Valuing the Census

A report prepared for Statistics New Zealand which quantifies the benefits to New Zealand from the use of census and population information

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"What is a cynic? A man who knows the price of everything and the value of nothing."

Oscar Wilde

Purpose of this Report

Statistics New Zealand has commissioned this report to estimate "what dollar value can we place on the benefits to New Zealand gained through the use of census and population statistics information?" This work fits within a much wider programme of engagement with census users to inform relative priorities, and will also provide much of the benchmark material from which an evaluation of the net benefits from changes to census frequency and/or collections methods can be made.

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Executive Summary

This report provides estimates of the dollar value to New Zealand gained through the use of census and associated population statistics information. The conclusion is clear: despite significant difficulties in developing a rigorous quantification, it is reasonable to conclude that the census delivers benefits well in excess of its direct costs.

The valuation task is complex, reflecting the fact that currently internationally there are no directly applicable models or approaches, and that there are costly hurdles in place to obtain precise estimates of user values for the information. As a consequence, this report utilises a range of approaches to valuation.

What does the census provide? The census provides information on people in New Zealand: it has surveyed the entire population every five years since 1881[1]. As such it provides both a comprehensive picture and a linked time series dataset that has no direct comparators. In valuation terms this poses challenges, as the census' existence (undergirded by the statutory requirement for returns by all New Zealanders) and its generally free dissemination of results means that no market prices exist for direct outputs and that there has not been investment in any tool which closely mirrors the census. Indeed, a frequent response from users during this review is that if the census did not exist, key users would have worked together to create as near a replacement as possible.

Uses of the census are diverse, with many applications that are indirect and/or embedded in other products and tools. For information at the level of overall population count with demographic characteristics, census data underpin long-term forecasting such as New Zealand's long-term fiscal position and the requirements for growth related infrastructure and housing. At the more detailed level, utilising the census' more detailed linkage to detailed demographic characteristics for defined geographic meshblocks allows firms and government agencies to identify target groups or, especially when coupled with the historical data, to better understand patterns and relationships such as achievement and earnings for Maori young people. Less direct linkages arise from the census' use in determining the frame for many other non-demographic surveys.

Reliable population based data and projections provide higher level benefits through the reduction in uncertainty for longer-term decisions and investments, and also provide an analytic basis for development of policy choices in some areas which otherwise involve difficult political choices.

In an era of growing dynamism in family structures, the census provides one of the main tools to identify those patterns, in turn informing policy, service delivery, and investment choices.

***Benefit quantification*.** As a consequence of the wide range of data uses and the complexity of valuing non-market transactions, this report gathers insights into possible valuations using a wide range of approaches. The core issue explored is in effect a valuation of the extra precision that census data provide over the multitude of other more partial measures. While only a few main areas

[1] Except for three instances as set out in the Background

of use are examined (as more detailed costing would be costly), the report also provides some guidance on the relative values in areas of use.

The main benefit areas quantified are:

- the benefits from more accurate health funding allocations as funding is delivered more accurately to more needy areas;
- reductions in the costs associated with underutilised fixed capital investments, in both the public and private sectors, because of better information on their timing and location (infrastructure funded by central and local government, aged care, retail);
- benefits from improved precision and insight in policy making in a range of government agencies, especially for Maori and vulnerable groups;
- improvements in the value added by a range of firms which use census data in a wide variety of analyses provided to government and private sector firms; and
- gains from improved survey accuracy and reductions in sample size for private sector market research companies, and StatisticsNZ in respect of a range of other non-census products.

Overall benefit to New Zealand. Benefits are typically estimated at an annual level and then summed over a 25 period to provide a net present value. Given the difficulties in assessing values for many benefits, this report provides a set of reasonable ranges in which a value is likely to lie for some key benefit areas. A cost for carrying out the census, including compliance costs, has been deducted from these benefits to provide an overall net present value. Given then that the values included in the table represent only some eleven major areas of benefit out of the much larger range of unquantified benefits discussed, it seems reasonable to conclude that a lower bound for the census's value to New Zealand is in a range as set out below:

Table 1: Overall value estimate for use of census and population information

	Net Present Value $Million		
Discount rate	**Low**	**Medium**	**High**
3.5%	710	1420	2670
6%	570	1130	2110
8%	480	960	1780

Using the most generally applicable discount rate of 8%, this suggests a net present value of close to $1 billion for the benefits to New Zealand gained through the use of census and population statistics information over the next 25 years. In other words, every dollar invested in the census generates a net benefit of five dollars in the economy. This value estimate though is not at the level of rigour applicable to assets recorded on an organisation's balance sheet. It does not include many of the uses discussed but not quantified.

