

Transforming the New Zealand Census of Population and Dwellings: Issues, options, and strategy



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Executive summary

Transforming the New Zealand Census of Population and Dwellings presents the issues on the development of a strategic direction and timeline for the transformation of the New Zealand Census of Population and Dwellings. This development is part of Tomorrow's Official Population and Social Statistics Programme.

1. The New Zealand Census of Population and Dwellings provides the official count of all people and dwellings in New Zealand and gives detailed socio-economic information at the community level. The population count recalibrates and improves the accuracy of all official population estimates and projections.
2. Census information determines the number, size, and boundaries of general and Māori electorates, enabling fair constituency representation. It is also used in reviewing electoral arrangements for local government. Census information underpins effective and efficient allocation of government funding; provides unique information for monitoring small populations and localities; and supports future planning at a national, regional and local level.
3. Although the cost of the New Zealand census compares favourably with other countries, increases in population size and per-unit cost have led to significant cost increases between consecutive five-year censuses. Questions have been raised on whether better value could be achieved by a change in the census model or frequency.
4. Internationally, a variety of approaches (models) are used to obtain census information. The approaches taken in each country continue to adapt and evolve in response to various drivers. Drivers of change include costs, quality of information, privacy concerns, technology, decreasing participation, availability of alternative information sources and the strong demand for more frequent information.
5. Investigative work by Statistics New Zealand has shown that with alternative data systems evolving, considerable uncertainty exists around changing the census frequency or model. There is also a lack of clear evidence on which to make decisions on long-term options for the New Zealand census.
6. In recognition of this, the strategy for transforming the census proceeds from a short-term focus on modernising the current census model to achieve efficiencies and reduce costs. In the longer term, the goal is to develop a new census model based on the use of formal registers or existing administrative data sources.
7. Countries that have register-based censuses are able to produce census information at much lower cost, and information can be produced more frequently. Transforming the New Zealand census will involve managing a high degree of uncertainty and complexity, and potentially the need to modify government infrastructure systems. Given this, a phased approach is proposed to the transformation to manage the high level of risk and to ensure continued production of quality population statistics. Four phases are proposed.
 - Phase 1 – 2011–15: Develop new collection processes for the five-yearly census and progress investigation of existing administrative data sources.
 - Phase 2 – 2016–20: Implement new collection processes in the 2018 Census and determine improvements to data sources for an administrative census.

- Phase 3 – 2021–25: Complete new collection processes; review timing of future censuses and progress development of administrative data sources.
 - Phase 4 – 2026–30: Complete evaluation and implementation of an administrative census, if feasible.
8. The sequencing of the phases is premised on continuing an increasingly efficient five-yearly census until alternative options become feasible. This will ensure minimal disruption to delivering critical population statistics and assist more rapid implementation of the strategy, since census data are needed to evaluate options. At the end of each phase, an evaluation report will ensure that progress and prospects are clearly signposted and that investment requirements can be reassessed as required and targeted effectively. It will also provide government policy choices at this time.



Introduction

Purpose

9. This paper presents issues associated with transforming the New Zealand Census of Population and Dwellings. It proposes a strategic direction and a parallel and phased work programme for the transformation.
10. The paper begins by outlining why census information is important in New Zealand. It provides some background to censuses in New Zealand and an overview of international trends and research. This is followed by a discussion of Statistics NZ's strategy for transforming the census, and an outline of the work programme for achieving this.
11. The appendixes provide detailed information on aspects of the census.
 - Appendix 1 – an overview of costs.
 - Appendix 2 – details of the uses of census information and the relationship between the Electoral Act and the census.
 - Appendix 3 – an overview of census models used internationally and assesses their viability within the New Zealand context.
 - Appendix 4 – an overview of the proposed work programme objectives and phasing for transforming the New Zealand census.

Context

12. The rising cost of the Census of Population and Dwellings has been the catalyst for discussions about the sustainability of its current arrangements. While the cost of New Zealand's census compares favourably with other countries, increases in population size and per-unit cost of the census have led to significant cost increases between consecutive five-year censuses. There are questions about whether New Zealand could obtain better value for money by moving to a 10-yearly census, or by moving to a census model that reduces reliance on census collectors and makes more effective use of administrative data. Appendix 1 presents the costs associated with operating the New Zealand five-yearly census and compares them with international costs.
13. Tomorrow's Population and Social Statistics (TOPSS) Programme initiated by Statistics NZ provided an opportunity to reflect on environmental and technological changes and international developments, and embark on a number of investigations and feasibility projects. These aim to put the census on a more sustainable basis in the future.
14. Cabinet decisions taken in March 2011 for 'Statistics 2020: Achieving the Statistical System of the Future' agreed that funding and work within the Tomorrow's Population and Social Statistics (TOPSS) sub-programme would be separately considered, by developing a stage 2 business case. This business case will focus on future pathways for population and social statistics with census variations (as outlined in the stage 1 business case), due for submission to the Cabinet Expenditure Control Committee by 31 March 2012 [EGI Min (11) 4/10 refers].

15. On 13 April 2011, the Cabinet Economic Growth and Infrastructure Committee (EGI) further directed Statistics NZ to submit a new paper by March 2012 with advice on the longer-term options for the frequency of the New Zealand Census, and international comparisons in terms of frequency [EGI Min (11) 7/11 refers].
16. During the development of the TOPSS stage 2 business case, and in consultation with central agencies, the Minister of Statistics, and the Minister of Finance, it was agreed to separate the advice on the future of censuses from the funding request for continuing the administrative data and household survey programme (the TOPSS business case). It was agreed that Statistics NZ would submit, in parallel with the TOPSS business case, an issues paper on future censuses and a census transformation strategy (this paper).

Why the census is important

17. The census provides the official count of population and dwellings in New Zealand, and their characteristics, down to small geographic levels. It provides the only source of detailed socio-economic information about local communities and small population groups.
18. The primary role of the census is to provide population and dwelling counts for New Zealand, including regions and territorial authorities, and smaller geographic units such as area units and meshblocks. These counts are critical for producing accurate population estimates and projections. The census provides the basic stock data about how many people there are and where they live. In between censuses, population statistics are updated using administrative data on births, deaths, and external migration, which provide measures of population change. Information about internal migration is problematic in New Zealand because no direct measure is available. The accuracy of population statistics decreases over time, particularly at subnational levels, due to the high mobility of New Zealand's population. Over half New Zealand's population changed residence between the 2001 and 2006 Censuses. The census is used to re-establish the population base (ie recalibration) every five years for calculating population estimates and projections.
19. The census is also a unique source of detailed information on local communities and small population groups, such as Māori, iwi, migrants, children, older people and single-parent families. In addition to basic information on their size and demographic make-up, the census gives an accurate and comprehensive picture of the socio-economic characteristics of local communities and small population groups (eg ethnicity, religion, family, education, occupation, and housing). Reliable and consistent information at this level is not available from other sources.
20. Over time, the content of the census has expanded to meet new information needs, and use of the census has grown around the available data. Until recently, the absence of other suitable survey vehicles has meant that the census has by default, become the vehicle for meeting information needs on social topics. It is proposed to review the uses of census information and confirm the critical information needs that the census must inform. This review includes confirming the minimum quality, frequency, and level of disaggregation (eg geographic and population subgroup) required to meet information needs. This will enable us to focus the census on producing fit-for-use data to meet information needs that cannot be met through other means, such as sample surveys or administrative data sources.
21. The census is a vital part of an integrated national statistical system, which includes sample surveys, registers, and administrative data. The census

provides essential infrastructure for household surveys, including those conducted by the private sector, and is integral to the effective use of a range of administrative data. It also provides a frame for surveying small populations.

22. Information from the census is used extensively by a wide range of stakeholders, including central and local government, businesses, academics and researchers, non-profit organisations, international bodies, community groups, iwi, and the general public. The uses they make of census data are equally wide ranging and have become embedded in many government systems and processes.
23. The uses of census data can be grouped into the following broad categories:
 - adjusting electoral boundaries for Parliament and determining the number of general and Māori electorate seats
 - reviewing local government representation arrangements
 - allocating resources and targeting investment by government
 - costing government programmes
 - monitoring outcomes of small populations
 - informing social and market research.

More information on each of these is in appendix 2.

24. The census has a key constitutional role under the Electoral Act 1993, which states that the number, size, and boundaries of electorates can only be revised on the basis of census data. The census also determines the timing of the Māori Electoral Option, which gives Māori electors the opportunity to choose between being registered on the Māori or general electoral rolls. The relationship between the Electoral Act and the census is discussed in appendix 2.

Census in New Zealand

25. New Zealand has conducted a Census of Population and Dwellings since 1851. A large workforce was employed at each census to physically enumerate every dwelling and deliver and collect census forms across New Zealand. The collection phase of the census is the single largest component of census costs, accounting for around half the overall cost of conducting the census.
26. The main pressures on the sustainability of the current census model are:
 - continuing cost increases due to population growth, and to inflation
 - not keeping pace with potential cost savings arising from technological changes
 - increasing availability of administrative data.
27. These pressures are not unique to New Zealand and the drivers for change vary from country to country. How various countries have addressed these is discussed in the next section, International trends.
28. Statistics NZ actively monitors changes and innovations being made to censuses internationally, and where possible applies them to the New Zealand census to make it more efficient and effective. Changes implemented in the collection, processing, analysis, and dissemination phases of the census have taken advantage of methodological and technological advancements. The Internet was introduced as a response mode in the 2006 Census. Uptake of the online form

was low (7 percent) in this first census, with a target of 35 percent for the 2013 Census and progressively higher targets in following censuses.

29. The Statistics Act 1975 was changed in 2010 to provide more flexibility in the methods used to deliver census forms to households. The requirement that all census forms be hand delivered to households has been removed and the Act now provides for either personal delivery, delivery by post, or by electronic means. Although it is too late to change the delivery and collection processes for the 2013 Census, this amendment to the Statistics Act creates opportunities for reducing collection costs at future censuses.
30. Statistics NZ has an investigative programme looking at alternative census models and international trends, which was recently stepped-up a level. This programme of work has resulted in a series of research papers and the publication of some information papers on the Statistics NZ website (see [The future approach to social and population statistics](#)).

International trends

31. Internationally there are a number of different census-taking models. Approaches to census-taking can be categorised into three main groups:
 - periodic full enumeration census – a survey of the entire population at a specific point in time
 - continuous measurement census – a proportion of the population is surveyed every year and the results aggregated to provide a complete country count
 - administrative census – information is obtained from administrative registers and administrative data sources rather than directly from respondents.

