Information is likely to be less relevant if it is available only after a 10-year census interval.

The Christchurch earthquakes of 2010 and 2011 are another example of a sudden shock that can occur to society and the economy. A census relatively close to the event will provide accurate, detailed data down to local suburbs. A census 8–10 years in the future would be much less relevant to the recovery process, which will be underway over the next few years.

Smaller sub-populations, like Māori, can be more vulnerable to external changes, such as economic developments and policy interventions, and their outcomes are likely to show more significant changes over time. Sub-populations can also be undergoing different demographic change to the total population trends. For example, Māori, as a relatively youthful population, will become an increasing percentage of the future workforce, so there is a need to understand their characteristics (eg education levels and workforce readiness) and how that could affect the future workforce.

See the shaded box at the end of this chapter for more examples of the impact of changing census frequency for small population groups.

Dependencies for a 10-yearly census interval

A 10-yearly census cycle runs the risk of being too infrequent to be able to successfully monitor the outcomes for local areas and subgroups that are of high policy interest, and so weakens the evidence base for policy making.

A 10-yearly census would require a much improved ability to support information between censuses about local areas and smaller populations. These populations include high interest information groups such as Māori and iwi, Pacific and other ethnicities, dwellings and housing conditions, households and families, migrants, children, youth, and the elderly.

A continuous measurement survey approach is one way to overcome this type of problem. One option might be to consider a 10-year census coupled with a very large sample survey carried out during intervening years, as in the United States census model. Depending on the sample size needed, a rolling census might in fact be a more cost-effective approach.

Census models that include a large continuous measurement survey can provide more frequent opportunities for monitoring change, but for the smaller groups, accuracy may be reduced, or results may be aggregated over several years.

An administrative census provides information more frequently, but only where this can be derived from administrative sources. A large survey might be needed to provide a wider range of data for topics that are essential to a census.

Any sample survey approach will introduce sampling error, and consequently an assessment of accuracy is required for different levels of geography, and for a variety of small populations. Greater accuracy generally means larger samples and higher costs. Information at the finest levels (eg meshblocks) is unlikely to be available from any sample survey.

A dependency for any shift away from a full-enumeration census at five-yearly intervals is agreement on the essential requirements for socio-economic information about subnational geographic areas and population subgroups. There is an interaction between frequency and accuracy, which differs depending on the size of geographical areas and on the characteristics of population subgroups. Additionally, an administrative census approach forces us to ask what the essential variables for a census are, and whether a survey is justified at all.

While the five-yearly full-enumeration census is flexible in providing a range of socio-economic characteristics for many types of small groups within a reasonable frequency, a change in census model means in effect that we need to re-evaluate what we expect from a ‘census’.

Examples of the impact of changing census frequency for small population groups

Māori and iwi statistics

The census is the primary source of information about Māori. It provides the basis for Māori ethnicity figures, which are the main measure used for Māori population statistics, Māori descent counts (which determine the number of Māori electoral seats), and iwi data. The census provides the only independent and comprehensive source of data on iwi affiliation. The data is used to inform iwi and government planning, Treaty negotiations, and settlement polices.

The census provides detailed information on Māori and iwi outcomes. For example, the Department of Labour developed the 'Tu Mai Iwi tool', built on 2001 and 2006 Census data, which allows iwi to identify their demographic and labour market characteristics. The demand for iwi level data will only increase in the post-treaty settlement environment. General sample surveys do include information about Māori as an ethnic group, but the ability to provide breakdowns is limited by sample size.

The census also acts as a frame for surveys directed to Māori and is by far the most efficient way to target samples of specific sub-populations. The post-censal Māori Social Survey will collect a wide range of information about and for Māori not available elsewhere. A 10-yearly census would reduce the depth, accuracy, and timeliness of supply of Māori statistics for Government and iwi.

School decile ratings

School decile ratings are recalculated by the Ministry Education after each census using census variables at meshblock level. Decile ratings determine school funding levels, and results can be subject to intense scrutiny. Individual schools may apply annually for a review of the decision if they believe that factors related to their school's decile rating have changed, for example, through new housing developments. The reviews can involve surveys of the local area. A five-yearly update is already considered too static by the Ministry of Education for the speed at which some residential areas in New Zealand are changing. Ten-yearly updates could result in many more decile ratings reviews at significant cost to the ministry.

The New Zealand deprivation index

The New Zealand deprivation index (NZDep) measures relative socioeconomic deprivation for very small local areas (Salmond, Crampton, & Atkinson, 2007). NZDep is recalculated after each census from meshblock level using nine census variables. NZDep is used for a number of purposes, including resource allocation in health funding formulas and research into the relationship between socioeconomic deprivation and health outcomes. It is also used by community-based service providers to describe the populations they serve and to advocate for extra resources. High levels of internal and external migration in New Zealand mean that changes can occur rapidly in local communities. A 10-yearly census would not effectively monitor these changes over time, and measures, such as NZDep, would not accurately represent the situation for local areas.