There are many other direct and indirect uses of the census for which quantification has not been attempted but which are clearly highly valuable. The census is used for instance to determine the electoral boundaries for Māori seats, it forms the basis for the NZ deprivation index (widely used in a range of research and policy work aimed at helping New Zealand's most vulnerable people), and underlies work on the Long-Term Fiscal model which informs tax and expenditure policy choices affecting the next 10-50 years.

Indirect uses are also widespread. Economic models rely on robust demographic analysis. Another less obvious application is the use of census data as part of modelling work underlying the calculation of sustainable pathways for Regional Councils and the ecological modelling used to estimate potential future environmental loads and impacts. The difficulty and/or cost of identifying values on these mean it is not cost-effective to develop further, but a consequence is that the overall value of the census to New Zealand will be significantly above the quantified benefits outlined in this report.

Looking forward: use of this valuation. This report clearly indicates that the census provides value to New Zealand well in excess of its cost, but it does not address the issue of whether the current collection and analysis system provides the best value-for-money. It could be that net expected value might be greater if either some additional accuracy or new outputs could be produced (even involving an increased cost), or a combination of changes to the collection and processing systems along with changes to the types and quality of outputs produced was adopted.

This would require a much more detailed set of analyses, for which the information in this report provides a starting platform. This report provides guidance on some areas of high value, some indications of relative value, and identification of many key users which enables more targeted exploration for further stages of census development. For instance, consideration of a move in the timing of censuses to 10 yearly could be investigated on the basis of the difference in value (accuracy and timeliness) to users in key areas, weighed against the expected reduction in costs. This step will require clearer details of the potential changes in methodology and their consequences in terms of accuracy and cost than are currently available.

The Census - a description of what it provides

Background

The census is a comprehensive record of all people in New Zealand, with linked information on location and a wide range of demographic factors. It does not though contain personal identification.

The first New Zealand Census was held in 1851. The interval was set at 3 years until the Census Act of 1877 set a requirement for censuses to be held every fifth year. Since 1881 censuses have been held every 5 years, apart from 1931 during the Depression and 1941 due to the Second World War[2], and a deferral in 2011 (to 2013) due to the Christchurch earthquake. A major driving factor behind the retention of this frequency is the high rate of population change in New Zealand, where our external and internal migration rates are high in international terms.

Overview of census outputs and uses

Census information can be broadly characterised as follows:

- counts of population units – people, households and dwellings
- population structures – e.g. family and households relationships, ethnic groups, and
- population and housing characteristics – e.g. health

A unique aspect of the Census is that these statistics are produced for very small areas[3] and for very small population groups, with cross-tabulation between different variables.

Census outputs

In summary, the Census is a snapshot of the whole New Zealand population at a given point in time. It acts as a de facto Population Register, and underpins the validity of all other data sources.

The census is critical for producing population statistics. In between censuses, population change is estimated using administrative sources for births, deaths and migration. Errors accumulate over time, particularly at sub-national areas, and the population base is re-established using the census. The census monitors core social outcomes, but its strength is in providing the essential distributional information to very fine levels. On its own, the census does not help understanding of causal relationships, but adds significant value when census is integrated with other data such as the Deaths Register.

[2] "History of the census in NZ", from Introduction to the Census, Statistics NZ website
[3] Meshblocks are the smallest administrative areas used by Statistics NZ, with a median of about 87 persons in 2006

Examples where census is the only reliable source of information are[4]:

- the basis for population estimates and population projections, including internal migration patterns
- comprehensive information on dwellings and the housing stock in New Zealand
- the number, types and distribution of households and families
- comprehensive information about sub-population groups, for example Maori and Iwi, Pacific, Asian and other smaller ethnic groups, older New Zealanders, external migrants, single parent and other household and family types, occupation groups, crowded households
- comprehensive information about sub-national areas, for electoral boundaries, Territorial Authorities and local communities
- detailed and very local information derived from census variables at the meshblock level, for example, school deciles, transport patterns, relative disadvantage (NZ deprivation Index), and
- information to a very detailed level on some variables, for example occupation, country of birth, language.

Sample surveys cannot produce this kind of detailed and cross-referenced information below national levels. Sample surveys do provide national level estimates for many census variables, with more depth than census and at a level of accuracy that monitors change at a national level. However, sample surveys also rely on the Census in several ways:

- it provides population counts and distributional information used as the basis of the Household Sampling Frame
- sample surveys use population estimates (based on the Census) to improve the accuracy of the survey results
- it can sometimes be used as auxiliary information to increase the level of detail available from sample surveys
- it is used as a frame for surveys targeted at specific sub-populations, for example Maori, and the disabled.