Appendix 3 contains more information on each model and an assessment of the pros and cons of various census models in the New Zealand context.
32. New Zealand is one of several countries that conduct a five-yearly census, including Australia, Canada, and the Republic of Ireland. Most countries conduct a 10-yearly census, while some produce census information from administrative registers or administrative sources.
33. Internationally, countries are continuing to introduce technological and methodological innovations to make conducting a census more efficient, thus responding to the challenges of producing high-quality data while controlling costs. There is increasing concern internationally over data quality, respondent burden, privacy, demand for more frequent information, and decreasing participation in the census, particularly among sub-populations of policy interest.
34. Innovations implemented in other countries in the 2010 Census round include:
 - using new technologies for data collection, such as the Internet and hand-held or digital devices such as smartphones
 - using new continuing survey approaches that provide more frequent socio-economic estimates, such as a rolling census or annual sample surveys
 - using administrative data sources in running the census (eg construction of address frame, data editing, and imputation)
 - growing use of data from population registers in combination with survey-based census data to create 'combined censuses' in addition to fully register-based censuses

- improved integration of the census with other social survey programmes, including linking census information over time and with other survey and administrative data sources to enhance its value
 - using interactive online databases and mapping tools in disseminating census data.
35. Statistics NZ has been actively involved in a number of international fora on the census. In February 2012, Statistics NZ hosted the International Census Forum to share experiences and future directions with Australia, Canada, the United Kingdom, United States, Ireland, and Scotland.
36. In Australia, an important focus at the 2011 Census was improving the census Internet uptake. The eCensus system, which was introduced at the 2006 Census, was redeveloped for the 2011 Census. The new application is faster, more efficient, easier to use and more cost-effective for the Australian Bureau of Statistics. At the 2011 Census, around 34 percent of households completed their forms online, up from 9 percent in 2006.
37. In Canada, efficiencies have been introduced into their census operations to reduce costs and improve census coverage. Since 2006, Statistics Canada has used a multi-mode delivery and collection process, with a strong focus on mail delivery of forms and maximising response via the Internet. In 2011, around 80 percent of forms were delivered by mail, and the Internet response to the census exceeded 50 percent. A major change at the 2011 Census was introducing a voluntary National Household Survey (NHS) as a replacement for the previously mandatory census long form. This change was driven from a privacy perspective, rather than as a cost-saving initiative (in fact additional funding was allocated), and was controversial, with concern about the potential impact on data quality. Preliminary results show the level of public cooperation to the voluntary NHS was around 69 percent, considerably lower than the 94 percent response rate achieved in 2006 when response was mandatory.
38. The Irish National Statistics Office (NSO), which has a five-yearly census due to high migration levels, is also beginning to look at more cost-effective options for producing census outputs, including exploiting administrative data. The NSO has made initial progress in this direction. It has gained explicit reference to developing the necessary infrastructure to support the use of administrative data for statistical purposes in a reform strategy for the public service in Ireland. They expect to begin to see the benefits of this strategy at the 2021 Census.
39. The United States and France have both changed their census model to address the problems associated with the long intervals between their censuses. The US census is held every 10 years. In the past, a short-form census was completed by everyone, and a more detailed long-form was answered by a 10 percent sample of the population. In 2010, the long-form census was replaced by the American Community Survey (ACS), in response to user demand for more timely data than the Decennial Census could provide. The ACS is a large annual survey of around three million households. Its primary purpose is to provide social and economic information about the characteristics of the population and households, which is updated annually. Because of the smaller sample size, compared with the census, information for small areas is aggregated (pooled) over several years. Adopting data pooling over several years has been troubling for some users, who are accustomed to having data for all geographic areas at one point in time. The US took 18 years to develop the ACS from the research proposal stage to the first publication of five-year estimates.
40. In France, a rolling census was introduced in 2004, replacing the traditional periodic full-enumeration census that was being undertaken at increasingly longer time intervals. For example, censuses were undertaken in 1975, in 1982, then in 1990, and finally in 1999. Under the rolling census model, a full-

enumeration of population and dwellings is undertaken in one-fifth of small municipalities every year. All small municipalities are covered every five years. In large municipalities, an 8 percent sample is conducted every year. Data are released annually as moving averages. This methodology is unique to France. It was adopted because France does not have a population register or personal identification number to enable linking administrative data files. The French rolling census took 12 years to develop, from the initial proposal stage to the first full production of results. The approach is still new and is evolving as lessons are learned and incorporated into the methodology. However, it appears to have achieved its primary goal of making data available on a more regular and timely basis.

41. Many countries, particularly in Europe, seek to reduce their census costs by obtaining census information directly from registers and administrative sources. Nordic countries have produced census information from population registers and other linked administrative data from the 1970s. Austria and Norway moved to a fully register-based census in 2011, and Italy is evaluating using a combination of municipal registers, a national index, tax data, and other linked administrative data to replace its next census. In 2010, Switzerland replaced its 10-yearly census with a new centralised population register and an integrated system of annual surveys. The Netherlands conducts a 'virtual census', which relies on sample survey information to supplement information not available from registers and administrative sources. An advantage of censuses based on registers and administrative data is that census information can be produced with increased frequency and minimal cost. However census information is limited to what can be compiled from administrative sources.
42. The above discussion of international trends in census taking has identified some of the different models used to conduct censuses around the world. Approaches to census-taking can be categorised into three main groups:
 - periodic full enumeration census
 - continuous measurement census
 - administrative census.

Appendix 3 contains more information on each model and an assessment of the pros and cons of various census models in the New Zealand context.

International research programmes

43. With the 2010 Census round coming to completion, an evaluation process is underway, and international discussion of the issues challenging the conduct of future censuses. For example, the Conference of European Statisticians in June 2012 includes a session on 'Challenges for future population and housing censuses'.
44. In the UK, the Office for National Statistics, which has run a 10-yearly census for 200 years, is investigating alternative options for producing census-type information. The key drivers for the 'Beyond 2011' project are cost constraints and the demand for more frequent, detailed, and accurate statistics. As a formal national population register or national unique identifier are ruled out by the present government, considerable research effort is focused on options for producing population statistics from existing administrative data. Recommendations for the future will be made in 2014. These will be informed by the statistical viability of the potential solutions, and by a full understanding of user requirements, public burden, and public acceptability.

45. Statistics Canada is researching methodology options for the 2016 Census of Population and Dwellings. These include some variant of the 2011 Census approach, a census based on existing administrative registers (with or without additional data collection), a full-enumeration field census with yearly updates of characteristics, and a so-called rolling census. An initial assessment was undertaken and concluded that the only feasible option for the 2016 Census is some variant of the 2011 Census approach. The next step is a detailed assessment by Statistics Canada of the options it will retain for the 2016 Census, and of the potential approaches for 2021 and beyond. Statistics Canada is preparing a report for the federal government for early 2012.
46. In Australia, a Census Data Enhancement Project was established, to integrate unit record data from the Census of Population and Housing with other ABS and non-ABS datasets – to create new datasets for statistical and research purposes. The project also aims to add value to census data by bringing it together with data from future censuses. Studies are being undertaken to assess the quality of the linking of census data with data from other sources, and the likely quality of a linked census dataset. For Australia's 2016 Census, the ABS proposes to further increase Internet uptake, and to introduce an address list to mail-out census forms/Internet keys, following a similar approach by Statistics Canada in 2011.
47. Israel, Italy, and Poland are examples of countries that are further developing census approaches that combine administrative registers with sample surveys. The surveys are used for coverage adjustment and to provide information not available from administrative sources.
48. Statistics NZ will continue to monitor international research and development relating to the census and assess its applicability to New Zealand.

Transforming the New Zealand census

Options for future censuses

49. This section presents potential options for future New Zealand censuses, and summarises the pros and cons of each option. Appendix 3 provides a more detailed discussion of the options.

Five-yearly census

50. A five-yearly full-enumeration census enables census information to continue to have the accuracy and frequency needed to support electoral requirements and produce subnational population estimates.
51. The census is the only available data source that provides information to monitor change for local areas and small population groups. The current five-yearly frequency is generally seen as adequate for most monitoring purposes, although more frequent information would align better with local government reporting requirements.
52. Opportunities for re-using census systems and infrastructure are high with a five-year frequency. Although census costs are high, and increasing under the current census model, clear evidence is available from international experience that costs could be reduced by modernising the current collection model.
53. Transformation of census collection would be based on developing a national address listing that would enable mail-out of census Internet codes and paper forms, with a strong drive towards Internet completion. Census collection would

be less labour intensive, with field staff concentrated in areas where address listings are poor, or responses difficult to obtain.

54. Conditions under which a five-yearly census could be considered a cost-effective option are: availability of a high-coverage address list; mail-out of census Internet codes and census forms; and high uptake of Internet response. These would lead to significantly lower operational costs.

Ten-yearly census

55. An immediate shift to a 10-yearly census following the 2013 Census would result in a reduced census budget, but not by half. The savings could be offset by cost-shifting as government agencies seek to make up for inadequate information in other ways. There is also potential for additional indirect costs – from misallocating funding and decisions being based on inaccurate data.
56. Moving to a 10-yearly census would have implications for the electoral process, but these have yet to be fully considered.
57. A 10-yearly census would not provide fit-for-purpose population statistics over the 10-year period (using current methods). Over time, improving administrative systems and developing new methodologies may allow adequate population statistics to be produced over a longer period than at present.
58. Stakeholders see a 10-year interval between censuses as too infrequent to be able to successfully monitor outcomes for small areas and small population groups of policy interest, such as Māori, iwi, low-income families, and children.
59. A 10-yearly census would result in a direct reduction in census respondent burden, but this may be countered by an increase in respondent burden through other surveying.
60. Moving to a 10-yearly census would require amendments to the Electoral Act 1993, possibly to entrenched provisions. The implications of a 10-yearly census for the review of electorate boundaries and the conduct of the Māori Electoral Option require further work.
61. Conditions under which a 10-yearly census could be considered a cost-effective option are:
 - improving population estimates and projection methodology to a level that can be sustained over a 10-year period, at sufficient quality
 - user acceptance that the characteristics of small populations and small areas can be monitored only every 10 years
 - developing cost-efficient methods to target surveys of small populations, such as Māori and people with disabilities, that do not rely on the census as a survey frame
 - resolving the consequences for the electoral system.

Ten-yearly short-form census and large-scale intercensal survey or rolling census

62. A 10-yearly short-form census, with a large-scale sample survey or a rolling census, would counter one of the key limitations of a 10-yearly census by enabling frequent monitoring of small groups.

63. International experience indicates that these approaches are unlikely to result in any cost reductions compared with two five-yearly censuses. A large up-front investment would be required to plan, develop, and test them in New Zealand. Implementing them would be risky because of their complexity. The benefit of more-frequent data would be offset, to some extent, by the greater complexity of the data and by the reduced accuracy of small area data.
64. Both a 10-yearly short-form census with a large-scale social survey, or with a rolling census, would have consequences for the electoral system that would need resolution.
65. There are no compelling advantages of moving to either of these census models in New Zealand. Countries using these models have had census intervals of 8–10 years, with the key driver being the demand for more timely data.
66. The same electoral implications arise under this option as for the 10-yearly census option above.
67. Conditions under which a short-form census with a large-scale social survey or a rolling census would become the preferred approach are:
 - methodological and technological developments lower operating costs significantly
 - user acceptance of the greater complexity of data and reduced accuracy of small area data
 - resolving the consequences for the electoral system.