The labour cost index

The labour cost index (LCI) is re-weighted every five years using the most recent census data to reflect changes in work force participation by sector, industry, and occupation. The finest level occupation and industry classifications are used, information that is available jointly only from the census. If census were held every 10 years, occupational shifts within industries may not be detected for some time, reducing the relevance of the LCI.

Language retention

New Zealand has three official languages: English, Te Reo Māori, and New Zealand Sign Language. Retention and revitalisation of Te Reo Māori is a Treaty of Waitangi obligation. Government investment in programmes to support the revitalisation of Te Reo Māori occurs across a number of votes. Close monitoring is needed to understand the impact of these investments. A 10-yearly census would not be sufficiently frequent for measuring language competency across age groups (particularly the current elderly population) to provide an evidence base for the current revitalisation programmes.

Pacific development groups have used official statistics on the numbers of speakers of their language to highlight the need for more targeted language programmes. They have worked with language providers and the government to ensure more Pacific people learn their language, strengthen their identity, and enrich our country.

6 Implications of census frequency on the overall statistical system

The census is one part of an integrated statistical system that also continues to evolve. This chapter examines the implications of changing census models on sample surveys and administrative data, and on future developments in these areas. The emphasis is on a longer census interval, with some implications of using other models noted.

Sample surveys

The census provides essential 'infrastructure' for the sample survey programme.

Increasing the census interval to 10 years would:

- make it harder to optimise sample designs
- reduce the accuracy of sample surveys
- mean the census data would be available less often as a sample frame.

Sample designs use the census data to inform the size, accuracy, and allocation of the sample. If the most recent data is old and no longer reliable, this means designs are less optimal and less likely to deliver the expected achieved sample and distribution.

The Household Survey Frame is now updated every five years after the census, and would be updated only every 10 years with a 10-yearly census. Areas of rapid growth or decline would not be known at the sample design stage, and the survey stratification (such as urban/rural and high/low ethnic groups) would be less relevant.

Population estimates are used to benchmark sample surveys. Any reduction in the quality of population estimates will affect the ongoing quality of sample survey estimates and the ability to correct for any bias due to uneven coverage. This is especially true for subgroups such as Māori and young males whose high survey non-response must be adjusted for.

A further use of the census is as a sample frame for surveys of particular groups. For example, surveys of disabled people and of Māori have used the census to select their samples, using characteristics of individuals available in the census. The census is the most efficient sample frame for surveys targeted at small subgroups which are expensive to locate with the area-based Household Survey Frame. A less frequent census means that post-censal surveys would be conducted less often, or more expensive methods would be needed to find the relevant groups.

On the other hand, sample surveys could benefit from some of the options for more frequent censuses. For example, a continuous survey or rolling census provides updated information every year that could benefit sample designs and stratification. Both are likely to provide a large enough sample frame for targeting subgroups more often than at present.

An administrative census, with its combination of a national population register linked to a national address register, offers significant advantages to sample surveys. The registers provide a dwelling sample frame and an individual sample frame that are updated on a regular basis. It is possible to target surveys to sub-populations, where these can be identified from variables linked to the registers. Non-response adjustment can be improved, and information for some survey questions may be obtained directly from administrative data linked to the registers.

A national address listing (chapter 7) is a prerequisite for proposals to reduce the cost structure of the current census model (or indeed any survey-based census approach). This alone would provide significant efficiencies for sample surveys if the address listing is maintained over time.

Future social statistics architecture

An ‘architecture’ describing the future directions for social and population statistics is described by Bycroft, 2011. Census information remains a cornerstone of the overall design, and in future, census data is likely to become even more important.

One of Statistics NZ’s strategic priorities is to make better use of the data we already have, particularly in ways that allow us to meet ever-increasing demands for information without increased costs or additional respondent burden. For social statistics, there are several ways to meet this strategic priority. Options involving census include greater use of census data, enhancing the census itself, and increasing the value that can be obtained from administrative data and sample surveys. Examples are:

- using census as auxiliary information to provide more detailed estimates from sample surveys, without increasing sample size
- further integrating census with administrative data, as in the Census Mortality Study and Cancer Trends
- developing a longitudinal census: linking censuses to follow the same individuals in censuses over time.

Each of these opportunities will be constrained if the census is conducted at 10-year intervals, but could benefit from other census models. An administrative census represents the most advanced integration of administrative data, and implicitly ensures a longitudinal component to census information. However, information available about individuals will be more limited than at present. The implications of a continuous measurement approach are less clear at this stage and require further work.

7 Quality aspects of six potential census models

This chapter describes key factors that influence the quality of census information. It then discusses six potential models for census-taking in New Zealand in terms of their quality.

Six dimensions[8] are used to describe the quality of statistical information (Statistics NZ, 2007a, Protocol 1, Quality). Three of these dimensions are particularly influenced by changing the approach to census-taking:

- relevance or content scope (what range of information is available)
- timeliness or frequency (how often census information is updated)
- accuracy (how well does the census information reflect reality).

The newer census approaches make explicit trade-offs between frequency, accuracy, and content scope.