Census users

It is difficult to provide anything like a comprehensive use of census users: while main users can be readily identified, there are also many other users who directly access particular parts of the dataset as well as users whose benefit arises more through indirect means, such as from the underlying framing based on census data (for example, estimates of per capita income).

Significant use is made of census data in both public and private sectors. Central government relies on census information to help understand many potential policy issues, to design and operate targeted funding regimes, and inform long-run projections. Local Government relies on census data to inform service provision and infrastructure planning. In the private sector census data underpin

[4] from "Future New Zealand Censuses: Implications of changing census frequency or adopting other models", Christine Bycroft, Statistics New Zealand, November 2011.

some key longer-run investment decisions, and a wide range of shorter run service provision and marketing. These uses are developed further below.

Uses of census data

While difficult to characterise with precision, six main uses of census data are described below.

Resource allocation – for resource allocation purposes it is crucial that population counts (both total counts and by key characteristics) are accurate, consistent and comparable over the area that the resources are to be allocated. This is becoming increasingly important as Government seeks to maximise the value for money from expenditure by better targeting.

Capital investment planning– for both government and the private sector there are significant capital investments where timing, location and scale are affected by the geographical patterns of movement, demographics, and anticipated levels of population movements.

Policy making and monitoring – there is a clear drive across Government for policy initiatives to be evidence based and to achieve desired outcomes cost effectively. In many cases this requires robust identification and analysis of smaller groups within the overall population.

Service planning – basic population counts and counts by key characteristics (such as age, sex, ethnic group, household type etc.) are important for service planning. If the different characteristics of an area's population can be identified, plans can then be made for the sort of services necessary. This is especially relevant for health, social services and education. In particular, data for small areas are crucial in local planning.

Academic and market research – the ability to produce multivariate statistics for small areas is vital for many research uses. Basic population counts and counts by characteristic are also required.

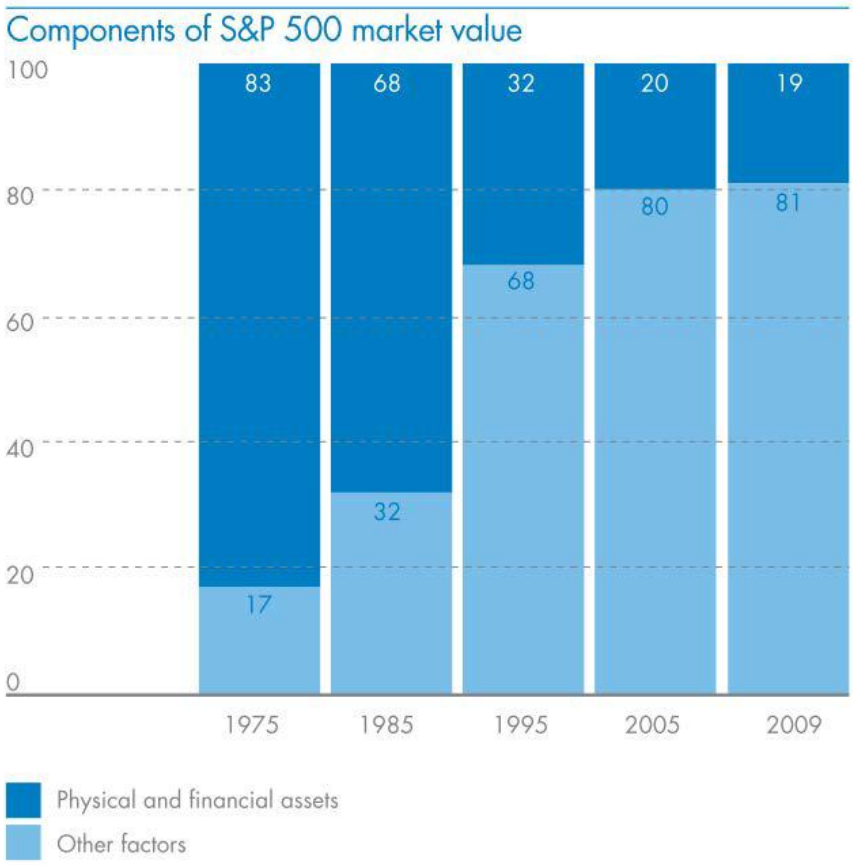
Statistical benchmark – more generally, census data are used to improve the quality of many other statistics, which may be used for the above categories. Many of SNZ's statistics are benchmarked or grossed up using census data, and as such the census is integral to the operation of sample surveys and to the appropriate use of administrative data.