Administrative census

68. What an administrative census might mean in practice for New Zealand is unclear at present. Initially a number of possibilities will be investigated. These include the potential for New Zealand to implement the infrastructure needed for a fully register-based census, as in the Nordic model. A register-based census is not feasible in New Zealand at present, because the necessary government infrastructure does not exist. Alternatives involve using existing administrative sources that might form the basis of a statistical population register. Statistics NZ has completed an initial investigation of some key administrative sources, which cover large parts of the population and could form the basis of a statistical population register. Despite clear limitations, there is sufficient encouragement to explore this further.
69. The feasibility and cost of constructing a statistical population register, based on reusing existing administrative data, would depend heavily on whether databases could be improved and brought together to solve coverage problems and to obtain up-to-date address information. Other government initiatives to improve information systems and establish more coordinated service delivery may also present opportunities for an administrative census approach.
70. If feasible, an administrative census would result in a substantial reduction in the cost of producing census information. It would reduce respondent burden and enable some user needs to be better met by providing more frequent information.
71. A major limitation of this approach is that the range and quality of information produced would be limited to what already exists in administrative systems. Any administrative census approach is likely to require a coverage survey and a large sample survey to adjust for the limitations.

72. Implementing an administrative census in New Zealand would require public support, together with legal changes and the cooperation of other agencies. It would have consequences for the electoral system, which would need to be resolved.
73. It is difficult to identify the electoral implications of an administrative census without further details on its form and frequency.
74. Conditions under which an administrative census would become the preferred approach are:
 - cost-effective ways of covering important data gaps can be found
 - public acceptance exists
 - legal barriers can be overcome
 - consequences for the electoral system are resolved.

Proposed strategy for transforming the census

75. Statistics NZ's initial assessment and evaluation of different census options highlighted their strengths and weaknesses, and the conditions under which they could be adopted in New Zealand. However, with alternative data sources evolving, considerable uncertainty still exists around changing the census frequency or model. More development and testing is needed before decisions on long-term options, based on clear evidence, can be made.
76. In the short-term, the aim is to focus on modernising the current census model so we can achieve efficiencies and reduce census operational costs while continuing to meet key information needs. The longer-term goal is to develop a new model based on administrative data sources. Although New Zealand does not have the fundamental infrastructure to support a register-based census at present, we do have individual administrative data sources with a high degree of coverage. This situation is promising enough to be worth progressing. Moving to a census based on administrative data is the only option that offers the potential for a huge step-change in costs.
77. The process of transforming from a survey-based to an administrative-based census is not certain. It could take more than three census cycles to achieve (based on international experience) or may turn out not to be feasible. It depends on successfully identifying and developing suitable administrative databases, and on establishing alternative means of efficiently producing the social content of the survey-based census. The administrative databases are also likely to require modifications to meet the new statistical requirements of them, and a programme of public consultation is likely to be needed.
78. A major advantage of this strategy is the availability of census information every five years to test administrative solutions against. This will result in a faster transition towards an administrative census than longer census intervals would.
79. Transitioning away from the current five-yearly census model will take some time, due to the complexity and inter-connectedness of census data that feeds into the official population and social statistical system. Census data also acts as the trigger for other government processes.
80. A phased and parallel approach to the programme of work is proposed. This is to ensure that progress and prospects are clearly signposted, and that investment requirements can be reassessed as required and targeted effectively. Evaluation

stages will be built into the work programme, to assure the feasibility of the required outcomes and to ensure that the transitions are implemented smoothly with minimal disruption to key information users. Reports will be submitted to government, with the direction of the next phase determined by government's response. The phasing presumes a 2018 Census and the continuation of a five-yearly census cycle to complete the evaluation requirements promptly.

81. The proposed phases are :

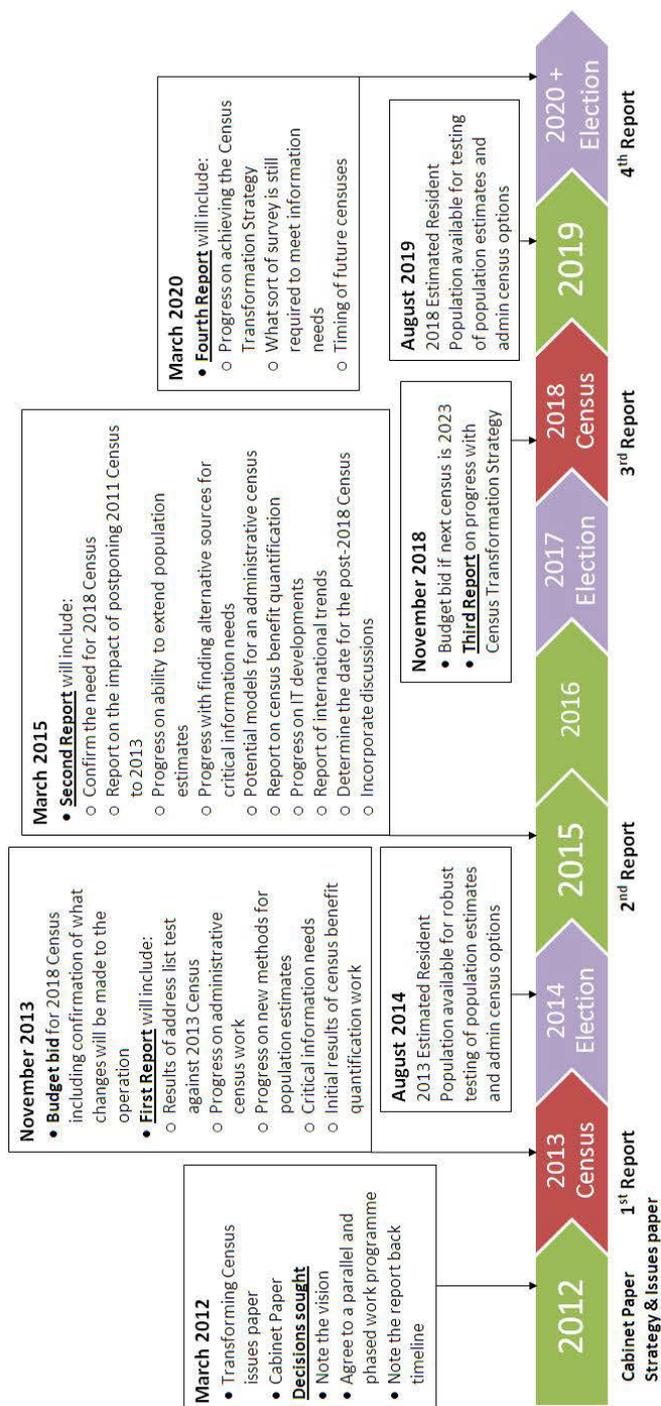
- Phase 1 – 2011–15: Develop new collection processes for the five-yearly census and progress investigation of existing administrative data sources. Report to Cabinet in November 2013 and March 2015
- Phase 2 – 2016–20: Implement new collection processes and determine improvements to data sources for an administrative census. Report to Cabinet in November 2018 and March 2020, including a review of census frequency issues and progress with developing administrative data sources
- Phase 3 – 2021–25: Complete new collection processes, review timing of future censuses, and progress development of administrative data sources
- Phase 4 – 2026–30: Complete evaluation and implementation of an administrative census, if feasible.

82. More information on the proposed work programme is in appendix 4. The diagram below shows the proposed timeline for transforming the census.

Proposed transforming census timeline

Figure 1

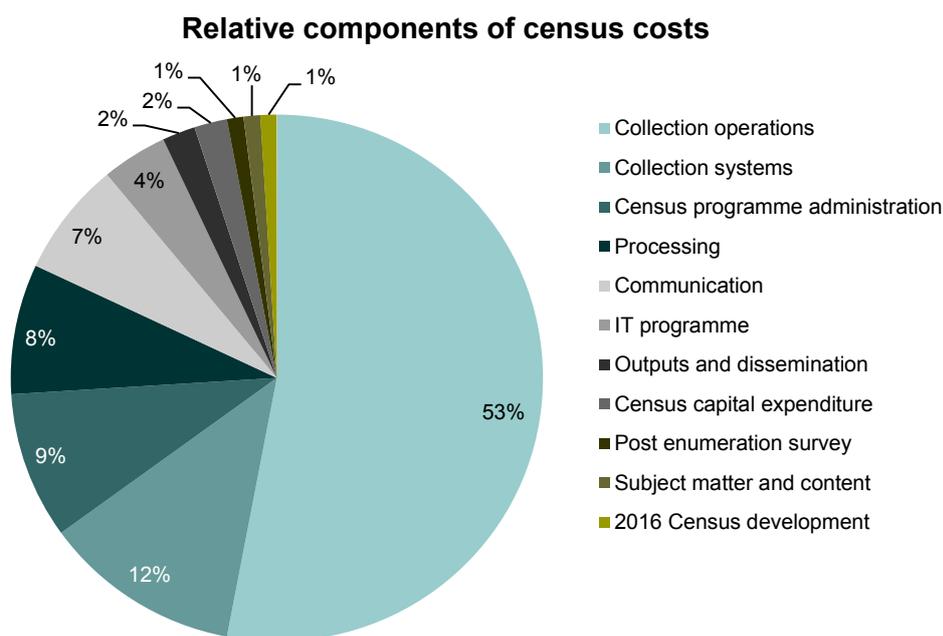
Proposed transforming census timeline



Appendix 1 – Census costs

83. A large temporary workforce is employed at each census to physically enumerate dwellings and deliver and collect census forms across New Zealand on census night. In 2013 more than 7,500 field staff will be employed to undertake the census. The collections phase of the census is the single largest component of census costs, accounting for around half the overall cost of conducting the census (refer figure 2).

Figure 2



Source: Statistics New Zealand

84. Each New Zealand census is a major investment for government, even though the per capita cost compares well internationally (see table 2). The budget for the 2011 Census was \$90.4 million, which translates to \$20.41 per person. Comparable costs for other countries with a full field-enumeration census are shown in table 2.

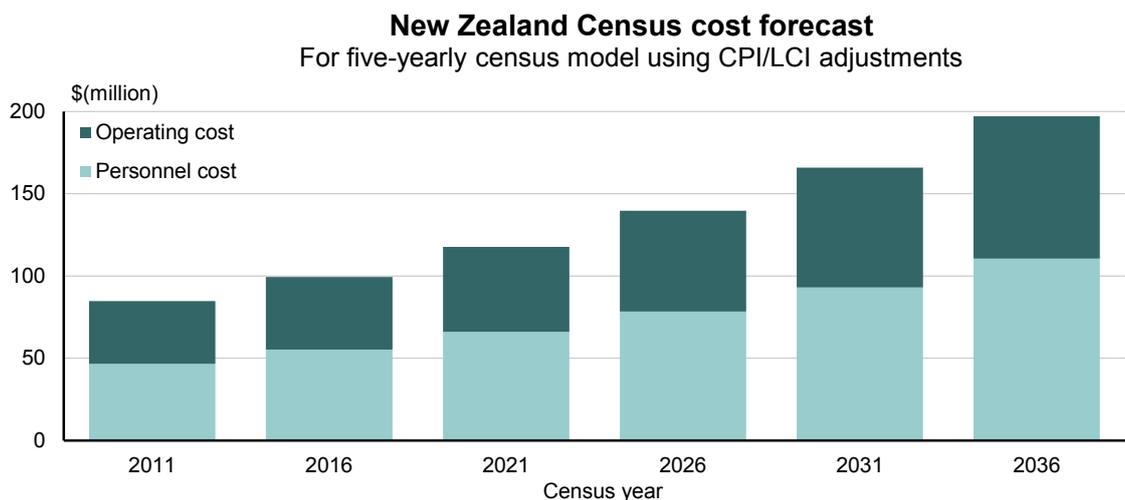
Table 1
Census costs compared internationally based on 2011 censuses in each country

	Country					
	United Kingdom	New Zealand	Scotland	Canada	Ireland	Australia
Frequency of census	10-yearly	5-yearly	10-yearly	5-yearly	5-yearly	5-yearly
Currency	Pounds sterling	NZ dollars	Pounds sterling	Canadian dollars	Euros	Australian dollars
Budget	£482,100,000	\$90,332,087	£57,035,027	\$630,373,000	€63,519,000	\$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	\$20.41	£10.84	\$18.25	€14.12	\$19.75
Cost per person in NZD ⁽¹⁾	\$18.46	\$20.41	\$23.13	\$24.56	\$25.38	\$26.26

1. At February 2011

Source: Personal contact

85. Census costs in New Zealand will continue to increase under the current collection model as the population and number of dwellings increases. Inflationary pressures also contribute to cost increases over time. Figure 3 shows the projected trajectory of census costs through to 2036, based on the 2011 Census. The figures in the graph show the five-yearly cost forecasts assuming the current census model is continued.