Factors other than quality can also influence the choice of model. Cost and the availability of alternative data sources also help determine the most appropriate census model. As well as the total cost, smoothing out costs and resourcing more evenly across years to avoid high funding peaks may also be important factors. The interaction of cost and quality is discussed in chapter 8.

What kind of approach would be most appropriate for New Zealand in the future? We return to the three types of census introduced earlier – periodic full-enumeration, continuous measurement, and administratively-based censuses. Hybrid combinations are possible and there is a choice of including sample surveys or not, leading to a potentially large number of census options. In order to focus the discussion, we restrict assessment to six census models that between them capture essential distinguishing features, and which might be feasible in New Zealand.

The previous discussions of the impact of census frequency are summarised for each model in table 1. Each model presents a different trade-off between the quality dimensions. We consider the quality of population counts (the first, and most important, requirement of a census) and the ability to capture the most important characteristics for small populations.

Table 1

Potential census models

Census categories	**Potential New Zealand models**
Periodic full-enumeration	5-yearly
	10-yearly
Continuous measurement	10-yearly, short-form census with annual census sample
	Rolling census
Administrative	Register-based (new NZ population register)
	Existing administrative sources

[8] The six dimensions of quality are: relevance, accuracy, timeliness, coherence, interpretability, and accessibility.

Periodic full-enumeration census

Accuracy and frequency

The traditional 'point-in-time' census provides highly accurate data for the time of the census, which then gradually becomes out of date and less relevant.

Full-enumeration censuses provide geographic information down to the smallest areas. They allow breakdowns by population subgroups and detailed multivariate analysis with a high degree of flexibility and accuracy.

The five-yearly census in New Zealand has provided an adequate frequency for most users of census data, and population estimates have been sustained to a reasonable level through the intercensal period.

With a census every 10 years, it is likely that population estimates in New Zealand would become less reliable. This could have a substantive impact on the many uses of population statistics, including the allocation of very large sums of government funding. Changes in the socio-economic characteristics of subnational areas and small populations could not be adequately monitored.

Wide ranging consultation with users of New Zealand census data produced an almost universal consensus that a 10-year interval would be too long because of the perceived impact that such a gap would have on the accuracy of required census data (Statistics NZ, 2011).

Content scope

Full-enumeration censuses, using a questionnaire administered to every household and individual, provide some flexibility in census content. Over time, the questions asked by census evolve to remain relevant to their time. Some are dropped (eg questions about domestic poultry, presence of flushing toilet or refrigerator) and others are added such as questions about Internet access (Statistics NZ, 2006, chap 18).

The length of the questionnaire is still restricted for reasons such as limiting the burden placed on respondents and the size of paper forms. Outside the core questions currently required of the census (defined in the Statistics Act 1975), the demand for adding questions to the census form is always greater than can be met. As a consequence, a high barrier is imposed before new questions are accepted. Within these constraints, the marginal cost of additional questions remains low since the majority of the census budget goes into obtaining the essential population count of the whole country.

Continuous measurement census

The two options considered for a continuous measurement census are

- 10-yearly short-form census with an annual sample
- rolling census.

Ten-yearly short-form census with annual sample

The United States census is the model for a 10-yearly short-form census with a large ongoing annual sample.

The impact of deteriorating population statistics over a 10-year interval is the same as for the 'long-form' 10-yearly census. The size, structure, and distribution of the population would still need to be estimated using administrative sources over a period of 10 years rather than five years.

This model differs in its ability to provide more frequent socio-economic information about small groups. However, accuracy is reduced compared with information from a periodic full-enumeration census. Detailed information about small groups is less accurate due to sample error, and information about small areas is aggregated over three or five years[9] because of the smaller sample size.

This trade-off of greater frequency with less accuracy is seen as beneficial in the United States and in Switzerland.

Because information on the characteristics of the population is obtained through a questionnaire, a large sample has similar advantages to the 'long-form' census. Content can evolve, and there is a low marginal cost for new questions. However, the need to aggregate results over several years complicates introduction of changes to the questionnaire.

A large ongoing sample survey would appear to offer little advantage compared with the current five-yearly New Zealand census. However, this approach may present more advantages if census were to shift to a longer interval, say 10 years. Whether overall costs would be reduced significantly depends upon the sample size needed.

Rolling census

In the French rolling census, both population figures and socio-economic characteristics are updated annually. The cycle is repeated every five years, with five years' aggregated data feeding into outputs. A recent evaluation, seven years after the start of the rolling census in 2004, reports that the new census system has met its goals. Good-quality results are disseminated annually at all geographic levels (Clanché, 2011).

The questionnaire is similar to that used in a full-enumeration census. Advantages are similar, although changes to questions are complicated by the need to aggregate data over several years.

"A rolling census does not reduce census costs, it simply helps to spread them over time and secure a better 'yield' since information is produced every year" (INSEE, 2006). Clanché (2011) states that the operational side of the census will evolve in the years ahead, chiefly in order to reduce costs without jeopardizing the quality of results.

