A horizontal green bar with a white circular icon on the left side.

A register-based census: what is the potential for New Zealand?

Christine Bycroft

A large, decorative graphic in the bottom-left corner consisting of several overlapping, light green circles of varying sizes, some with double outlines.

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Abstract

Some countries, including Finland and Denmark, are now conducting their population censuses using administrative data registers rather than a nationwide survey of households.

This information paper describes the main features of a register-based census, and the necessary pre-conditions for this approach. The pre-conditions are: a strong legal basis, public approval, unified identification systems, and comprehensive and reliable register systems developed for administrative needs.

The administrative registers would need to include a population register and a national address register. We consider how well-placed New Zealand is for meeting these pre-conditions.

Contents

Abstract	3
1 Introduction	5
2 The census in New Zealand at present	6
The role of census.....	6
Census costs.....	7
3 Statistical systems based on population registers	8
The administrative base – a population register	8
Statistical use of the population register	8
Costs to the statistical agency	9
4 Could New Zealand replace the traditional census by a register-based statistical system?	10
A legal basis.....	10
Public approval.....	10
Unified identification systems.....	11
Comprehensive and reliable register systems developed for administrative needs.....	12
5 Comparison of methodologies	14
6 Discussion	15
References	17

Figures by chapter

2 The census in New Zealand at present	6
1. Interactions between census and other official statistics data sources and models	7

1 Introduction

The five-yearly Census of Population and Dwellings has been the major source of social and population statistics in New Zealand for over 150 years. While sample surveys and administrative data now provide more information than in the past, the census continues to play a fundamental role. Census fulfils two main aims. Firstly, census produces a count of the population down to small geographic areas. These census counts form the basis for official population estimates and projections. Secondly, census provides a wealth of socio-economic information for the whole population, and at a low level of geographic detail.

The New Zealand census is successful in terms of the public support it receives, the good data quality, and the high benefit derived from the very wide range of areas in which census data is used. The problem is cost. Census is expensive. While efficiencies continue to be adopted over time, enumeration of the whole population drives the total cost. Under the current collection model, total costs will continue to rise as population size increases.

Other countries find themselves under similar cost pressures, or face other problems such as falling response rates or a lack of timely data if there is a long interval between censuses. One alternative is to use administrative population registers and avoid the need to enumerate the whole population, as the traditional census does. Nordic countries have led development of a new register-based statistical system. In this system, a population register provides the essential population base and is linked to an address register, to birth and death registers, and to other administrative sources such as tax, health, and education data. When well developed, as in Finland for example, this register-based system has replaced the traditional census. Census information is produced from the linked registers without the need to enumerate the whole population.

Statistics NZ is developing strategies for future censuses, and more broadly is looking at the shape of the overall system of official social and population statistics. This paper forms part of that larger programme of work. We describe the main features of a statistical system based on a population register, and the necessary pre-conditions for this approach. We briefly consider the changes that would be required in New Zealand to replace the traditional census by a register-based system.

Two main barriers to a census based on linked administrative registers exist – the absence of a population register in New Zealand, and uncertainty over public acceptability. Establishing and managing a population register for administrative purposes would first have to be championed by government, and a vigorous public debate over privacy concerns versus potential benefits could be expected. Statistical uses may not be seen as high priority in this context.

2 The census in New Zealand at present

The role of census

New Zealand, along with most countries, follows a traditional approach to census. The UN Principles and Recommendations for Population and Housing Censuses (United Nations, 2008) describes the main features of this traditional census as:

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

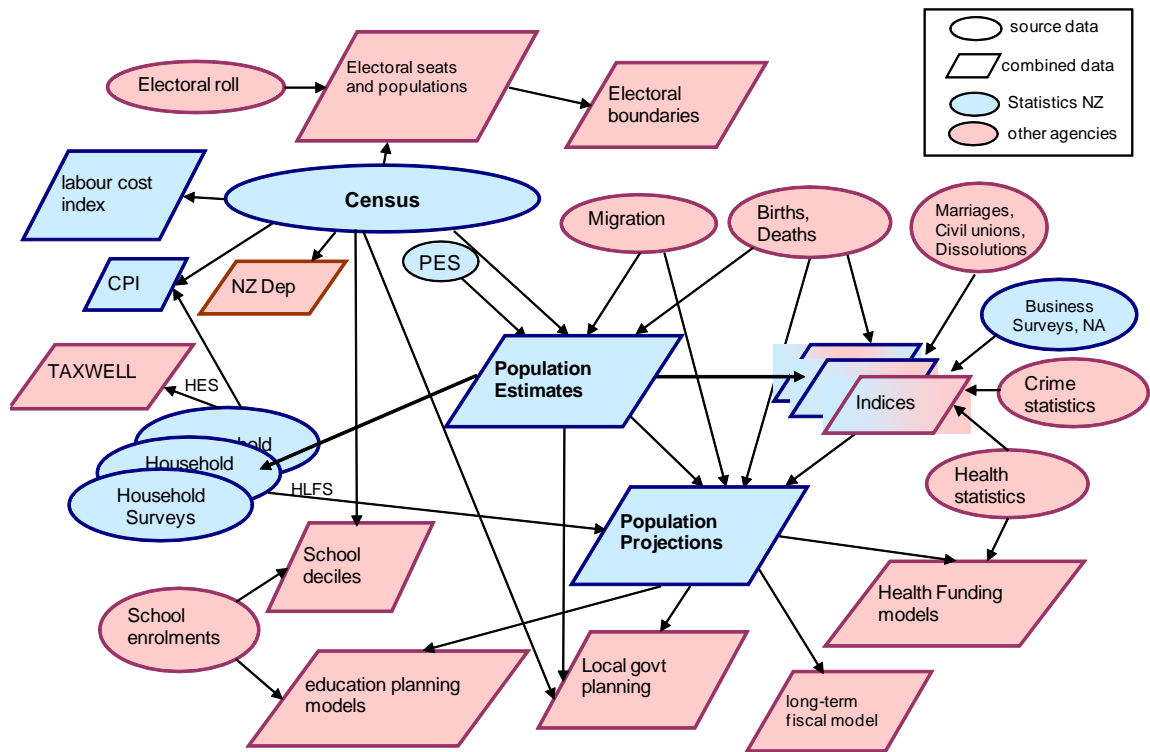
The two main sets of information obtained through census are:

1. A count of the population and dwellings, by small geographic areas and for basic demographic variables (age, sex, ethnicity). These census counts form the basis of population estimates and population projections. Population estimates are updated through the inter-censal period using administrative data on births, deaths, and migration.
2. A range of socio-economic information for the whole population, and for small areas. The richness of census derives from this ability to collect a wide range of variables at the same time, and to produce this data for small population subgroups and local communities.

Figure 1 illustrates the central role of census and population statistics across the whole of government. We see the many connections between data sources, with census feeding into functions as diverse as determining the number of electoral seats, calculating fertility rates, local government planning, input into the Treasury's long-term fiscal model, and the major expenditure areas of health and education.

Any alternative approach to census must also meet the needs for high quality population estimates, and for a diverse range of socio-economic variables, at least some of which should be provided for small population groups and local areas.

Figure 1
Interactions between census and other official statistics data sources and models



Census costs

The 2006 Census cost almost \$78 million over five years, and the 2011 Census has a budget of \$90.4 million. Under the current approach to field operations, and with legislation that requires paper forms to be delivered to every household, we can expect the cost of future censuses to increase as the population increases. To put the census in context, a useful comparison is running a general election – perhaps the only other regular attempt to engage much of the population on a single day. The 2008 electoral cycle cost around \$102 million in total over a three-year period, and was aimed only at individuals aged 18 years and over. No-one follows up if you do not vote. Census is significantly more complex than an election, includes a count of dwellings, and covers 50 percent more people.

We should also consider the direct financial benefits of census information. Health, education, welfare, and transport budgets allocated using population-based funding formulas run into tens of billions of dollars annually.¹ The impact of poor quality population figures on major public spending could be much larger than the cost of running the census, and is an area where a more detailed understanding would be beneficial. One could argue that census is relatively efficient and provides value for money, however it is still a major expense and we need to assess alternative approaches.