Approaches to valuation

Introduction

A more globally interconnected world has brought with it a much greater set of risks and opportunities for businesses. The rate of change in market opportunities has massively increased as has the potential scale of opportunities for easily tradeable goods and services. In turn, the value of innovation and the information needed to identify and exploit market opportunities has correspondingly grown, demonstrated in Figure 1 below. The value of non-physical or financial assets (ideas, brands, information) has grown from 17% of the market value of the US's top 500 firms in 1975 to around 81% in 2009.

Figure 1



Source: IPSASB presentation 2012

Unsurprisingly, as innovation and information have become increasingly valued, markets have responded. Ongoing developments in information technologies and widespread applications have spawned many new information sources along with growing markets for providers who can connect across information sources (for example, connecting geographic information system (GIS) data with payments data, or GPS/individual location with retailers/marketing data).

At this stage users are not suggesting that the available new, non-census, data sources are significantly replacing their reliance on census information. This may in part reflect relative costs as census data are generally free, and certainly many users are taking advantage of new information opportunities (for example detailed payments information which is GIS-linked). In large part, much of the census benefit derives from its complete coverage of the population which provides a frame for the many more detailed and individually personalised applications which have never been direct census-enabled applications. This field, and the underlying technologies and applications, are still developing rapidly. As further linkages emerge between datasets and some of the sets move towards more comprehensive coverage it may be that more substitutes for some of the census data emerge, diminishing census value over time. Alternatively, smart interlinkage might provide opportunities to change the ways that the census data are collected and provided which could increase its value.

Specifying exactly what is to be valued

The core valuation question is "what value do census data provide to current and future users?" The valuation question has few parallels given that:

- the census is delivered by a single government supplier
- there is a statutorily imposed requirement for responses by all people in New Zealand (in effect a monopoly survey right)
- it has generally free outputs, and
- it has existed for close to 160 years.

Direct market prices for almost all outputs do not exist. Significant further complexity arises because of the lack of near substitutes: the statutory requirement for responses makes its coverage unique, and its long history of free outputs has stifled the development of any near substitutes for most outputs. The main approach to tackling valuation, examining the benefit compared with a counter factual of the next best alternative, is therefore unrealistic in some significant areas. Users in many areas have deeply embedded systems and processes which rely on ongoing access to census data. One response from users is that, if the census data were unavailable and known to be unavailable in the future, then groups of users would probably band together to develop a near alternative[5] . In the short-run, if historical census data were suddenly unavailable and there were no plans for future censuses, there would be little option in some cases but to commission urgent and costly alternatives[6].

Where possible, realistic next-best sources of data are examined so that the valuation estimates the additional value that census accuracy or linkages provide.

This report does not explore in any depth the issue of potential replacements - in part that will feature as part of subsequent work on options for census in the future.

[5] Raised in particular by several local authority staff

[6] While not a complete replacement for the census, in the early 1990s the Auckland Regional Council invested significantly in the development of its own regional model because of concerns about the accuracy of population estimates for Auckland.

Accounting approaches to valuation

In New Zealand, Government entities are required to prepare accounts in accordance with the relevant accounting standards (NZIFRS). These are continually evolving, and in particular over the last few years have there has been a considerable focus on aspects of valuation.

There are three most relevant standards, although none are directly applicable to a census valuation:

1. New Zealand Equivalent to International Accounting Standard 16, Property, Plant and Equipment (NZ IAS 16)
2. New Zealand Equivalent to International Accounting Standard 38, Intangible Assets (NZ IAS 38)
3. New Zealand Equivalent to International Financial Reporting Standard 13, Fair Value Measurement (NZ IFRS 13)

NZIAS 16 sets out the approach for tangible physical assets, essentially requiring use of historic cost, adjusted over time for depreciation and revaluations. It does apply to government organisations[7]. While not applicable to information systems or databases, it is applied to physical collections of ideas and information. This distinction is not always clear-cut and may well become increasingly blurred as future collections move from physical to digital media. Depreciation is applied to the asset's value "reflecting the pattern in which the asset's future economic benefits are expected to be consumed by the entity"[8]. This has been used for a significant semi-information asset- the Turnbull Library collection where a valuation is included in Appendix 5.

NZIAS 38 applies to identifiable non-monetary assets that are without physical substance. It does apply to government organisations. It covers internally generated assets (e.g. such as a new software tool or system), but the standard requires an expectation of a probable future economic benefit and the cost of the asset can be measured reliably before an intangible asset can be recorded on an organisation's balance sheet. It disallows inclusion of some internally generated assets such as goodwill or brand values where the asset is hard to identify and measurement is not reliable. If applicable, the intangible asset needs to be measured initially at cost.