A rolling census does not offer much real advantage in New Zealand compared with a regular five-year census, particularly in regard to costs savings. However, it may have advantages over a 10-yearly census cycle.

Questions for a continuous measurement census in New Zealand

There are several key questions to consider for future New Zealand census options involving a rolling survey design.

- Which subgroups would a sample need to provide census information for?
- How would 'small areas' be defined?
- If the full-enumeration census was 10-yearly and primarily for population estimates, would census questions then be reduced to only the main demographic questions?
- What size would a census sample survey need to be? Should it be an annual ongoing survey, or less often?
- Could a rolling census be effective in New Zealand with its small and highly mobile population?

[9] The first five-yearly estimates from the American Community Survey were released in December 2010. Population and housing characteristics down to the smallest areas (census tracts and block groups) are based on data collected from 1 January 2005 to 31 December 2009.

Both the rolling census and interim sample approaches are more complex to design and produce estimates for than the current point-in-time census. Research and development would very likely take several years, perhaps a decade or more. For example, research for the American Community Survey began in the early 1990s but the survey was not completely implemented until 2005 (US Census Bureau, 2008b, chap 2).

Administrative records census

Two approaches to an administrative census are considered. A 'register-based-census' is one based on established population registers, and is the model implemented internationally. A second possible approach is to use a range of existing administrative data, but without a formal population register.

An essential precondition for a register-based census is that the country has an established central population register that associates individuals with the dwelling where they live. Notification of address changes are compulsory and captured within administrative systems. The register needs to be of high quality, have good coverage, and link with a system for continuous updating (United Nations, 2008, para 1.65).

New Zealand does not have a population register and there are no plans to create one at present. Without a population register and unique personal identity number, the shift to a fully register-based census is currently not possible in New Zealand. The primary motivations for a population register are not usually statistical, but commonly rely on establishing other tangible benefits for public administration to justify such a major change to government infrastructure.[10] Political and public acceptance of the need for a population register and personal identity number, and accurate capture of address changes are prerequisites to establishing a register-based census (Tønder, 2008; Bycroft, 2011).

Several existing administrative data sources already cover large sections of the New Zealand population (eg Inland Revenue tax data, national health index, electoral roll, national student number). These data sources collect information on a sub-population specific to the administrative purpose of the service, but are not compulsory for the whole population.

Currently, none of the existing administrative sources can, on their own, provide the type of accurate population statistics supplied by the census. Present work is focused on using these sources more effectively to improve subnational population estimates between censuses. Some combination of existing administrative sources may eventually provide an alternative source of census information. A solution may lie in using linked administrative data, perhaps combined with a reduced census or large coverage survey. However, new methodologies would need to be developed. Changes to the existing administrative data or new registers may also be required. New legislation is likely to be needed before an administrative census could be implemented.

Other government initiatives, for example igovt or Service Link, may provide opportunities. At present, these initiatives are directed towards improving client service, are voluntary, and strongly centred around ensuring client privacy. They also appear to have long timeframes before they reach a mature stage. The challenge is to coordinate the development of new client service and other efficiency measures across government with their potential for use in statistical systems.

[10] United Nations Principles and Recommendations (2008, para 1.66) put it this way: "Establishing and conducting administrative registers involve higher costs than the census alone may justify. It is a more useful and effective administration that must prove the need of a register, not the statistics alone."

Administrative data lacks the flexibility of a questionnaire approach to census content, as it is limited to the information already collected by administrative systems. Some of the current census information about population characteristics would likely be of poor quality using administrative data, or would not be available. Examples include household and family characteristics, accurate Māori descent counts and iwi, birthplace (if outside New Zealand), housing characteristics (such as number of bedrooms), travel to work data, and detailed occupation.

Consistent ethnicity data would be difficult to obtain from existing administrative sources. Changes to administrative collections could potentially provide some of this information. Otherwise, a new large sample survey to produce small area data could be required, or information could simply not be provided.

One key component of an administrative census is an accurate address list that identifies each dwelling. In a fully register-based census, individuals are associated with the dwelling where they live. Notification of address changes are compulsory and captured within administrative systems. While accurate and complete capture of address change in New Zealand reveals some challenges at present, the creation of a comprehensive national address list is not out of reach.

At present, we do not have a firm view on the possibility of New Zealand adopting an administrative records census. The most that can be said is that a census based on administrative records, if feasible at all, would likely require 15 to 20, or perhaps 30 years to become a reality.

This paper considers that a census where direct contact is made with respondents will be required until the 2020s at the earliest, and more likely beyond.

8 Trade-offs: quality, cost, and the ability to change

This chapter looks at the trade-offs of quality, cost, and the complexity of change under the six potential census models discussed in this paper.

The current five-yearly census is very widely used and trusted. It also meets well the information needs for which census is designed. The five-yearly census comes with a major monetary, time, and resource investment across the census cycle. Quality is high, but cost is also high.

Discussion about the future of census in New Zealand must consider the costs of census and possible trade-offs with quality. Across government, agencies are being tasked to consider the current and future costs of the work they do, to look for efficiencies and savings, and prioritise services. The direct cost of running the census needs to also be balanced by the overall quality of information produced, and by the indirect costs of poor quality or missing information. Change itself requires investment, which is considered alongside the long-term costs of running the census differently.