¹ Total over five years 2006–11 is likely to be \$150 billion. This figure is based on approximately \$44 billion over five years for DHBs through the Ministry of Health's Population-Based Funding Formula, \$1 billion over five years to schools through the Ministry of Education's decile funding models, \$90 billion over five years allocated by the Ministry of Social Development using population-based funding formulas, and an estimated \$15 billion of central and local government funding for land transport infrastructure over five years. (Source: Stage 2 Business Case 2011 Census Programme.)

3 Statistical systems based on population registers

We now describe the main features of a system where census information is obtained through a system of linked administrative registers. In contrast to the data collected in census and surveys, administrative registers consist of identified lists of individuals. The administrative purpose is focused on the individual, and the person must be identified correctly. The birth and death registers, and vehicle registrations are good examples in New Zealand.

A good quality register aims to be a complete and identified list of the population of interest (Walgren & Walgren, 2007). Thus we can see that an accurate and well maintained register of the whole population could also serve a statistical purpose by estimating the size and distribution of the population.

The administrative base – a population register

Many countries, particularly in Europe, maintain population registers. There may be a legal requirement for residents to register with a local authority, and a concept of legal residence or 'official domicile' exists. The modern population registers may have grown out of much older village or parish registers, as in Finland. During the 1960s, Nordic countries established central population registers, combining existing local registers into a national system (Tonder, 2008; based on UNECE, 2007).

Once a good initial list of the population is established in the population register, ongoing maintenance consists of recording changes to the population. The status of individuals must be updated when they enter the population (are born, or migrate to the country), leave the population (die or migrate out), or move within the country (change address). In Nordic countries and the Netherlands for example, it is mandatory to register any change of address. Changes due to migration can be more difficult to capture. Immigrants generally need to register when they take up residence, but there is much less incentive to notify the register when a person leaves the country.

Statistical use of the population register

These administrative population registers have been used by the statistical agencies in Sweden, Denmark, Norway, and Finland as the source of population estimates since the 1970s. Over time, other administrative sources have been linked to the central population registers to the point where totally register-based censuses can now be conducted (*ibid*). Other countries where the traditional census has been either partially or fully replaced by a system based on a population register include the Netherlands, Germany, Belgium, Austria, Slovenia, Israel, and Singapore.

Within the statistical agency, the population register serves as a central spine and establishes the reference population of people resident in the country. The population register includes basic demographic variables such as date of birth and sex, and, most importantly for statistics at subnational areas, individuals are recorded at their home address. An address register is an integral part of the system. Other registers and administrative data are linked to the population register and replace census information for variables such as income, employment status, and educational qualifications.

The range and quality of statistical outputs depends on the information collected through administrative systems. Population estimates are produced by the statistical agency directly from data held about the individuals listed on the population register. Socio-economic census variables are derived from linkages to other registers, and are restricted to the information collected by those administrative systems.

Systems dependent on administrative data often encounter problems related to relevance (Statistics Norway, 2008). Information may be missing for part of the population (eg educational qualifications gained abroad will not be included; little may be known about new migrants), be of poor quality because it is not important to the administrative agency, or simply not be available (eg family relationships within a household, hours of work and occupation, mode of transport to work). The accuracy of population coverage is often most affected by people moving abroad failing to de-register, and will be worse in countries with a high level of international mobility.

Costs to the statistical agency

Rather than conducting a census at regular intervals, the costs for a national statistics agency are in **converting** the administrative population register to a statistical register. Sample surveys may be needed to improve coverage or address other quality issues associated with the administration of the register. Other costs will be incurred in developing a whole system of registers from other administrative sources linked to the base population register. Substantial investment in systems and new types of expertise is likely to be required (Slovenia, 2008). Depending on the data available from these other registers, sample surveys may be needed to fill information gaps, but otherwise census information is obtained from the register system without returning to the respondent. There is no longer a need to periodically survey the entire population.