Figure 3


Source: Statistics New Zealand

86. In addition to cost, the increasingly complex ways in which people live are making census taking more challenging. It is increasingly difficult to contact and engage respondents, and expensive practices are required to maintain the accuracy of census data. At the same time, advances in computer technology and the growth of computerised records about individuals and services, including private sector administrative databases and social networking sources, are

providing new opportunities that could lead to producing more frequent and more cost-effective statistics, with reduced public burden.

87. The rising cost of the census has been the catalyst for discussion about the sustainability of the current census arrangements. It has raised questions about whether New Zealand could obtain better value for money by moving to a 10-yearly census. It is important to note in this context that although census costs are high, and continue to rise under the current census model, there is clear evidence from international experience that census costs could be reduced by modernising the census collection model.
88. A 10-yearly census interval is one option for long-term change, with the main objective of saving costs. However, one census every decade does not halve the costs of running a census compared with two five-yearly censuses. Statistics NZ is currently investigating this and has developed a cost model to assist with the complexities.
89. Statistics NZ's preliminary investigations indicate that the cost of operating a 10-yearly census is about \$122 million (based on the same assumptions as we budgeted from the original 2011 Census budget of \$90 million). Note that these costs do not include any costs associated with transitioning; if these are factored in, the cost of a 10-yearly census is likely to be about \$131 million. Another issue is that a 10-yearly census, while cheaper than two five-yearly censuses, will be less efficient. This is due to the longer time between censuses, which involves more rework, revamping infrastructure, re-learning of lessons, and loss of knowledge and experienced core staff as the programme shrinks back to base levels between censuses. Also, the contracts procured are likely to be more expensive.



Appendix 2 – Uses of census information

90. The Census of Population and Dwellings provides the authoritative count of population and dwellings in New Zealand every five years, and is the only comprehensive source of information on communities.
91. The census provides a unique source of detailed information on local communities and small population groups, such as Māori, iwi, migrants, children, older people, and single-parent families. As well as basic information on size and demographic make-up, the census gives an accurate and comprehensive picture of the socio-economic characteristics of local communities and small population groups (eg ethnicity, religion, family, education, occupation, and housing). Reliable and consistent information at this level is not available from other sources.
92. The census is a vital part of an integrated national statistical system, which includes sample surveys, registers, and administrative data. The census provides essential infrastructure for household surveys, including those conducted by the private sector, and is integral to the effective use of administrative data. It also provides a frame for surveying small populations.

Information needs

93. Information from the census is used extensively by a wide range of stakeholders, including central and local government, businesses, academics and researchers, non-profit organisations, international bodies, community groups, iwi, and the general public. The ways they use census data are equally wide ranging and have become embedded in many government systems and processes.
94. The uses of census data can be grouped into the following broad categories:
 - adjusting electoral boundaries for Parliament and determining the number of general and Māori electorates
 - reviewing local government representation arrangements
 - allocating resources and targeting investment by government
 - costing government programmes
 - monitoring outcomes of small populations
 - informing social and market research.

Electoral boundary adjustments

95. Electoral boundaries ensure fair constituency representation in Parliament, which is essential to maintaining trust in constitutional arrangements. Under the Electoral Act 1993 (section 35), the Representation Commission (the commission) is charged with determining the boundaries of general and Māori electorates and naming those electorates. The commission must review and potentially re-draw the boundaries following each census, and not on any other occasion, to take account of population changes and Māori electors' choice to be on either the Māori or general electoral roll (the Māori Electoral Option). The census also determines the timing of the Māori Electoral Option.
96. The number and placement of boundaries are based on total population. Calculations in the Electoral Act provide the population quotas used to divide the country into electorates. The basis for determining the population quotas, and hence the number of electorates is the General Electoral Population and the Māori Electoral Population. These populations are based on the number of people ordinarily resident in New Zealand, derived from the census. Utilising census data ensures a high level of public trust and confidence in the independence of electoral boundary setting. Census data is non-controversial

and therefore accepted by all parties with an interest in the boundary setting process.

97. The overriding rule for the placement of boundaries is that all electorates must have the same population size. This can be adjusted to allow plus or minus 5 percent in the electoral population quota of each seat (section 36). When setting boundaries, the commission must take into account the factors set out in the Act (sections 35(3)(f) and 45(6)).
98. The requirement for the commission to review the boundaries following a census, the calculation of general electorate seats, and the 5 percent tolerance of the quota, are entrenched provisions (sections 35 and 36). They may only be amended by a 75 percent majority in the House of Representatives or after a majority vote in a referendum. The definition of general electoral population (section 3) is also an entrenched provision
99. The review of electoral boundaries uses data at meshblock level, provided by Statistics NZ. This data provides the commission with the level of information needed to ensure that proposed or new boundaries are drawn in accordance with the statutory criteria. Currently, data at meshblock level can only be sourced from census data.

Māori Electoral Option

100. The number of Māori seats and the population quota for Māori electorates is based on the Māori electoral population. The calculation of the Māori electoral population (as defined in the Electoral Act) requires data on the number of Māori ordinarily resident in New Zealand. Information on the number of Māori in New Zealand, including by age group, is currently only able to be derived from the census.
101. The Māori Electoral Option (the MEO) is a four-month period within which any enrolled voter of Māori descent can choose to move between the general and Māori rolls. The Electoral Act (sections 76–79) requires that the MEO must take place in the same year as the census of population is taken, or if census and election years coincide, in the following year. The only other time outside this window that a voter can move between the rolls is when they first enrol. During each MEO voters can only change rolls once.
102. The size of the Māori roll contributes to determining the number of Māori seats in Parliament. Since 1993 there have been four MEOs (1994, 1997, 2001, and 2006). These four MEOs have seen the number of Māori electoral districts increase from five to seven. At the first MEO, following the move to MMP, the number of Māori electorates rose from four to five.
103. The last MEO in 2006 resulted in a net increase of 14,914 on the Māori roll and a net decrease of 4,634 on the general roll. There was no change in the number of Māori electoral districts for the 2008 election. Current population projections, and the growth trend in the Māori electoral roll over the past decade, indicate that a 2013 Census is likely to result in one more Māori electorate.
104. Unlike some provisions relating to the Representation Commission, provisions in the Electoral Act relating to the MEO are not entrenched. The MEO provisions can be amended by an ordinary legislative process.
105. Any change to the census will have electoral implications. Options to address the implications will each have advantages and disadvantages. These trade-offs will need to be considered when determining the best way to address the electoral implications of any proposed change to the census.

Local government representation reviews

106. Periodic reviews of local government representation arrangements help ensure fair representation of the various communities making up local authority districts. Changes in the allocation of members of local government may be made to reflect changes in the pattern of settlement in a district, and population growth or decline in communities. The allocation of members is determined mainly by using the usually resident population, which is based on either the most recent census or a more recent estimate of population by Statistics NZ. In carrying out reviews, populations are normally required at the meshblock level or by new groupings of meshblocks. Using population estimates involves greater cost and is more time consuming than using census data at the meshblock level.
107. Where a local authority has Māori wards or constituencies the number of members elected from these is determined using the general electoral population, and the Māori electoral population derived from the Māori Electoral Option referred to in paragraph 92. The issue of Māori seats on local authorities is currently being considered as part of the review of New Zealand's constitutional arrangements.

Resource allocation/targeting investment

108. Census data, and population estimates and projections derived from census data, are used extensively for resource allocation at national, regional, and local levels. More than \$150 billion of government funding is allocated on the basis of census data over a five-year period.
109. In the health sector, the census underpins the neutral allocation of around \$10 billion between district health boards (DHBs) each year, using a population-based funding formula (PBFF). The relative size of each DHB's population is the major determinant of its share of funding – between 83 percent and 98 percent. Since population size is such an important factor in the distribution of PBFF, the accuracy of the data is very important.
110. In the education sector, census data is used to calculate school decile ratings, which determine funding levels for schools. The school decile ratings are recalculated by the Ministry of Education after every census by using census meshblock data on household incomes, occupation, household crowding, educational qualifications, and income support. Schools are ranked in relation to every other school according to these five factors. A school's decile rating indicates the extent to which it draws students from low socio-economic communities. The lower a school's decile rating, the more funding it gets.
111. In addition to allocating health and education funding, census data are used by central and local government to guide investment of billions of dollars on everything from services for the elderly, transport infrastructure, broadband initiative, roading capacity, and other utilities.

Costing government programmes

112. Census data is vital to estimating the future fiscal costs of a wide range of government social expenditure programmes, and effectively evaluating alternative policy proposals designed to change payment thresholds and modify programme eligibility. Census data is used extensively by government agencies for this purpose.
113. For example, the Ministry of Social Development is required to forecast expenditure on government benefits and pensions as an input into preparing budget estimates each year. The size and composition of the eligible population are key drivers of expenditure on benefits and pensions. Census data plays a pivotal role in accurate forecasting. For example, census data on the partnership status of people aged 65 years and over is used in forecasting expenditure on New Zealand Superannuation, because the rates differ according to whether the person is single or partnered.

114. As well as the direct use of census data in programme costing, population projections derived from census data are used widely to forecast future costs across government portfolios. These include health, education, justice, transport, housing, and the tax system. Population projections also underpin virtually all future planning at national, regional, and local levels.