Quality

This section summarises the earlier discussion about information needs dependent on the census and the effect of different census models on data quality.

Frequency is a key component of quality. As the time between censuses increases, the accuracy of population statistics decreases. Census data also becomes less relevant because it no longer reflects a changing reality. Providing census information more frequently increases relevance but may decrease accuracy, depending on the model used.

The breadth and accuracy of socio-economic variables are other aspects of census quality. With a questionnaire approach, the scope of census content is broad and flexible, questions can be tailored to measure the statistical concept, and new questions come at a low marginal cost.

Administrative data may be available frequently and can be very good quality if it closely approximates the statistical purpose. If the administrative data does not measure the statistical concept well, then accuracy can be poor unless discrepancies can be overcome through statistical techniques or survey back-up. Content from administrative sources is limited and inflexible but low cost where available. Additional content comes at a high cost.

Table 2 summarises the quality of information gathered under the main census models discussed in this paper. The two main kinds of census information are treated separately: ‘population statistics’ refers to the ability of the wider system to sustain accurate population statistics (how many people, where they live, and their age, sex, and ethnicity); ‘socio-economic variables’ relates to the census variables that provide information about the socio-economic characteristics for small groups.

Table 2

Quality of information gathered under different census models

Census model	Frequency	Quality of population statistics	Quality of socio-economic variables
5-yearly census	5 years	Good: improvements desired for highly mobile subgroups	Good: accuracy high at census year; frequency adequate
10-yearly census	10 years	Low at present: new methodologies and/or data sources needed over longer interval	Low: accuracy high at census year, but frequency too long and becomes out of date
10-yearly census with annual census sample	10 years population Annual content updates	Low at present: new methodologies and/or data sources needed over longer interval	May be good: accuracy and frequency of updates depend on sample size
Rolling census	Annual	May be good: dependent on ability to capture mobile population	Good: less accurate at each year, but frequent updates
Register-based	Annual	Not possible at present: in future would be dependent on coverage and timeliness of population register system	Investigation needed into scope, accuracy, and timeliness of census information from existing administrative data
Existing administrative data	Annual	Low at present: new methodologies and/or changes to administrative systems needed.	Investigation needed into scope, accuracy, and timeliness of census information from existing administrative data

Quality and cost shifting

The interplay of cost with quality is complex and cannot be addressed in depth here. However, it is clear that the costs imposed by inaccurate population statistics and a lack of robust information about local communities and small populations would be substantial. The potential impact on many users of census data could be very high, and could result in billions of dollars of government monies being misallocated and policy-making and future planning being developed on an uncoordinated evidence-base. There are also flow-on effects to sample surveys, and the wider statistical system.

Frequency and quality of data are key considerations for government agencies. It is likely that, in order to counter the uncertainty of official figures seen to be increasingly inaccurate or out of date, agencies might seek alternative data sources, and at an additional cost to government.

Many government agencies currently use smaller private sector market research agencies to regularly survey the public and collect data on specific projects or ‘questions of the moment’. Alternative data collection sources such as these are usually independent of the official statistics network. Commissioned projects, driven by specific information needs, are often required to help answer key questions for government.

These projects make no attempt to meet overall national totals, unless required to. Quality assurance is primarily driven by the requirements of the specific project, and cost considerations, driven by commercial necessity, usually keep such quality assurance to the minimum required.

In the absence of frequent and quality-assured statistics, agencies could call on the wider market research industry to help collect data specific to agency needs. Users of census data would carry out their own surveys to gather information on selected areas of interest, imposing increased costs and possibly duplicating effort.

A risk of using the wider market research industry is that government agencies may receive inconsistent and competing results across a variety of different survey and other data-collecting projects. Over time, these results may start to work against the public interests they serve.

Population estimates and projections have major financial implications for central and local government. If official figures are perceived to be unreliable, agencies may seek to obtain other population estimates. Independent companies and researchers can and do compile alternatives to official population figures, for example as commissioned by local areas. However, they use their own assumptions, data sources and methods. They often will not be constrained to national totals and are usually not independently quality assured.

If official population figures are widely seen to be of low quality, the consequences include more use of alternatives, competing and inconsistent estimates of subnational populations, and a higher level of debate over the ‘true’ figures. All of this would result in increased costs to government, as well as efficiency and equity concerns associated with inaccurate population data. It is difficult to underestimate the importance of a single source of robust, authoritative, and independent population statistics.

A cost-benefit analysis of census models will, therefore, need to take into account the shifting of cost to other government agencies (as well as many other users of census data) that is likely to occur for models that provide lower quality information.

Change and cost

Change itself imposes a cost. Clearly much remains unknown about the viability of alternative census models for New Zealand. A major investment in research, development, and testing would be needed for any of the potential new models. This would need to be resourced adequately both financially and using people with the right mix of skills. More complex methods would place greater reliance on high levels of expertise.