It is worth noting that a range of other sample surveys is still required for information that cannot be obtained from administrative data. If such a register-based system were in place in New Zealand, we would be likely to continue to need a General Social Survey, Household Labour Force Survey, and some form of Household Economic Survey. The existence of a central population register does create advantages for running sample surveys, such as providing a direct population frame for sample selection, a better understanding of non-response, and the ability to replace some survey questions directly with administrative data. However these advantages are of a lower order than the cost savings from replacing the traditional census.

4 Could New Zealand replace the traditional census by a register-based statistical system?

Based on the Nordic experience, Tonder outlines the pre-conditions and processes needed for a country to progress to a register-based statistical system. The essential pre-conditions are a sound legal basis, public approval, unified identification systems, and the existence of suitable administrative data sources. We compare each of these aspects with the present situation in New Zealand.

A legal basis

A strong legal basis is essential. Legislation should provide the national statistics agency with the right of access to administrative data at the unit level, with identifiers, and with the right to link them with other administrative registers for statistical purposes. Legislation should also put in place privacy safeguards, allowing the statistical agency to use the data only for statistical and research purposes, and maintaining the confidentiality of data irrespective of its source.

Existing New Zealand legislation partially meets these requirements. Statistics NZ is governed by the Statistics Act (1975) which provides safeguards for the use of data for statistical and research purposes only, and for protection of confidentiality. The Act applies equally to data from any source, and is reinforced by Official Statistics Principles and Protocols.² The Privacy Act (1993) regulates the use of identifiable personal information. Several principles in the Privacy Act recognise statistical and research purposes as distinct from other administrative purposes.

Statistics NZ is able to link data for statistical purposes, although there is no explicit mandate in the legislation. Each data integration project is considered on a case by case basis under the Statistics NZ Data Integration Policy. Unique identifiers may be used in the linkage, if available; however, the Privacy Act prohibits the long-term retention of unique identifiers assigned by another agency (principle 12).³ Legislative change would be needed before a population register could be introduced in New Zealand.

Public approval

A positive public attitude is essential. Tonder describes the possible negative reaction to the idea of a national statistics agency knowing 'everything' about every citizen. He counters this with the fact that when people know the data is already collected for tax purposes and so on, it is difficult to motivate people to report the same data for statistical purposes. He reports that in the experience of Nordic countries, most citizens accept the advantages as a good argument for the statistical use of existing administrative data. However, an open discussion and debate, explaining the rationale and benefits of register use, has always been considered a key principle in the Nordic countries.

There appears to be a strong cultural aspect to this situation. In the UK, for example, many argued against the introduction of an identity card, which is an accepted part of daily life across much of Europe and elsewhere. The open debate Tonder refers to is about the statistical use of existing population and other registers; there appears to be unquestioning acceptance of the population register itself.

² Official Statistics Principles and Protocols [Accessed 3 December 2010].

³ Privacy Principle 12 [Accessed 3 December 2010].

In New Zealand the Privacy Act reflects a strong concern for individual privacy and unease towards sharing data across government agencies. Nevertheless, many data matching projects are carried out between government agencies for specific administrative purposes. The data matching is governed by the Act. Each data matching project is expressly approved by the Privacy Commissioner and is reported on annually.⁴

The degree of public acceptance is a key determinant of whether a register-based statistical system is feasible in New Zealand. Public acceptability relates directly to trust in government as a whole, and to the extent to which Statistics NZ is distinguished as a separate agency, with its own strong standards of privacy protection, security, and confidentiality. Most concerns are likely to relate to the misuse of data about directly identified individuals. Essentially the issue is one of privacy and the use of data for purposes for which it was not intended, particularly any uses that could adversely affect individuals.

As a national statistics agency, Statistics NZ is well-placed to hold identified, linked, register data because its sole purpose is the statistical use of data, and Statistics NZ has no regulatory or other purpose related to individuals. However, a statistical agency is dependent on the trust and goodwill of the public, and cannot afford to jeopardize that trust by moving ahead of public opinion, regardless of whether that opinion is formed by a misplaced perception of Statistics NZ or not. Somewhat paradoxically, far more data matching is routinely conducted to identify individuals for administrative purposes than is carried out for statistical purposes.