Monitoring the outcomes of small populations

115. National-level patterns can manifest themselves more dramatically at the local level and among small populations. The ability to understand diversity and change at lower levels is the unique contribution of the census.
116. The census is a key source of information on the characteristics and circumstances of Māori. It provides the only reliable data to monitor the health of te reo Māori and to understand iwi dynamics. Te Puni Kōkiri and other government agencies use census data on Māori for reporting on initiatives to advance Māori development and well-being, such as Whānau Ora and the Māori Language Strategy. Iwi authorities also depend heavily on census information for monitoring iwi development plans.
117. The census is the only body of reliable and comprehensive information on small population groups, such as Pacific peoples, ethnic communities, youth, older New Zealanders, single-parent families, and new migrants. Government departments, such as the Ministry for Social Development and the Ministry for Pacific Island Affairs, rely on census information to monitor outcomes for these population groups, and to inform and evaluate policy interventions.
118. The census also provides a frame for surveying small populations. It has been used to conduct post-censal surveys of people with disabilities at the last three censuses, and a further survey is scheduled to be held after the 2013 Census. A post-censal survey of Māori is also planned to follow the 2013 Census. The post-censal survey methodology is the most efficient and cost-effective way of surveying small populations, and enables more detailed information to be collected than is possible through the census.
119. The census is the primary source of information on the characteristics of geographical populations, territorial authorities (including Auckland and Christchurch city), neighbourhoods, and Māori tribal areas (rohe). Local authorities depend on census data to meet the accountability requirements of local government legislation, which include producing regular monitoring reports on the well-being of their populations every three years. They also use small-area data from the census to analyse commuter flows and develop transport strategies.
120. Census data also provide an important evidence base for monitoring communities and neighbourhoods where social and economic outcomes are poor or under threat, and for developing programmes to address the specific challenges faced by these areas. Users require data for very small geographical areas to allow them as much flexibility as possible when aggregating areas.

Social and market research

121. Economic and social researchers make widespread use of census data to generate new knowledge. Recent examples of major research projects include the NZ Census Mortality Study, Cancer Trends, NZ Deprivation Index, Family Whānau Wellbeing Project, Modelling Social Change in New Zealand, and Labour and Population Dynamics.
122. There is strong interest amongst politicians and researchers in understanding the flows of population between New Zealand and Australia, and the impact on the skills, incomes, labour market structures, and other characteristics of both countries. The census is an important data source for these types of analyses, which depend on the availability of comparable census information. To obtain comparable data, censuses must be conducted at similar times and include similar questions.

123. Census data is also used to inform business processes and decisions. Businesses use the data to segment and classify areas, match supply to local demand, plan services (eg location of shops, banks), target local advertising, establish market penetration rates, and make merchandising decisions.

The accuracy of data required

124. The census aims to meet information needs with data that is fit-for-purpose. Of fundamental importance is the need for accurate statistics on:
- the population count
 - the characteristics of small populations.
125. Accurate statistics depend on achieving both a high coverage rate and a high response rate. A high coverage rate means that the primary purpose of the census (to count the population) has been achieved. A high response rate means that a high proportion of the population has completed and returned their census form.
126. International performance benchmarks are for a census coverage rate of at least 98 percent and a minimum response rate of 94 percent. At the last New Zealand Census of Population and Dwellings the coverage rate was 98 percent and the response rate was 94.8 percent. Response rates below 94 percent mean there will be a lot of missing data. Imputation is used to provide the missing data for age and sex – to achieve accurate population counts. However, for other variables the data remain missing, resulting in low counts. The impact of low counts tends to be disproportionately spread across population groups that are of particular policy interest, such as Māori and youth. For example, an 88 percent response rate in the 2006 Census would have resulted in an undercount of the Māori population of around 70,000, and produced a national count lower than that recorded in the 2001 Census.
127. The key effects of poor census coverage and/or response rates are that electoral boundary adjustments will not fairly reflect population change, and that official population estimates and projections may have more error. As noted above, population estimates and projections are used to cost government programmes and underpin almost all future planning. The economic impact of inaccurate data could be significant. For example, a 1 percent misallocation error in the \$150 billion spent by the Ministries of Social Development, Health, Education, and the New Zealand Transport Agency between 2006 and 2011, based on population models, equates to \$1.5 billion. This is equivalent to 16 times the budget for the 2011 Census.



Appendix 3 – Census models

128. Approaches to census-taking can be categorised into three main groups:
- periodic full-enumeration census
 - continuous measurement census
 - administrative census.
129. In practice, many countries use a combination of these approaches. The three approaches are described below, with a brief evaluation of their advantages and disadvantages.

International perspective on census models

Periodic full-enumeration census

130. The full field-enumeration census model provides highly accurate information at a point in time. The information becomes less accurate and relevant over time. This model is used in most countries including New Zealand. Of 138 countries that responded to a recent United Nations survey, 83 percent used a full field-enumeration census model.
131. The frequency of a full field-enumeration census varies. The United Nations recommends that countries take a national census at least every 10 years, but recognises that some countries need more frequent censuses because of rapid population change and/or housing circumstances. Internationally, 10 years is the most common interval, followed by five years. Few developed countries take their census at other intervals. Countries with high levels of external migration, including Australia, Canada, the Republic of Ireland, and New Zealand, conduct a five-yearly census. This ensures the continued availability of accurate population statistics and enables rapidly changing communities and small population groups to be monitored.
132. In a full field-enumeration census, a questionnaire is administered to every household and individual in the country on census night. In addition to collecting essential population data, there is scope for asking questions on social and economic topics at marginal extra cost. Over time the questions can evolve, in response to new information needs and emerging phenomena, so the data remains relevant. The main constraint is the restriction on the length and complexity of the questionnaire – to limit the burden on respondents.
133. Some countries, including Canada, administer short and long forms within the context of a full field-enumeration census. The short form contains only questions intended for universal coverage, while the long form collects information from a sample of households and people – to reduce respondent burden. The main purpose of the short form is to count the population and collect essential demographic and socio-economic characteristics. The long form collects more detailed demographic, housing, and socio-economic information. There is wide variability between countries in the short form's content and length and in how the long form is administered. Some countries have a very limited set of questions on the short form while a few have a substantial number. Typically, 10–20 percent of the population receives the long form.

134. Although simple in concept, the full field-enumeration census poses challenges in organisation and implementation. The census is an elaborate and complex operation that involves large costs concentrated within a short period. The most significant cost item is collection, mainly due to the need for a very large number of temporary staff for the field operation. This item represents around 50–60 percent of census costs. Countries are increasingly looking to reduce collection costs by mailing-out census forms and by encouraging Internet response. The mail-out of forms depends on the existence of high-quality address data.
135. The cyclical nature of the full field-enumeration census makes it difficult for statistical agencies to retain experienced census staff and use their knowledge from one census to the next. This is particularly a challenge where censuses are conducted only every 10 years. Countries that conduct a 10-yearly census also face the challenge of having to completely redevelop their census each time, because technology becomes obsolete. Those running five-yearly censuses can benefit from reusing technology and business processes, resulting in efficiencies and cost savings. For example, reuse savings between the 2011 Census and 2013 Census in New Zealand are estimated at \$18 million.
136. The full field-enumeration census requires a great deal of cooperation and coordination with local and national organisations and groups but above all, the public's full awareness and participation. Public willingness to cooperate is vital to the quality of the census results. Some countries have experienced growing difficulties in this respect. Respondents are increasingly reluctant to open their doors, especially when they are older, living alone, or residing in large cities or neighbourhoods where security is a concern. Young people are hard to engage with and people with mobile lifestyles and multiple residences also make the enumeration difficult.

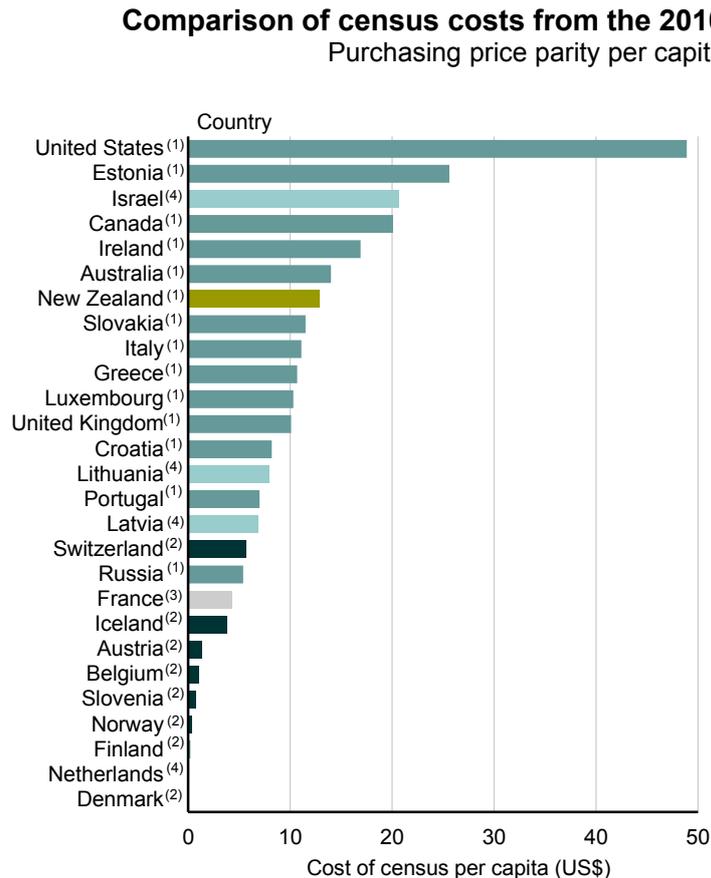
Continuous measurement census

137. A continuous measurement census is based on a large-scale continuous annual survey. Such a census produces data on a more frequent basis than a traditional census, but with less local precision and reduced detail for very small groups. This trade-off between greater frequency and less accuracy has been welcomed in the United States, where censuses have been conducted every 10 years. The United States and France both use this approach, with the American Community Survey and the French Rolling Census.
138. Like the full field-enumeration census, the continuous measurement census obtains information on the characteristics of the population and households through a questionnaire. The questionnaire is administered to an annual sample of population and households. The American Community Survey, which has replaced the long-form census in the United States, has an annual sample of three million households. Content evolves over time and there is a low marginal cost for new questions. Information is aggregated over several years and released as moving averages, to provide reliable estimates for small populations.
139. The main advantage of this census approach is that it provides up-to-date statistical information to users. It allows the production of annual estimates, although data for small areas are aggregated over several years and released as moving averages (five years for the smallest areas). The continuous measurement approach also has the advantage of spreading the census workload and costs over time, which enables the retention of census staff and knowledge. However, it does not result in any reduced cost when compared with a full field-enumeration census. It is also more complex to design and the data are more complicated to deal with. In France, complex mathematical adjustments are required to bring the data to a common reference period. The resulting estimates come from an enumeration but also incorporate a degree of modelling and sampling error.

Administrative census

140. An administrative census uses registers and other administrative data sources, rather than field enumeration, to produce census information. Some additional surveying may be needed. This approach maximises the use of data collected by other government agencies, places little additional burden on individuals, and is less costly to implement than other census approaches. Figure 4 compares the costs of census-taking in the 2010 census round, for countries with an administrative census against costs for countries with other census models.

Figure 4



1. Enumerated census
2. Administrative registers
3. Rolling census
4. Other (register and traditional/integrated censuses)

Source: UNECE-UNSD survey on the 2010 round of population and housing censuses.