NZIFRS 13 (applicable from 1 Jan 2013) defines fair value as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. Fair value is a market-based measurement, not an entity-specific measurement. The standard also indicates that a fair value measurement requires an entity to determine, among other things, "the appropriate valuation technique(s) to use when measuring fair value. The

[7] *Public benefit entities* are reporting entities whose primary objective is to provide goods or services for community or social benefit and where any equity has been provided with a view to supporting that primary objective rather than for a financial return to equity holders.

[8] See also Treasury publication "Valuation Guidance for Property, Plant and Equipment, Including Specialised Items in the Health and Education Sectors", 2007

valuation technique(s) used should maximise the use of relevant observable inputs and minimise unobservable inputs. Those inputs should be consistent with the inputs a market participant would use when pricing the asset or liability." However, the standard is not applicable for government organisations, although aspects of the fair value test are widely used as part of the approach used for asset valuation.

Applicable treatment for the census valuation

None of the existing NZ standards applies directly to the census (or indeed many other government information assets or processing systems). But a starting point in the most relevant standards for many asset measurements is the use of historic cost, adjusted over time for depreciation and market value movement. Generally the standards then look towards market prices which can be used to provide independent "recoverable amount" tests that are often based on observable earnings or sales of similar assets, along with regular updating, to ensure the measurement of the asset is not overstated, i.e. that the cost of the asset will be recovered from the earnings it generates or from its sale.

For the census, an historic cost assessment can be provided relatively simply (and is set out in Appendix 1). Such an approach is consistent with the National Accounts in that government services are valued at the cost of production. Two key parameters affect the valuation very significantly, the depreciation rate and the discount rate.

Depreciation: Two forces are at work in opposite directions with census data. On one hand, the snapshot in time is refreshed every 5 years, so for users whose primary requirement is the most recent population frame the value of prior data diminishes significantly with each refresh. On the other hand, users who rely on patterns and trends will see prior years' information as maintaining its value.

Discount rate: To some extent there is an unresolved debate around appropriate rates to use. One approach emphasizes long-term social rates of time preference and this leads to use of lower rates especially for benefits or costs which have very long time horizons. On this basis, one of the current NZ Treasury guides suggests use of a rate of 3.5% (risk free and real) for long term assets and liabilities which are risk free.[9] The other stream of thinking emphasizes the opportunity cost of capital so adds a tax and risk component to the risk-free rate, requiring use of the rates currently applicable for cost benefit in the public sector of between 6 and 10%[10]. An 8% rate is used by default for most analysis in this report but sensitivity at 6% is included.

Historic cost valuation (see Appendix 1 for full detail)

The valuation uses actual costs since 1992/93, and then backcasts the pattern of 5 yearly costs to 1881 when the census first moved to a 5 yearly cycle. Given that real census costs were almost certainly lower when the population was less, and incomes were lower, the approach assumes that

[9] "Methodology for Risk-free Discount Rates and CPI assumptions for Accounting Valuation Purposes", July 2010, and the review of the latter publication "Review of Long Term Assumptions" May 2012. Both NZ Treasury.

[10] "Public Sector Discount Rates for Cost Benefit Analysis", NZ Treasury, July 2008

real census costs per head were incurred at the level applying to 1992/3- 1996/97. This is translated into an overall annual cost using the StatisticsNZ long term data series for population.

The choice of depreciation rate is highly significant, amplified by the long time series.

A user concerned largely with single snapshots every 5 years would use a depreciation rate of close to 20%. Users who rely on trend information and consequential forecasts such as population forecasts, or need the time series analysis of population subgroups would apply much lower depreciation rates, more like 2-4%. The later analysis of user benefits indicates the bulk of user value derives from this latter group, supporting an overall depreciation rate in the 3-4% range.

Table 2: Overall historic cost valuation $billion 2012

	Depreciation rate				
	0%	2%	3%	4%	5%
Value in $2012:	$ 857m	$441m	$352m	$294m	$253m

Economic approaches to valuation

Over the last 15 years accounting valuation approaches have increasingly moved more towards those used by economists, which put more weight on forward looking estimates of likely earnings. But economic approaches still provide a much wider toolkit when dealing with unpriced costs and benefits, or handling valuation when goods and services are not provided under market conditions.

In the case of assets used to supply services under imperfect market conditions (most commonly in New Zealand the regulated gas, electricity and airport sectors), the basic analytical approach applied involves the regulator calculating an appropriate cost of capital for the industry, and setting prices that achieve that level of return. This requires valuation of the capital base on which the return is calculated, most typically using some form of optimised depreciated replacement cost (ODRC).