The existing census would need to continue while other methods are investigated. There are two main reasons for this. Research takes time, and outcomes are uncertain. There is a continuing need for census information which cannot be set aside while waiting for new methods to be developed. Also, the validity of alternative approaches would need to be tested against the results of a concurrent census.

Changes in field operation

The cost of the current full-enumeration model could also be reduced through changes to the field operation.

Statistics Canada and other countries have shown that the field force can be reduced by establishing an accurate and up-to-date address listing before the census, and by maximising Internet uptake. An accurate address list allows census Internet access codes or paper forms to be mailed out. If the majority of respondents use the Internet or mail-back paper forms, a smaller field workforce can concentrate on more difficult areas.

Internet responses will significantly change and streamline the census operation once it becomes the main mode for census returns.

Overall cost comparisons

Table 3 gives an indication of the cost components for each of the main models. The second column describes the relative complexity of shifting to a new census model as a proxy for the cost of change (and of the time required). An address listing and operational efficiencies are assumed for the current five-yearly model as well as for each of the alternative survey-based options. Direct costs of running the census model once it is in place are roughly indicated in the third column, based on overseas experience. The final column shows the likely level of cost shifting, based on the overall quality of data that might be expected at present. All of these cost components should be read as very early assessments. They are open to debate and will be refined as further work is undertaken.

Table 3

Cost aspects of census models

Census model	Complexity of change	Direct census costs compared with 5-yearly census	Indirect cost shifting
5-yearly census	Medium: changes to field operation	…	Low
10-yearly census	Medium-high: changes to field operation; new methods for population estimates;	Somewhat lower	High
10-yearly census with annual census sample	High: changes to field operation; new methods for population estimates; new sample design and estimation	Similar	Medium
Rolling census	High: new sample design and estimation; new field operation	Similar	Low
Register-based	Very high: population register is a major new cross-government infrastructure	Much lower, but depending on additional survey support	Unknown
Existing administrative data	High: new methodologies and/or changes to administration systems	Much lower, but depending on additional survey support	High

Symbol: … not applicable

9 Summary and next steps

United Nations recommendations are for censuses to be conducted at least every 10 years. Many countries do hold their census every 10 years. The underlying reasons for New Zealand's five-yearly census – high external migration flows and high internal mobility – remain valid. Administrative sources do not accurately capture this high rate of change in New Zealand's population. Countries we often compare ourselves with – Australia, Canada, and Ireland – also have high migration rates and conduct five-yearly censuses.

More frequent census updates would be welcomed, if they were sufficiently accurate. Longer census intervals, such as every 10 years, can cause census information and population statistics based on census to be wrong by a margin that is material to the decisions being made.

It is critical to understand that the census does not sit in isolation, but is part of an integrated system of census, sample surveys, and administrative data. The census supports sample surveys and underpins the usefulness of administrative data. If the census were to change from the current model of a five-yearly full-enumeration census, then a different mix of surveys and administrative data would be needed to make a successful adjustment.

Much work remains to determine the most appropriate model for future New Zealand censuses. Prioritisation of future information requirements is a critical element. Since resources are limited, in-depth investigation should be concentrated on models which offer the best opportunities for maintaining quality and reducing overall costs.

A national address register stands out as one element that is clearly beneficial whichever direction is taken in the end. A national address register would increase the efficiency of a full-enumeration census, whether this is 5-yearly or 10-yearly, and is essential for both of the continuous measurement options considered in this paper. It is also on the pathway to a fully administrative census.

Key dependencies

Several areas for investigation stand out as key dependencies to inform future directions.

- **Establish an address register and reduce census field costs**
  Given the long timeframes needed to establish fully administrative alternatives, a full-enumeration census will be required for some time, at whatever interval is decided. Reducing the cost structure of census, mainly through changes to the field operation, must be a top priority. Establishing an address listing, and continuing to increase Internet uptake are key components of this.

- **Improve intercensal population estimates through greater use of administrative data**
  Improving intercensal population estimates would benefit the five-yearly census by reducing errors at the end of the five-year period. It would also test our ability to sustain robust population statistics over a longer period, which is the first requirement of a 10-yearly census interval. The experience and understanding gained would be a first step towards understanding the viability of a fully administrative census.

- **Determine the opportunity costs associated with poor-quality census information**
  Building a better understanding of the value of census information is key to any cost-benefit analysis of options for changing the census. We can say that the budgeted cost of the 2011 Census, at $90 million, represents less than 0.1

percent of the more than $150 billion dollars government allocates based on census data over five-years. We would be in a better position to consider alternatives if we had more robust quantitative estimates of the economic value of census information.

- **Determine the opportunity costs of census information to the wider statistical system**
  Other elements of the statistical system – sample surveys and administrative data – also depend on the census, with flow-on effects for economic statistics such as the national accounts. The allocation of electoral seats within the electoral system is determined by the census data. An options analysis needs to include assessment of the wider implications and costs associated with poor quality, or loss of, census information against these statistical and political system information needs.

Further investigation

Other work depends on the priority given to various options, but could include two areas.