141. The costs reported internationally for administrative censuses include only the direct costs associated with producing census outputs. They do not take into account the cost of creating and maintaining registers that are used for other government purposes.
142. Administrative censuses are the main source of census data in 15 countries or areas, mostly in Europe, and are being considered by a number of other countries. All 15 countries that produce census outputs from administrative sources use a national population register.
143. Successful administrative censuses depend on the existence of high-quality data from administrative sources. In particular, a high-quality national population

register is needed. The population register is an individual-level list that establishes the reference population of those people resident in the country. It is continually updated by adding records for births and new migrants and flagging those who leave the population through death or out-migration. An address register and/or dwelling register is also essential. People are linked to their place of residence to provide geographic information. This allows the production of population estimates. Other administrative registers and data sources are linked to the population register to enable the production of a range of socio-economic data on the characteristics of individuals and dwellings, such as their income, educational qualifications, and labour force status. For example, Finland used 30 administrative sources in their 2000 Census.

144. Political and public acceptance of the need for a population register, a personal identity number, and accurate and timely capture of address changes are pre-requisites for a register-based census. This approach also demands close cooperation between the statistical agency, register authorities, and the public administration, as well as strict legislative oversight. Generally, establishing and maintaining a high-quality register-based system requires significant resources and societal will.
145. In addition to reduced cost and reduced respondent burden, an important advantage of an administrative census is the ability to produce data on an annual basis for many variables. A major limitation of this approach is that the range and quality of the information that can be produced is limited to what already exists in registers and administrative systems. Surveys are sometimes needed to fill information gaps. Another important issue is the long lead time before registers and administrative data sources have typically been able to be used for census-type activities. In countries that have made the transition to an administrative census, it has usually taken 20–30 years to move to a fully register-based census. For example, Sweden, which has had a population register since the 1960s, did not move to a census based entirely on administrative sources until 2011. The transition to an administrative census is a lengthy process because of the step-by-step nature of the development process. First, the infrastructure for an administrative census needs to be established, including new legislation, creating or improving a national population register and dwelling register, and developing new statistical systems. Next, subject-matter statistics from administrative sources must be tested against census data. Administrative data is not introduced into the census until the quality is considered sufficient.
146. The general pattern for countries that have moved to a fully administrative census is as follows. The central population register is adopted first, and is initially supplemented by surveys or complete enumeration to collect information not available from the register. Then, as additional registers are developed and their quality becomes sufficient for census purposes, the collection of data is gradually replaced by administrative registers.

New Zealand perspective on census models

147. This section assesses the benefits, costs, and risks of different census frequencies and models in the New Zealand context. It focuses on the following five approaches:
 - five-yearly census
 - ten-yearly census
 - ten-yearly short-form census with large intercensal sample survey
 - rolling census
 - administrative census.

Five-yearly census

148. A five-yearly point-in-time full field-enumeration census would enable census information to continue to be provided with the accuracy and frequency required to support its most important uses, ie electoral data and population estimates. With a three- or four-yearly electoral cycle, a five-yearly census frequency enables the revision of electoral boundaries at least every two elections.
149. Population estimates can be sustained at an adequate level of quality through the five-year census interval. Estimating populations for subnational areas is difficult because of the lack of direct measures of internal migration. Despite this, estimates are generally seen to be just adequate by the end of the five-year census interval.
150. Census data is used extensively for planning, monitoring, and evaluating government policy, programmes, and services, particularly at a local level and among small population groups. The five-year interval between censuses is generally regarded to be adequate for most monitoring purposes, although more frequent information would align better with local government planning and reporting requirements.
151. Census costs are high under the current model (\$90 million for the 2011 Census). Transformation of the census collection methodology, so that it is less dependent on a large field workforce, would reduce the impact of population growth on future census costs. Other changes to the content and outputs of the census could be introduced in a phased way alongside changes to the collection process.

Ten-yearly census

152. A shift to a 10-yearly census in New Zealand would mean that new census information would be available less often, and would be 11 years out of date by the time the next census data became available (compared with a lag of around 6 years with a five-yearly census).
153. Moving to a 10-yearly census would have implications for the electoral system. If the link between the review of electoral boundaries and the census remained, the tolerance level would likely need to be reviewed. Amendments to the frequency of the Māori Electoral Option would also need to be considered. The implications and workable options require further work. Amendments to entrenched provisions in the Electoral Act may be needed.
154. Deterioration of the accuracy of intercensal population estimates would become problematic, particularly given that some estimates are already marginal towards the end of a five-year period. Although encouraging investigations have been made into alternative methods of estimating subnational populations (incorporating a wider range of administrative data), it remains uncertain whether this research will produce estimates that are sufficiently accurate over a 10-year period.
155. A 10-yearly census would mean that census information would become increasingly ineffective for planning and monitoring change for local areas and small sub-populations. New Zealand already has in place a programme of national sample surveys that monitor change successfully at a national level. However, these do not capture the diversity present at local levels and among small population groups of high policy interest, such as Māori. This is the unique contribution of the census.
156. Although a 10-yearly census would result in some savings compared to a five-yearly census cycle, it is likely that these savings would be substantially offset by cost-shifting. In countries with a 10-year interval between censuses, demand has

typically shifted to other parts of the national statistical system to bridge the information gap. This has led to considerable investment in alternative statistical infrastructure. For example, in the US an annual intercensal survey has been developed to meet the demand for more frequent low-level socio-economic information than can be provided from a 10-yearly census.

Ten-yearly short-form census and large-scale intercensal survey

157. A variant of the 10-yearly census option is a 10-yearly short-form census with a large-scale intercensal survey. The short-form census is aimed solely at producing accurate population counts and is limited to key demographic information. The objective of the intercensal survey is to provide up-to-date information on the socio-economic characteristics of small groups in the population, including small geographic communities and small population sub-groups.
158. In order to meet the need for data on small population groups and low levels of geography, the intercensal survey would need a large sample. Preliminary investigations suggest that in New Zealand an annual sample of 200,000 individuals would be needed to produce estimates for area units, with data averaged over five years. A sample of this size would provide excellent annual estimates at a national and regional council level, good-quality three-yearly estimates for territorial authorities, and estimates with, we expect, moderate to high sample errors for area units. It would not provide meshblock-level data. A continuous survey of 200,000 individuals would be expensive to run.
159. In the US, it took 18 years to implement the American Community Survey (ACS). The lessons learned from the US experience could shorten this period for New Zealand, but it would require the same four phases: development, testing, demonstration, and full implementation. The US implemented the ACS only after comparing long-form data from the 2000 Census with corresponding data from the demonstration ACS. If a demonstration phase in New Zealand was conducted in parallel with the 2018 Census, the development and testing would have to be completed by 2017. Evaluation of the demonstration data and planning for the full implementation of the survey would take another 2–3 years following the availability of 2018 Census data. This means that the earliest the survey could begin collecting data would be 2021, and the earliest that it could generate small-area data would be 2026.
160. Based on the US experience, a 10-yearly short-form census supplemented by a large-scale survey is unlikely to result in any cost savings compared with a five-yearly census. The main advantage of this option over the 10-yearly long-form option is that it would meet the demand for timely data on small populations and low-level geographies, albeit at a lower level of detail and accuracy than a full enumeration census.
161. Compared with a five-yearly census, this option would provide lower-quality population estimates and less detailed socio-economic information. The same electoral implications arise under this option as for the 10-yearly census option outlined above.

Rolling census

162. Replacing the current five-yearly full field-enumeration census with a rolling census in New Zealand would result in more frequent data, with updated estimates produced each year. Annual population statistics from the census would remove the need to derive population estimates using a combination of census and administrative data. The availability of annually updated data on the socio-economic characteristics of small populations would have benefits for some users, such as local government, which has three-yearly planning and reporting requirements. However, the advantages of more frequent data would

be offset by its increased complexity, making it difficult to interpret and use. In addition, New Zealand's mobile population would have an adverse impact on the quality of the data, since people who move may be enumerated more than once or may be missed. The effects of this may not cancel out, particularly for small areas.

163. From an operational perspective, a rolling census would have the advantage of spreading the workload rather than concentrating it in one year. This approach reduces the operational risks of the census, as it allows recovery from unforeseen events, such as the Christchurch earthquake. A geographic infrastructure (address list or maps) would be required, but unlike the full field-enumeration census, the infrastructure would need to be continuously updated rather than being updated just once before the census.
164. Implementing a rolling census in New Zealand would require considerable development and testing. We would need to undertake a field test study in parallel with the census to evaluate the quality of the data using the new methodology. Although New Zealand could benefit from the experiences of France, it would take at least 15 years before such a methodology could be implemented because of its complexity. Given that the data are released as moving averages over a five-year period, it would be a further five years before data were available.
165. The rolling census approach would not result in any reduction to census costs, and in fact would likely contribute to higher costs because of the complexity of the design. Because most of the population would be enumerated over the census cycle, it would not contribute to any reduction in respondent burden.
166. A rolling census would be challenging from an Electoral Act perspective. It would give rise to data source and methodology issues, and would likely require changing the data basis of determining boundary changes. Amendments to entrenched provisions in the Electoral Act may be needed.

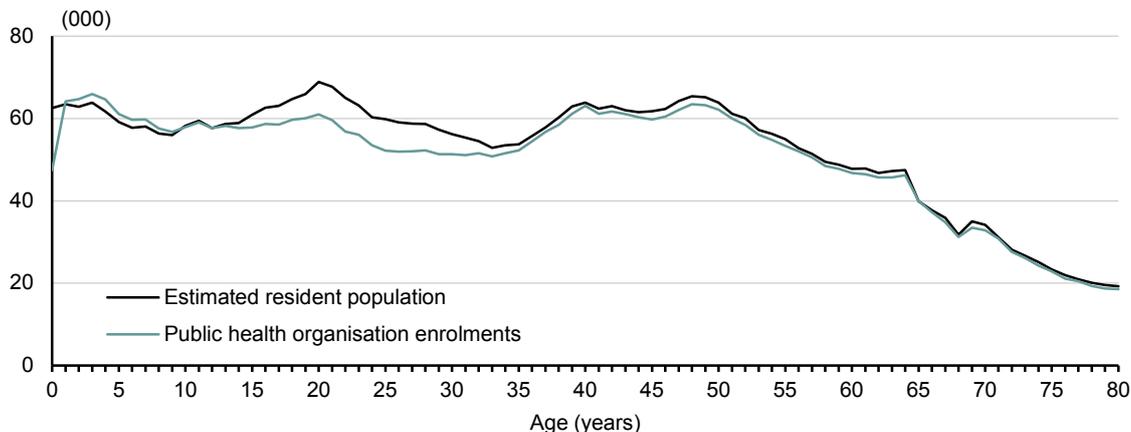
Administrative census

167. The exact form of an administrative census in New Zealand is unclear. What is clear is that development of an administrative census would be challenging and lengthy to implement. New Zealand has neither a population register nor a unique identifier held in common across administrative systems. These are essential preconditions for a register-based census. Also, none of the existing administrative systems in New Zealand provides complete coverage of the New Zealand population, which is necessary to construct a statistical population register.
168. The feasibility and cost of creating the appropriate government infrastructure for a register-based census in New Zealand are unknown. Establishing a population register and unique identifier would require a government-wide business case, and would be contrary to the Privacy Act as it currently stands. Public and political acceptability would need to be established. An indication of the magnitude of the costs of establishing a population register is available from Canada, where the start-up costs of a national identity card system were estimated at \$3 billion to \$5 billion in 2003. The budget for the 2011 census in New Zealand was \$90 million, so it is unlikely that a national population register would be cost-effective solely on the basis of replacing the census. A population register would need to provide additional offsetting savings and/or benefits to government, such as administrative efficiencies and fraud prevention. It is important to note, however, that once established, a register-based census would enable the production of census-type outputs at around 10 percent of the cost of a traditional census.