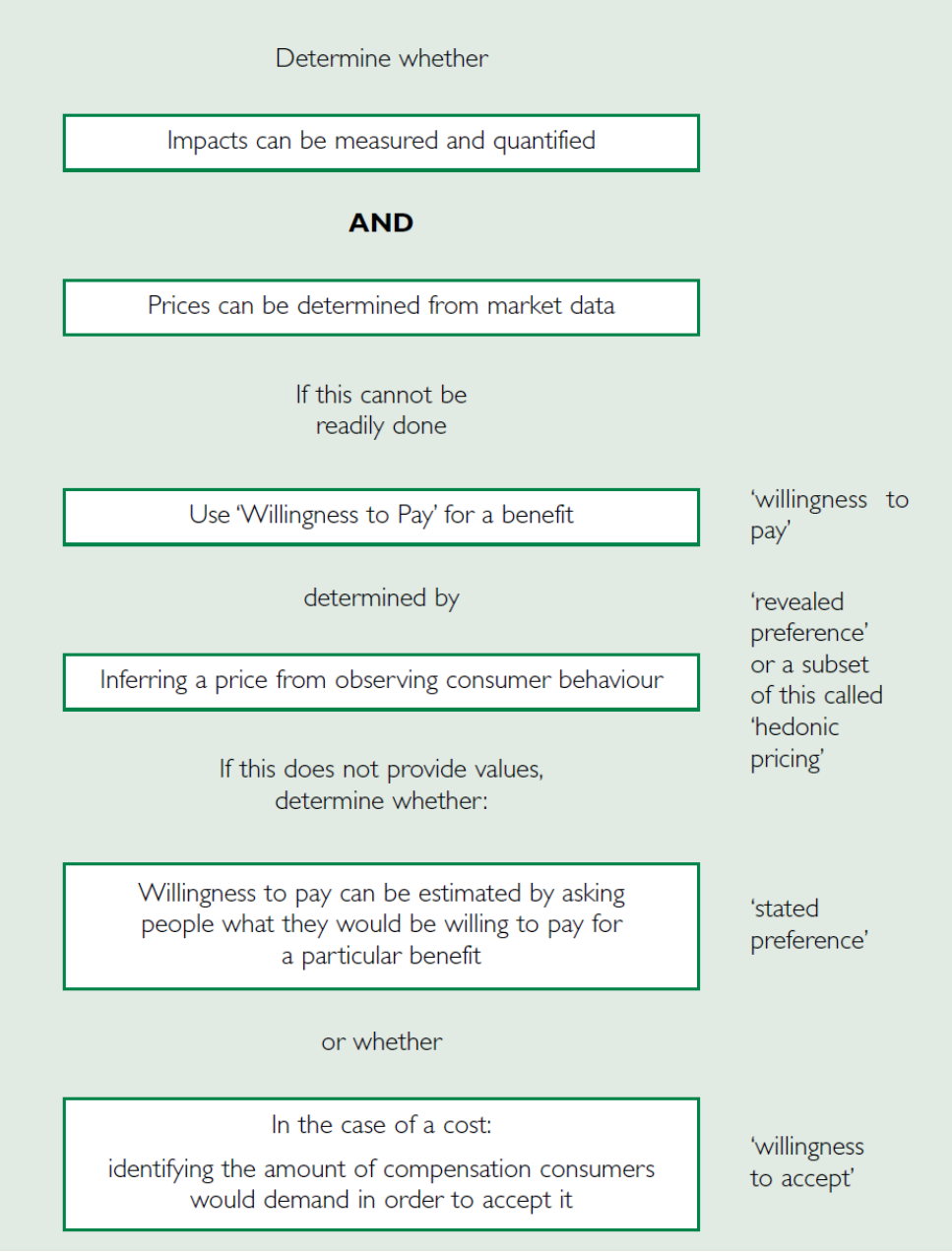
An ODRC valuation effectively considers the replacement cost for the asset(s), including an adjustment that optimises the replacement for changes in technology or in the required services. This value is then adjusted for depreciation of the current assets. This approach has some relevance to the census as its main asset is derived from a monopoly survey right. If this right was given to a private firm, it is highly likely that subsequent pricing for services would be subject to an ODRC based rate of return form of price regulation.

Such an approach would follow the historic cost approach discussed previously, basing initial costings on historic cost and then examining depreciation. Optimisation though is a new issue, and in effect foreshadows the forthcoming examination of optimal frequency and whether changes in collection methods would produce effective outcomes at lower cost. Given that this work is complex, and still some months away, it is not attempted here.