- Investigating a 10-yearly census option, which would first need to determine:
  - the direct costs of running a 10-yearly census
  - the sample size and frequency needed to replace the point-in-time census content
  - the appropriate changes needed to the electoral system.
- Implementing a programme of work towards an administrative census, which would include a timeframe to test administrative methods against the latest census. It would also investigate:
  - public attitudes towards privacy and any legal or other issues associated with extensive statistical use of linked administrative data
  - the potential for linking external migration data to other administrative systems
  - methodologies for producing population estimates using data with errors due to record linkage
  - potential changes to administrative systems, for example, capture of additional variables
  - the need for new registers
  - the potential for combining coverage surveys with administrative estimates
  - the range of census content available through administrative data, and the potential for sample surveys to fill gaps.

Conclusion

The census is a common resource that is reused extensively. Census results are used to determine electoral seats and are invaluable for both national and local policy formation, planning, and the effective targeting of resources. Census data also informs investment decisions in the commercial sector and is a resource used by researchers and community groups.

Any adverse impact of a changed census model in New Zealand would be felt widely. In recent consultation, government departments highlighted their grave concerns over a potential 10-yearly census and were unanimous in their support for a 5 yearly census.

Demands are for more frequent information, not less. Rolling survey designs provide continuous updates, but are complex and may not achieve cost savings. Administrative data may appear a good alternative, but New Zealand administrative systems are not designed to accurately capture population information. That has been the role of an independent census. A national address register stands out as a critical dependency for any future scenario, as we look to reduce the cost of census while retaining the value of census benefits.

References

Brown, D (2010). *Social and population statistics information needs: Towards 2020*. Wellington: Statistics NZ.

Bryant, J, & Graham, P (2010). *The effect of alternative designs on the accuracy of subnational population estimation: Preliminary findings*. Statistics NZ internal report.

Bryant, J, & Graham, P (2011*). Demographic estimates and projections using multiple data sources: A Bayesian approach.* Proceedings of 58th World Statistics Congress of the International Statistical Institute (ISI) Dublin August 2011.

Bycroft, C (2010). *A register-based census: What is the potential for New Zealand?* Wellington: Statistics New Zealand.

Bycroft, C (2011). *Social and population statistics architecture for New Zealand.* Wellington: Statistics New Zealand.

Clanché, F (2011, June). *France's redesigned census: Lessons and prospects*. Paper presented at the conference of the Italian Statistical Society, Bologna.

Department of Labour website, To Mai Iwi tool. Available from www.dol.govt.nz.

Dumont, J-C & Lemaître, G (2005) *Counting immigrants and expatriates in OECD countries: A new perspective.* (OECD Social, Employment and Migration Working Papers, no. 25). Paris: OECD Publishing.

INSEE (2006). *The population census in France: from general census to "rolling census"*. Conference of European Statisticians, Paris 2006 ECE/CES/2006/24.

Martin, D. (2006). Last of the censuses? The future of small area population data. *Transactions of the Institute of British Geographers, 3*, 6–18.

Office for National Statistics (2011). Beyond 2011. Available from www.ons.gov.uk.

Salmond, C, Crampton, P, & Atkinson, J (2007). *NZDep2006 Index of Deprivation.* Wellington: Department of Public Health, University of Otago.

Statistics New Zealand (2006). Introduction to the Census. Available from www.stats.govt.nz.

Statistics New Zealand (2007a). Principles and Protocols for producers of Tier 1 statistics. Wellington: Author. Available from www.statisphere.govt.nz.

Statistics New Zealand (2007b). QuickStats about Culture and Identity: Birthplace and people born overseas. Retrieved 7 March 2011 from www.stats.govt.nz/census.

Statistics New Zealand (2008). How accurate are population projections? An evaluation of Statistics New Zealand population projections, 1991–2006. Available from www.stats.govt.nz.

Statistics New Zealand (2011). *Future census engagement summary.* Statistics NZ internal report.

Swiss Federal Statistical Office (2008). The Swiss Census 2010: Moving towards a comprehensive system of household and person statistics. Retrieved 7 March 2011 from unstats.un.org.

Tønder, J-K (2008, October). The register-based statistical system – preconditions and processes. Paper presented at the IAOS Conference, Shanghai. Available from http://isi.cbs.nl/iaos.

United Nations (2008). Principles and recommendations for population and housing censuses, revision 2. Retrieved 7 March 2011 from http://unstats.un.org/unsd.

United Nations (2010). 2010 World Population and Housing Census Programme: Progression of the 2010 census round. Retrieved 1 October 2011 from http://unstats.un.org.

United Nations (2011). Report on the results of a survey on census methods used by countries in the 2010 census round (Working Paper: UNSD/DSSB/1). Available as PDF from http://unstats.un.org.

UNECE (2007). Register-based statistics in the Nordic countries – review of best practices with focus on population and social statistics. New York & Geneva: United Nations. Available from http://unstats.un.org.