Unified identification systems

Linkage is made much easier if a common unique identifier is used for the population register and for other administrative registers. In the Nordic countries, unified personal identity codes are present in nearly all registers used in producing statistics.

It is possible to link different registers without common identifiers, as has been done for some existing data integration projects at Statistics NZ. However if extensive linking is to be carried out, there is a stronger argument for a common identifier across different systems, both for efficiency reasons and the greater accuracy of the linkages.

There is no common unique identifier in use across administrative systems in New Zealand, and as noted above, this is expressly prohibited by the Privacy Act. A legislative change would be required, and public approval would be an important element to achieve this.

Austria has resolved similar legislative restrictions through having data matched across government 'branches' by their Data Protection Agency (rather than by Statistics Austria), and a complex system of encrypted identifiers (Statistics Austria, 2008).

⁴ Office of Privacy Commissioner. 46 operating matches were reported in 2007/08. These programmes have their legislative provision included in Schedule 3 of the Privacy Act. (Accessed 3 December 2010).

Comprehensive and reliable register systems developed for administrative needs

Clearly, a register-based statistical system cannot exist without the administrative registers. New Zealand is fortunate in having a well-functioning government administration. Many administrative systems produce data that support statistical purposes, and some meet the requirements of a good register. As well as the obvious registers of births, deaths, and marriages, the Ministry of Education has developed a National Student Index for tertiary students, the Ministry of Health supports the National Health Index, the Electoral Enrolment Centre maintains the electoral rolls, Inland Revenue issues IRD numbers for reporting personal income tax, vehicles are registered to owners, passports are issued, and citizenship is conferred. All these systems are used to some extent for statistical purposes in addition to their primary administrative purpose.

Notably, a population register is missing from the above list. Each of the administrative sources attempts to include a complete listing of the relevant population, and will do so more or less successfully. However, none aim to include all people living in New Zealand at a given time, at their place of residence, and to record all migrants who have entered or left New Zealand.

Population registers elsewhere have, broadly speaking, two main functions. The first is to register an 'official domicile' in some sense, either as a resident of the country or resident of a local authority area, which may then be used for taxation or other government functions. The second is for personal identification. The register acts as a system for issuing unique personal identity numbers. Government efficiency may be another benefit, if agencies can readily share information about the same person via the identity number.

Population registers have a long history in some countries; for example, in Finland⁵ local population registers have been maintained since 1634. Used originally as lists of people paying poll tax, they later became an administrative tool that also helped determine place of residence and military recruitment, and acted as electoral registers and tax rolls. Finland today is among the foremost countries in administrative use of a population register.

The Finnish Population Information System is a computerised national register that contains basic information about Finnish citizens and foreign citizens residing permanently in Finland. It also records information about buildings, construction projects, residences, and real estate. The information in the system is used throughout Finnish society's information services and management, including in public administration, elections, taxation, judicial administration, research, and statistics. Businesses and other private organisations can also gain access to the information.

The Population Information System issues personal identity codes, needed for many normal activities. People need a personal identity code to be able to apply for pensions and other benefits. It is also needed for the payment of wages, salaries, and fees and is essential in bank transactions. Identification services now extend to online verification. The Population Register Centre creates an electronic identity for Finnish citizens when providing them with a personal identity code. The electronic client identifier is used for identification in secure online transactions.

The high quality of the Population Information System then allows the Finnish statistical agency to use the population register as the basis for population estimates, and with good linkages to an extensive range of other registers, the traditional census is no longer needed.