As depicted in the following diagram, an economic valuation approach moves through a series of tests. As with accounting approaches, the first preference is market-based prices but if these cannot

be obtained, a sequential set of tests are applied each time trying to obtain the best proxy for a price but with decreasing objectivity and robustness. Recent reviews of these approaches also indicate that while they are theoretically sound, much depends on the actual way in which they are applied. As with survey questions, framing can be critical.

Figure 1: Economic approach to valuation[11]



[11] See HM Treasury, "The Green Book. Appraisal and Evaluation in Central Government," and a subsequent publication by HM Treasury and DWP, "Valuation Techniques for Social Cost-Benefit Analysis," by Daniel Fujiwara and Ross Campbell, July 2011

Approaches adopted in this report

Willingness to pay/Revealed preference: This approach works well especially when there is a range of reasonably close substitutes for the good or service being valued. Observing the amount spent on the near-substitute reveals the willingness to pay. A challenge, however, is that in many areas there are no close substitutes for the census, particularly in applications where both a total population frame is required and, more significantly, one which then links to demographic factors.

In those areas where the census data have crowded out any near alternatives, a synthetic calculation can be made by comparing the accuracy and completeness of census data to the next best alternative, and then calculating the impact that the change has on the activity. In the absence of external value measures, the approach adopted has been to estimate reasonable ranges for potential impacts, as set out later in this report. This is the approach that has been applied in the main benefit areas covered in this review such as:

- Central Government resource allocation
- Long-term investment planning
- Service planning

The approach has also been used, albeit with some very wide ranges of uncertainty, for some of the policy making and monitoring areas. In these cases there is clear evidence of the importance of census data to the policy making task, so values have been imputed using the cost of the policy services (as proxy for value) and applying an estimate of the extent to which access to census data improves the effectiveness of that work.

In a very limited way, revealed preference could be applied to those expenditures that were incurred as a result of census deferral, probably most applicable to fast growing councils (eg, Auckland City). But again because of the one-off nature of the deferral, these expenditures are unlikely to reveal a sustained valuation and have not been used in this report.

Stated preference: To apply this well would typically require direct surveying of respondents. There are several areas where, with time and careful survey design and application this could reveal more precise valuations. This could be applied especially amongst those market-oriented companies which in turn are on-selling some value added services, including areas such as:

- economic research companies which carry out market analysis and regional analysis, or provide input into policy-related work
- market research companies where census data are of direct assistance in reducing the required sample size for market research work or informing targeted marketing
- some retailers or service providers where census data are critical for business planning, affecting investment and service level and location choices (eg, aged care, early childhood care and education).

Such work is both costly and requires careful survey design and framing to elicit reliable responses. In many cases discussions with firms have indicated that they regard census data as critical, especially in the short-term, and they have not thought about possible alternative because census

data have been available freely for so long. Consequently this approach has not been adopted in this review, but remains an avenue if further evidence is required.

Other relevant examples of valuation

A review of the international literature has not revealed any other systematic attempts to value a census. The most comparable and advanced work has been undertaken by the UK's Office of National Statistics. This work, most effectively captured in the Business Case that was accepted by HM Treasury in 2009[12], began the journey towards starting to identify and quantify benefits from the census. Its conclusion, accepted by HM Treasury at the time, identified quantified benefits in just three of the six main areas (health funding accuracy, market research, and targeted marketing, new store investment), and from three groups of users, that provided a discounted benefit value of £750m. This was accepted at the time as a significant underestimate, and was well in excess of expected future costs leaving an estimated positive NPV of the census of some £288m. A project is underway taking into account some revisions and attempting significant extensions (including for instance working with the Bank of England to attempt to place a value on the benefit of improved accuracy in labour market forecasts in reducing inflation and interest rates).

This ONS work takes forward earlier work which examined the valuation of marginal changes to statistical products[13] and which has been adapted and applied by this author in earlier work for Statistics NZ in respect of the business case for Statistics 2020 and Tomorrow's Official Population and Social Statistics (TOPSS).

Of some interest and relevance are two other significant recent studies:

1. A UK study which estimates of the value of mathematics to the UK economy. Using a form of input output analysis it used the employment of certain jobs categorised as heavily maths based (10 per cent), to derive an estimate of 16 per cent of Gross Value Added (GVA) or £208 billion, to the UK economy that stems from mathematical sciences research[14].
2. A NZ commissioned study[15] that quantifies the contribution spatial information makes to the New Zealand economy. Based on estimates of the productivity benefits (cost reductions and improvements in output quantity and quality), it utilised a Computable General Equilibrium model of the economy to identify an added $1.2 billion in productivity related benefits to the New Zealand economy in 2008.

Neither of these studies is considered particularly relevant (or robust) for this valuation exercise but they demonstrate a variety of approaches being taken to estimate the values of information-based improvements.