UNECE (2009, June). Main results of the UNECE-UNSD survey on the 2010 round of population and housing censuses. Paper presented at the conference of European Statisticians, Geneva ECE/CES/GE.41/2009/25. Available from http://unstats.un.org.

US Census Bureau (2008a). A compass for understanding and using American Community Survey Data. What general data users need to know. Washington DC: U.S. Government Printing Office. Available from www.census.gov/acs.

US Census Bureau (2008b). American Community Survey Design and Methodology Report. Available from www.census.gov/acs.

Appendix 1 Temporal distribution of censuses for 2010 round

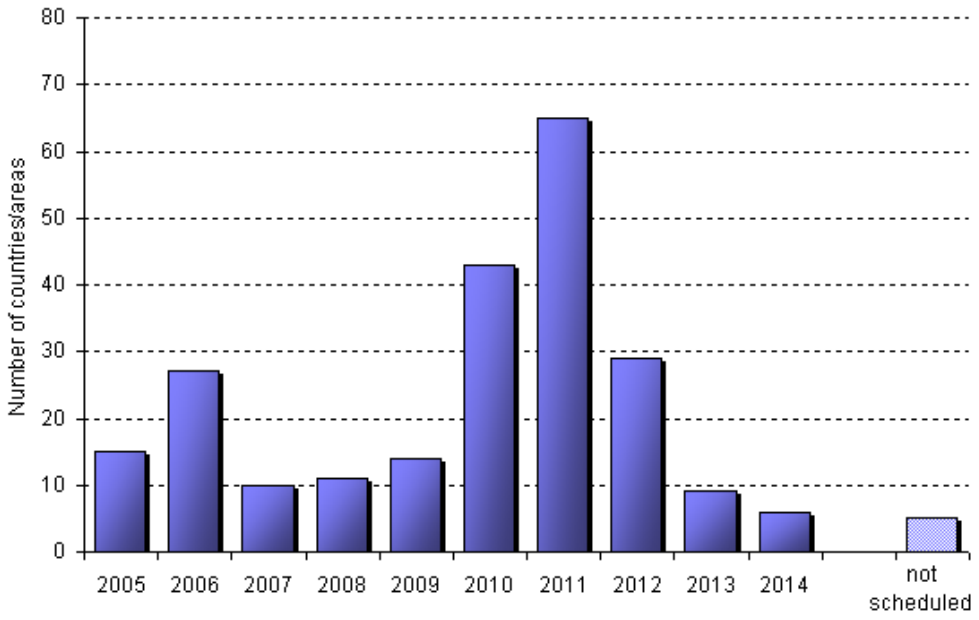
The following extract is from *2010 World Population and Housing Census Programme: Progression of the 2010 Census Round* (United Nations, 2010).

Progression of the 2010 Census Round

Two hundred and twenty-nine countries or areas have scheduled, or already conducted, at least one census in the 2010 census-round spanning the period 2005 to 2014. This also includes countries which base their detailed population statistics on population registers, administrative records, sample surveys or other sources, or a combination of those sources. Of those 229 countries or areas, 171 have already conducted a census in this census round. Five countries or areas have not yet scheduled any census until 2014 (as of 1 October 2011).

The figure below shows the overall temporal distribution of censuses over the period of the 2010 round (first censuses only). A number of countries/areas have postponed their census since the initial announcements shifting the peak of census-taking from the year 2010 to the year 2011.

Distribution of conducted and scheduled censuses over the period of the 2010 Census round



Appendix 2 Census costs compared internationally

Table 4
Cost per person for selected countries that use full-enumeration census

	2011 Census costs					
	UK	NZ	Scotland	Canada	Ireland	Australia
Budget	£482,100,000	NZ$90,332,087	£57,035,027	C$630,373,000	€ 63,519,000	AU$445,000,000
Population	55,700,000	4,425,000	5,260,000	34,541,386	4,500,000	22,528,067
Cost per person	£8.66	NZ$20.41	£10.84	C$18.25	€14.12	AU$19.75
Cost per person (NZ$)[1]	**$18.46**	**$20.41**	**$23.13**	**$24.56**	**$25.38**	**$26.26**

1. Exchange rate at 17 Feb 2011

Source: Compiled by Statistics NZ from various sources.

Appendix 3 New Zealand migration

Table 5

Usual residence five years ago indicator for the census usually resident population count, 2006

Usual residence five years ago indicator		Census Usually Resident Population Count	Percent of total	Percent of 2001 residents (1)
01	Same as usual residence	1,493,010	37	45
02	Elsewhere in New Zealand	1,800,228	45	55
03	Not born five years ago	275,079	7	
04	Overseas	343,113	9	
05	No fixed abode five years ago	396	0	
77	Response unidentifiable	-	0	
99	Not stated	116,124	3	
Total		4,027,947		3,293,238

1. Total is categories 01 + 02, those usually resident in 2001, with usual residence stated.

Note: This data has been randomly rounded to protect confidentiality. Individual figures may not add up to totals, and values for the same data may vary in different tables.

Source: Statistics New Zealand, 2006 Census, Classification counts about people, chap 35, table 42