The historical background and present situation in New Zealand is quite different. Local authorities in New Zealand register rateable properties and ratepayers, not individual

⁵ Following text is quoted from the Finnish website. Personal data recorded in the system includes name, personal identity code, address, citizenship and native language, family relations, and date of birth and death (if applicable). See <http://www.vaestorekisterikeskus.fi/vrk/home.nsf/www/services> (Accessed 3 December 2010).

residents. The electoral system is independent of other government activities, and each government sector has established their own separate system of registration. There is no equivalent to a personal identity number or identity card, and sharing information across government is tightly controlled by the Privacy Act. This may be inefficient, but it reflects New Zealand history and cultural attitudes. One is tempted to say that, at least at present, a population register is a foreign concept to many New Zealanders.

A dwelling register, or some kind of real-estate or address register that identifies individual dwellings, is also a fundamental component of a register-based system. The dwelling register links people to where they live, and so allows the system to provide outputs by small geographic areas. New Zealand is much closer to achieving an address register than a population register. However to date there has been a conspicuous failure to implement a single definitive national address register.⁶

Thus, while New Zealand government agencies maintain several good administrative registers, and these can and do contribute to the official statistical system, there is no central population register. In other words, there is no high quality list of people living in New Zealand at a particular period that is essential if we wish to replace the census.

⁶ The most recent attempt, the National Address Register (NAR) project, closed in 2008.

5 Comparison of methodologies

While the aim to produce good quality statistical information is the same in both a full enumeration census and a register-based system, there are major differences in the methodologies underlying these approaches, with implications for policies related to identified data and to linked data.

In the current method for producing population estimates, census data is first aggregated by age, sex, ethnicity, and small geographic areas. These aggregates are created at a fine level of detail, but they are counts, not individual records. The census counts are then adjusted for net census undercount and updated for population change during the inter-censal period, using birth, death, and migration data. Again, calculating the change in population uses aggregated administrative data, not individually identified records.

As we have seen, the process is quite different in a system based on a population register. Here it is the list of individuals on the register itself, for any given reference period, that provides the population count. Change to the population is measured by directly linking birth and death records to the population register and changing the migration status of known individuals. Geographic data is obtained through the link of each individual to their home address.

The change in methodology would mean new methodological issues would need to be addressed. Potential examples might include assessing the coverage of the population register and the impact of linkage errors. The methodology changes also raise new issues for the Statistics NZ policy environment.

Important distinctions between the periodic full enumeration census and a register-based system arise from the role of identified unit record data, and the role of linked data. A register-based system is normally centred on an identified list of individuals in the population, held by the national statistics agency, and the links for these individuals across many sources. Information about named individuals needs to be held permanently and updated on a regular basis. Of course, access to data about named individuals is strictly controlled, and most staff and other users would see only an anonymised version.

This requirement to keep information about identified individuals is different from the current approach at Statistics NZ. Names are used to link administrative data in some cases. However, in accordance with the Data Integration Policy,⁷ names are kept only while necessary for linking and then removed. To support a register-based statistical system, a shift in the current time-limited policy for retention of names would be needed.

If some form of register-based system were to be adopted by Statistics NZ, it would also mean a fundamental change in our approach to linked datasets (ie to data integration). Extensive linkage of registers from many government sectors is a basic premise of a register-based system. In contrast, under the current Data Integration Policy,⁸ data integration projects proceed only after carefully considering privacy impact and benefits. Data integration is approved by the Government Statistician on a case by case basis, only where high value outcomes can be shown to outweigh privacy concerns. Each data integration project is held securely, to prevent any matching with other datasets.

The integrity of the overall official statistical system would need to be assured before any major shift in approach to data integration could proceed.

⁷ Statistics NZ Data Integration Policy, Principle 10. [Accessed 3 December 2010]

⁸ The Privacy Act and Data Integration Policy apply to individuals, not to businesses. The same restrictions do not necessarily apply to integration of business datasets.

6 Discussion

This paper has described register-based statistical systems in the context of considering alternatives to the traditional census in New Zealand. The benefits reported by countries that have replaced their census by a system of linked registers are reduced cost to the national statistics agency, reduced burden for respondents, and greater use of existing administrative data. In New Zealand, respondent burden imposed by the five-yearly census is not considered a major issue, and there are other means of making good use of existing administrative data that are outside the scope of this paper. The main problem for census in New Zealand is one of cost. Using a system of linked registers, based on a population register, to produce census-type information is reported to substantially reduce costs for a national statistics agency, but only in situations where a population register already exists to fulfil other administrative purposes.