169. If a formal population register was established in New Zealand, data from it would need to be validated against census data to ensure that it met minimum quality standards for census outputs. This suggests that the earliest a population register could be used as the basis for census population counts would be about 10 years after its implementation, assuming five-yearly census data was available to validate the quality of the administrative data. To move to a fully register-based census, data from other administrative sources would need to be linked to the population register to provide other census content. The experience of other countries suggests that it could take several decades before the content and quality of data from administrative sources would be sufficient to adopt a fully register-based census. In the meantime, the population register would have to be supplemented by surveys and/or complete enumerations to collect the additional content.
170. An alternative to a register-based census involves the use of data from existing administrative sources to establish a statistical population register. We have completed an initial investigation of several administrative data sources that include large sections of the New Zealand population. These could provide the basis for a statistical population register. The most promising sources include health data and tax data, because they are national datasets and include people of all ages. Electoral data and education data are other good data sources but are restricted to certain age groups. These and other sources are already used to help derive subnational population estimates in between censuses. But each source is incomplete compared with the national resident population, and is subject to other limitations. As examples, figures 5 and 6 below compare the official estimated resident population figures, which depend on the census, with health data (figure 5) and tax data (figure 6). The figures show national totals by single year of age, one of the most essential and simplest outputs provided by census. Older age groups tend to be fairly consistent. However, as can be seen, there are major differences between the administrative sources and the official data for children and for young adults through most of the working ages. These differences become more pronounced and more variable as the data is broken down by sex, and by geographies such as territorial authorities. Neither source includes Māori descent (needed for electoral calculations), and ethnicity is absent from tax data and poorly collected in health data.
171. Despite these limitations, investigation of existing administrative data sources has been sufficiently encouraging to warrant further exploration of their use. The feasibility and cost of constructing a statistical population register based on re-use of existing administrative data sources would depend heavily on whether these data sources could be improved and linked to solve coverage problems. Because this type of approach risks adverse public reaction, a public consultation process would be necessary. It is important to note that no other country has yet implemented an administrative census without a formal registration system.
172. It is difficult to identify the electoral implications of an administrative census without further details on its form. Amendments to entrenched provisions in the Electoral Act may be needed.
173. The production of census outputs from administrative data would result in a significant reduction of census costs. Another key advantage of an administrative census would be the ability to produce census-type information more frequently, although the range and quality of the statistical outputs would be dependent on the information collected through administrative systems. It is important to note that some of the content that is currently collected in the census may never be part of any administrative collection. For example, mode of travel to work, iwi affiliation, languages spoken, religion, and family composition. If data on such topics continued to be rated as important, surveys would be required.

Figure 5

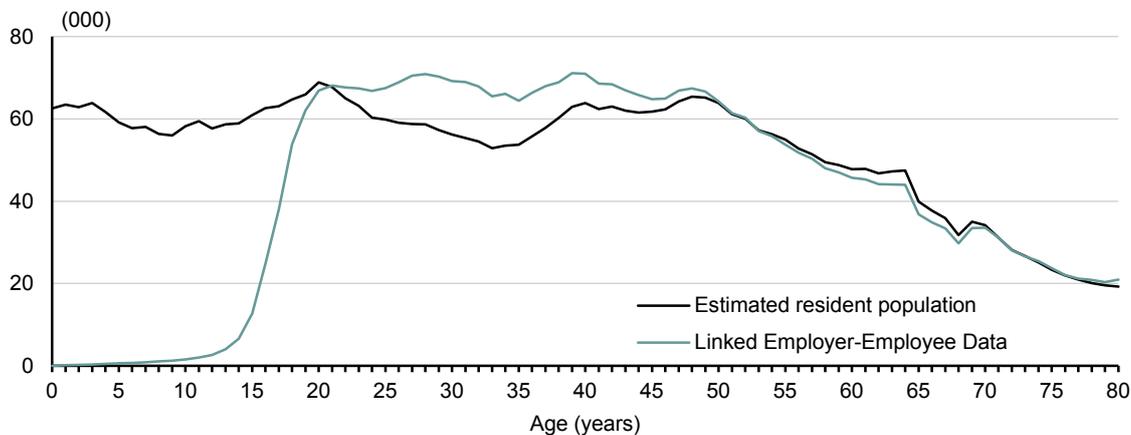
Estimated resident population compared with health data from public health organisation enrolments, 2011
National totals by single year of age



Source: Statistics New Zealand

Figure 6

Estimated resident population compared with tax data from Linked Employer-Employee Data, 2011
National totals by single year of age



Source: Statistics New Zealand

Summary evaluation of alternative census models against current model

174. Table 4 summarises the key benefits, costs, and risks of four alternative census models against the current five-yearly full field-enumeration census model.

Table 2**Benefits, costs, and risks of alternative census models compared with a five-yearly census**

	Ten-yearly census	Ten-yearly census plus survey	Rolling census	Administrative census
National population estimates				
Accuracy	Lower	Lower	Similar	To be determined
Small populations and low-level geographies				
Accuracy	Similar	Lower	Lower	To be determined
Timeliness	Lower	Increased	Increased	Increased
Costs				
One-off development	Increased	Increased	Increased	Increased
Running costs	Lower	Similar	Similar	Lower
Respondent burden	Lower	Lower	Similar	Lower
Privacy concerns	Similar	Similar	Similar	Increased
Risk	Increased	Increased	Increased	Increased

175. An immediate shift to a 10-yearly census following the 2013 Census would result in some savings. However, these are likely to be offset by cost-shifting as government agencies seek to make up for inadequate information in other ways. There is also potential for indirect costs from misallocation of funding and decisions based on inaccurate data. A 10-yearly census would result in a direct reduction in census respondent burden, but this may be countered by an increase in respondent burden through other surveying.
176. International experience indicates that a 10-yearly census combined with a large-scale sample survey, or a rolling census, would not result in any cost reductions. The experience of France and the US indicates that the cost would be at least as high as a five-yearly census and possibly more. A large up-front investment would be required to plan, develop, and test these approaches in New Zealand. Implementing them would be risky because of their complexity. The benefit of more frequent data would be offset, to some extent, by the greater complexity of the data. In the case of the 10-yearly census and large-scale sample survey option, the benefit would be offset by the reduced accuracy of small-area data. There are no compelling advantages of moving from a five-yearly census to a rolling census or to a 10-yearly census supplemented by a large-scale continuous sample survey in New Zealand. Countries that have adopted these models have had census intervals of 8–10 years, with the key driver being the demand for more timely data.
177. A register-based census is not feasible in New Zealand at present, because the necessary government infrastructure does not exist. However, initial investigation indicates that some administrative data sources cover large segments of the population. If coverage was improved, such as through linking data sources, these could form the basis of a statistical population register. Production of census information from administrative sources would result in a substantial reduction in census costs. It would also reduce respondent burden and enable user needs to be better met through the ability to produce census-type outputs more frequently. Implementing this model, however, would require public support, together with legal changes and the cooperation of other agencies.

178. The five-yearly full field-enumeration census is currently the only viable approach for the continued delivery of good-quality population statistics and detailed socio-economic data for small areas and population groups. Although the cost of a five-yearly full field-enumeration census is high, there is potential to change the cost structure through modernising the collection methodology and other efficiencies in the processing and dissemination of census outputs.
179. Although the five-yearly census is the only immediately viable approach for meeting critical information needs, including Tier 1 statistics, the evaluation has highlighted the considerable benefits of producing census-type outputs from administrative data sources. From a strategic point of view, there are strong incentives to investigate an administrative census in New Zealand. Using administrative data wherever possible is highlighted in Statistics NZ's strategic priorities, and in the long-term the costs of census information could be greatly reduced.

Transformational pathways

180. There are a number of different pathways that could be taken to transition to an administrative census. These pathways are not mutually exclusive and any transition could be paused or stopped at points along the path depending upon feasibility, costs, and government policies.
181. Each of the pathways has a five-yearly census as the starting point, but the pathways diverge and transition through different census models/frequencies as they move towards an administrative census. The four potential pathways are:
 - A: transition to an administrative census while continuing the five-yearly census cycle
 - B: transition to an administrative census while holding a census every 10 years
 - C: transition to an administrative census while holding a census every 10 years, supplemented by a large-scale community survey
 - D: transition to an administrative census while conducting a rolling census.

A: Transition to an administrative census while continuing the five-yearly census cycle

182. This pathway involves continuing with a five-yearly census that is increasingly supplemented with administrative data. Using administrative data to transform the collection phase of the 2018 Census would reduce the cost structure of the census following initial investment. A major advantage of this option is the availability of census information every five years to test administrative solutions against. This would result in a faster transition towards an administrative census than with longer census intervals. This is assuming that we are developing administrative alternatives over the five years.

B: Transition to an administrative census while holding a census every 10 years

183. Under this pathway option, the timing of the move to a 10-yearly census would depend on when new models for producing population statistics became available. Transformation of the collection phase of the census would be implemented in the census following the 2013 Census. As in the previous pathway option, census data would be used to test administrative data solutions. However, with a 10-year gap between censuses there would be fewer opportunities for testing, and this would delay the transition to an administrative census. A 10-yearly census would imply accepting out-of-date information about

small populations and communities. It is likely that agencies would seek to address these in other ways, offsetting to an unknown extent the savings from moving to a 10-yearly census.

C: Transition to an administrative census while holding a census every 10 years, supplemented by a large-scale community survey

184. The advantage of a large-scale survey is that information about small groups is available more frequently, though with less accuracy than a five-yearly census. Under this pathway option, the timing of the shift away from a five-yearly census would depend not only on when models for producing population statistics became available, but also on the time required to develop and implement a large-scale community survey. A large-scale field test would be needed to validate the survey results against census data. The earliest that this could take place is at the 2018 Census. As a result, the soonest that the community survey could be fully implemented would be 2020/21. Because the purpose of the community survey would be to collect long-form census information, it would need to be accompanied by a short-form census at the beginning and end of the decade.

D: Transition to an administrative census while conducting a rolling census

185. This pathway option is similar to the previous one, in that the timing of the shift away from a five-yearly census would depend on the time required for developing and implementing a rolling census. Because of the complexity of the rolling census, it is likely that the development time would be longer than that required for a community survey. This suggests that the earliest a rolling census could be implemented would be around 2025/26. Because data are aggregated over five years, the first results would not be available until 2030/31. This means that at least three more five-yearly censuses would be needed before the traditional point-in-time census could be replaced by a rolling census. It is questionable whether the additional development needed for a rolling census would be justified if the long-term goal is an administrative census.



Appendix 4 – Information on the proposed work plan for transforming the census

186. Statistics NZ's long-term goal is to produce census-type information from administrative sources, rather than by the current census approach, which takes a survey of the whole population. The short-term focus is on modernising the current census model to create efficiencies and reduce operational costs.
187. To achieve this goal we developed three objectives to guide the transformation programme):
- A: improve population statistics between censuses
 - B: improve the efficiency and reduce costs of the current census model
 - C: investigate alternative census options, including extending the census cycle to 10 years and implementing an administrative census.
188. The three objectives are summarised below.
189. **A: Improve population statistics between censuses**
This will progress work on investigating alternative methods for producing population estimates and projections, and incorporating data from a wider range of administrative sources, to reduce reliance on a five-yearly census.
190. Regular updating of population estimates and projections is needed to reflect New Zealand's mobile population, which causes the accuracy of the data to deteriorate at an increasing rate over time. The degradation of the quality of the estimates and projections is greater at the subnational than national level because a direct measure of internal migration is unavailable; ie there are no data sources that accurately capture all the people who change their address within New Zealand. With the existing methodology, subnational population estimates are generally seen to be just adequate at the end of the five-year period after census date. Estimates are mostly within 5 percent of the true value. However, there are substantial errors in some areas and for some age-groups, such as young adults, where migration rates are high.
191. Exploratory work is underway on investigating the feasibility of using alternative statistical models and a wider range of administrative data sources to determine population estimates. There are two key components to this work. Firstly, evaluation of a range of alternative administrative and commercial data sources to determine their usefulness for producing population estimates. Secondly, the development of a new (Bayesian) model of population estimation, incorporating data from multiple administrative sources.
192. We have produced a report summarising our evaluation of alternative data sources for population estimates. It identifies two administrative data sources – Linked Employer-Employee Database (LEED) and health service data – that provide useful symptomatic indicators of population flows, namely internal migration via people's change of address information. This data has now been incorporated into the current model for producing population estimates.
193. **B: Improve the efficiency and reduce costs of the current census model**
As the collection phase of the census accounts for a large share of census costs, the collection methodology will be revolutionised. This will include the development of an address register and creation of a new multi-modal census, with a strong drive towards Internet completion.

194. We propose to change the collection paradigm from face-to-face delivery of forms and Internet codes to a less labour-intensive mode. This will involve mail-out of Internet access codes followed by mail-out of paper forms, and maximising the return of forms by Internet or by mail-back. The proposed change has been made possible by an amendment to the Statistics Act in 2010. The amendment removed the requirement for forms to be personally delivered, which has opened the door for other delivery methods.
195. We will also investigate and progressively implement other efficiencies within the processing, analysing, and dissemination phases of the census process.
196. **C: Investigate alternative census options**
This will include investigating the development of an administrative census, and potential options for establishing a high-quality statistical population register. Overseas experience has shown that a population register is critical to the operation of a successful administrative census.
197. Privacy and public acceptability are perhaps the first issues to consider in any approach to an administrative census. Privacy concerns, if not managed well, can act as a barrier. We need to decide whether we **should** change to an administrative census, before deciding whether we **can**. New legislation will likely be required to support changed use of administrative data, in particular the Electoral Act, Privacy Act, and Statistics Act. The potential options for moving towards an administrative census represent a continuum of change to administrative infrastructure across government. A register-based census requires the highest level of change. The essential pre-conditions of a register-based census are:
- a sound legal basis
 - public approval
 - unified identification systems
 - suitable administrative data sources.
198. New Zealand does not meet any of these pre-conditions at present. The first steps towards a register-based census involve creating these conditions. The new administrative conditions required include:
- a national population register
 - a national address list and/or dwelling register
 - accurate linkage between administrative systems (a unique personal identifier is the most efficient solution)
 - compulsory notification of address change.
199. We propose four phases to the work programme.
- Phase 1 – 2011–15: Develop new collection processes for the five-yearly census and progress investigation of existing administrative data sources.
 - Phase 2 – 2016–20: Implement new collection processes in the 2018 Census and determine improvements to data sources for an administrative census.
 - Phase 3 – 2021–25: Complete new collection processes, review timing of future censuses, and progress development of administrative data sources.
 - Phase 4 – 2026–30: Complete evaluation and implementation of an administrative census, if feasible.

200. The phases have been chosen so that the end of each phase coincides with the end of the census cycle, as census data is the only reliable source for testing the feasibility of alternative solutions. The duration of later phases in the transformation programme may change if the earlier phases demonstrate that changes to the frequency of the census are feasible. Figure 1 shows the four phases and associated work programme.
201. The first phase, 2011–15, includes the 2013 Census and testing of administrative solutions against the census results. The decision-point in 2015 would be too late for a 2018 Census. Because of the size and complexity of the census, project planning must begin early enough to ensure that the project can deliver to an agreed scope and budget. The budget for a 2018 Census would need to be confirmed no later than March 2014, given the extensive redevelopment and testing that will be needed to radically change the collection process. The census is a large operation and the costs of failure are high. Given the uncertainty around the results of the testing and evaluation work based on the 2013 Census, it is prudent to plan for a census in 2018.
202. Two significant investigations that we will undertake in the 2011–15 phase include the evaluation of address data and alternative approaches to producing population estimates. The 2013 Census will be used as a platform to test and evaluate the quality of address data from administrative sources. The results of this investigation will inform the collections phase of the 2018 Census, by identifying areas where the address list coverage and quality are sufficiently high to permit mail-out of census forms/Internet codes.
203. The 2013 estimated resident population (ERP), based on 2013 Census data, will form the benchmark for testing alternative approaches to producing population estimates. The ERP data will be available in August 2014, and evaluation of the new population models should be completed by 2015. The results of this work will inform decisions about the timing and sequencing of censuses following the 2018 Census. For example, if new methods for producing population estimates show that it is possible to sustain the accuracy of the estimates over a longer period than those produced by the existing model, it may be feasible to increase the interval between censuses, by perhaps seven or eight years. Therefore, the 2023 Census could be deferred until 2025 or 2026, returning us to international alignment. The earliest that we could move to a 10-yearly census would be in 2030.
204. Other work that will be undertaken in the 2011–15 phase includes:
 - investigating the impacts on users of the deferral of the 2011 Census until 2013
 - analysing cross-government benefits of a formal population register, and options for establishing a register
 - resolving issues arising from the interdependence of census frequency, and the role of census data in the electoral system, in collaboration with the Ministry of Justice
 - determining the critical information needs that the census must support
 - quantifying the benefit of the census programme
 - studying IT developments
 - reviewing international developments in census taking.
205. We will report to government on the outcomes of the phase 1 investigative work in 2015. The programme of work after 2015 will depend on the government's responses to this second report. The 2018 Census will implement the new

collection methodology, and there will be a further report back to government in 2020. A third report back will be in 2025, at the earliest. By that time, the feasibility of an administrative census should be well established.

Table 3

Transforming the New Zealand census: Objectives and work programme

Strategy	To maximise the use of administrative data and move to an administrative census while continuing census information production			
Objective	Continue producing population statistics	Improve population statistics	Improve efficiency and reduce costs of current census model	Investigate alternative census options
Actions/ tasks	<ol style="list-style-type: none"> 1. Run the 2013 Census 2. Continue to produce intercensal population estimates and projections (using new methodologies as they are developed) 3. Plan for a 2018 Census 	<ol style="list-style-type: none"> 4. Investigate a wider range of administrative and commercial data for subnational population statistics 5. Develop and test new Bayesian models for intercensal population statistics 6. Evaluate and implement alternative methods for measuring net overseas migration 7. Implement new methodologies when successfully developed 	<ol style="list-style-type: none"> 8. Determine the quality of administrative address listings 9. Decide on extent of mail-out areas 10. Determine processing efficiencies and implement as appropriate 11. Implement a comprehensive development and testing programme 12. 2018 Census: <ul style="list-style-type: none"> - Implement mail-out (approx 50% of areas) - Implement 'self-response' strategy nationally, to maximise Internet returns - 50% Internet response rate targeted 13. Implement new processes, strategies and systems when successfully developed 	<ol style="list-style-type: none"> 14. Determine future requirements for population statistics, including electoral system requirements 15. Determine future requirements for socio-economic information at the subnational level 16. Establish criteria for assessing alternative options 17. Conduct a benefit quantification assessment of population statistics 18. Measure the impact of the deferral of census from 2011 to 2013 19. Investigate 10-yearly census cycle <ol style="list-style-type: none"> a. Determine necessary conditions b. Determine consequences 20. Investigate administrative census <ol style="list-style-type: none"> a. Determine privacy and legal issues b. Assess Inland Revenue and Ministry of Health data to provide adequate information, as well as other potential sources c. Determine changes required to existing administrative data sources to enhance census information d. Investigate establishing a population register <ol style="list-style-type: none"> Determine need for additional socio-economic information at subnational level and investigate alternative methods for providing them.



Glossary

Administrative data – data resulting from interactions of individuals and groups with government agencies. Data can be collected for, or as part of, service delivery, an application, membership, regulation, or registration. For example, administrative records are maintained to regulate the flow of goods and people across borders, to respond to the legal requirements of registering births and deaths, and to administer benefits such as pensions, or obligations such as taxation. Data is typically collected with a specific administrative purpose in mind, without regard to its statistical use.

Administrative census – a census based on administrative registers and other administrative data sources.

Coverage survey – a large survey carried out after the census to establish the extent of census non-response.

Data pooling – aggregating one or more survey datasets to obtain a larger 'pooled' dataset. Pooling can occur either across time, with multiple instances of one survey, or across surveys, combining several surveys for the same time period, or a mixture of both.

Full field-enumeration census – a population count is obtained by contacting every household and person in the population, and obtaining information directly from them. The data may be collected by census collectors or through self-completion of a questionnaire by the household. Various collection modes may be used, such as personal visits, mail, telephone, and Internet.

Moving average – the mean of time-series data from several consecutive periods. It is called moving because it is continually recomputed as new data becomes available; it progresses by dropping the earliest value and adding the latest value.

Multi-modal census – a census where forms are delivered and collected using a mixture of methods, such as personal visit, mail, telephone, or Internet.

Population register – a formal list of all members of a defined population, together with key demographic information (eg age, sex). The population register is continuously updated by adding records for births and new migrants, and flagging those who leave the population through death or emigration.

Post-censal survey – a survey that uses a census question or questions to identify the target population. It is usually carried out shortly after the census, with census staff and field infrastructure selecting the sample. Census data are used to augment the data collected in the post-censal survey questionnaire.

Register-based census – census data are produced by linking together data from administrative registers. A high-quality population register is the basis of the population count. A national address register, and a way to accurately capture address change through administrative systems, are also essential. People are linked to their place of residence to provide geographic information. Other administrative registers (eg employment registers, education registers, taxation registers) are linked to the population register to produce socio-economic data on the characteristics of individuals – such as their income, educational qualifications, and labour force status.

Statistical population register – a possible alternative to a formal population register. This lists members of a defined population by combining data from existing administrative sources, such as tax records and education records, or health records. Statistical adjustments may be needed to accurately estimate the population.

Tier 1 statistics – Tier 1 statistics are the most important statistics needed for informing on-going decisions of national importance in New Zealand. They include measures of:

- performance or progress of New Zealand
- effectiveness of government and public sector
- economic, social, environmental, and cultural well-being
- welfare, quality of life, security, and sustainability
- New Zealand's population and sub-populations.



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