New Zealand does not have a population register, nor does the underlying infrastructure for creating a population register exist in New Zealand. Establishing and managing administrative registers is very expensive. This is a good argument for making more statistical use of existing administrative data. But it does not make a good case for replacing the costs of census by the costs of a new administrative infrastructure, unless there is also a strong administrative purpose to be served. Countries with population registers see major benefits for government administration and efficiency, and in having a rigorous system for personal identification.

The initiative for a population register would have to come from across government. If government wished to proceed in this direction it is likely to be a long-term project. Steps would include reaching agreement on objectives, ownership, and funding; sufficient time for public debate and passing of legislation must be allowed for, business processes set in place, and IT systems built before a system could be implemented. Depending on the rate of progress, two or three censuses would be likely to elapse before an administrative population register was functioning fully. Further time would be required to consider and resolve a range of statistical methodological issues before statistical outputs based on linked administrative registers were of sufficiently high quality to replace the current full enumeration census.

Another approach could be to create a statistical or 'pseudo' population register by linking existing administrative datasets that already have a high coverage of the population.⁹ Possible data sources include the National Health Index, National Student Index, Inland Revenue Client Register, and the electoral rolls. While combining data sources such as these would provide a rich source of information for research across sectors, it is much less clear whether sufficiently accurate population estimates could be produced. Methodological questions pose a major challenge. Statistics NZ would also need to consider the costs involved, privacy issues, impact on the integrity of the whole Official Statistics System, impact on agencies providing the data, and legislative changes. It may be worthwhile investigating such an approach, even if results showed that it was not a feasible alternative to census. This work could be led by Statistics NZ, but again, will not provide a replacement for census in the short to medium term.

The potential for adverse public reaction is a major barrier to the introduction of an administrative population register. Public perception also has a strong impact on the way Statistics NZ approaches the linkage of different administrative data sources. At present, each linkage proposal is assessed separately on its own merits and wider linkage systems are ruled out by design. A register-based system views multiple linked administrative datasets as the main source of data, taking precedence over surveys. The current household survey-based model views multiply linked datasets with caution, due to concerns over privacy and the potential for losing the trust of survey respondents. Statistics NZ does not assume public acceptance for an extensive system of linked data relating to individual people. Similar considerations of privacy and security relate to the retention of data associated with identified or named individuals, which is essential for a register-based system but kept to a minimum in the current survey-based approach.

⁹ We are not aware of any other country that has implemented this approach.

Legal changes would be required to permit the introduction of a population register. Statistics NZ's situation in this potential new environment would need to be strengthened – by explicit legislative recognition of a right to access administrative data and a right to link that data for statistical purposes.

In summary, at present New Zealand meets none of the pre-conditions described by Tonder for introducing a register-based statistical system. If the New Zealand Government wished to move in this direction in the longer term, the essential base population register would still be expensive to create and perhaps more importantly, to maintain, and would need to be justified by major improvements in government efficiency, or some other purpose such as secure and compulsory identification. Public acceptability is a major factor, and statistical benefits may not feature highly in any debate. For Statistics NZ, the trust of respondents and integrity of the overall Official Statistics System is paramount. As an independent statistics agency, Statistics NZ already has strong safeguards in legislation and existing security practices and so provides a good environment for linked administrative data, but cannot afford to move too far ahead of public opinion.

This paper has focused on the feasibility of a population register in the New Zealand context, where the cost of census is a key driver in considering alternative approaches to producing census-type information. If a New Zealand Population Register were to become available, whether we would in fact move the social statistical system towards a much greater reliance on administrative data would depend on the overall balance of costs and benefits. The quality of the population register and the range of other relevant administrative data that could be linked would be an important consideration. Census variables that we would be unlikely to capture from administrative data include family relationships, occupation and hours of work, and transport to work. Approaches that reduce the costs of the traditional census, particularly enumeration costs, are also being explored.

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