Other literature considered most typically examined the value of information in relatively narrowly defined areas, often where there were versions of revealed preference to provide value estimates.

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[12] ONS, "The 2011 Census Project Business Case," Feb 2009 s*upplied under Restricted Commercial conditions*

[13] ONS, Gavin Wallis, 2005, "A methodology for valuing statistical benefits."

[14] EPSRC commissioned study, working in partnership with the Council for the Mathematical Sciences (CMS), provided by Deloittes, 2012. http://www.epsrc.ac.uk/newsevents/news/2012/Pages/mathsciresearch.aspx

[15] "Spatial Information in the New Zealand Economy - Realising Productivity Gains", commissioned by LINZ, DoC and MED, and provided by Acil-Tasman, 2009 : http://www.geospatial.govt.nz/acil-tasman-report

Benefit elaboration and quantification

Overview - main users/uses

Census data are very widely used, and this report does not attempt to detail the many thousands[16] of users. Rather it identifies some of the major use areas which preliminary analysis suggested may be amenable to some form of quantification, and which represented some of the likely main value areas. These are summarised in the table below, and have been identified in consultation with the Census Information Needs Data Uses and Outputs (CINDUO)[17] work currently underway within StatisticsNZ.

Table 3: Main potentially quantifiable benefit areas

	Areas	Main activity where census data are used
Note: this table is not comprehensive, but includes the main items where some quantification or case study material seemed possible		
Resource Allocation		
Central Govt	Health	Overall health spending is allocated on a census based demographic basis, plus a variety of targeted funding streams
	Education	While main funding is off own roll numbers, some targeted components require census data
	Treasury	Relied on for long-term fiscal modelling and forecasting to inform broad expenditure and revenue choices
	MSD	Largely around benefit for longer-term forecasting, plus some targeted funding and service forecasting
	TPK	Relied on for some targeted funding
Capital investment planning		
Central Govt	NZTA/MoT	Estimating the impact of demographic forecast data for major investments, use of travel to work times for roading investment
	Education	Estimating the impact of demographic forecast data for major investments
	MBIE/HNZC	Estimating the impact of demographic forecast data for major investments
	Infrastructure providers	Estimating the impact of demographic forecast data for major investments
Local Government	Infrastructure	Planning new infrastructure for growth areas
Private sector	Retail: new stores	Estimating the level, location and type of demand for new investments

[16] The census page has had 86,743 views from 62,182 people from 1 December 2011- 1 December 2012. 50,006 people viewed from NZ (top 3: Auckland, Wellington, Canterbury), followed by Australia with 3,368 (top 3: Victoria, New South Wales, Queensland) and 2,413 from United States (top 3: California, Texas and New York). *Many main users would, however, bypass this page, or use material already partially transformed by an intermediary*.

[17] The CINDUO project is a formal process of seeking input from census users on their information needs and output requirements, and is part of the process of guiding decisions on the future direction of the census.

	Aged care	Estimating the level and location of demand for new facilities
Policy making and monitoring		
Small populations	MSD	Widely used in analysis and policy development, combining time series and small area population demographics
	TPK	Crucial for policy analysis and development
	MBIE	Estimated values for housing affordability and labour market detail
	Treasury	Time series and detailed policy analysis
Service Planning		
Central Government	MBIE/CERA	Estimating labour demands for the Canterbury rebuild and housing needs
Local Government	District planning Service provision	Estimating likely demographic and business demands to inform District Planning and service provision
Academic and market research		
	Academic	Used in a wide variety of research, especially in health and social policy areas
	Census based analysis	Used in a wide range of reports/analyses for clients
	Market research	Used to inform sample size and selection for research and marketing
Statistical benchmark		
Denominator/ Frame setting	Statistics NZ	Provides direct benefits in reductions in sample size required for some surveys, as well as the links/benefits especially for economic stats.
	MSD	Provides direct benefits in reductions in sample size required for some surveys
Key ingredient	NZ Deprivation Index	Widely used for targeting services and spending, and for policy analysis.
Electoral boundaries and representation		
	Electoral Commission	Required by statute for seat calculations and boundary determination

Estimation techniques- main considerations and approach

The core approach to developing benefit estimates is identifying the expected improvements to accuracy derived as a result of census related information being available. For each of the main areas discussed below, this involves two main components:

1. Establishing the counterfactual. The approach assumes that census data are no longer refreshed or updated from this time forward. In turn for each area, the likely range of alternate data sources that would be used to inform expected investment/spending is identified. This does require an area by area consideration of the specific alternatives that would be used.

2. Impacts on accuracy. For each area the change in accuracy from relying on the counterfactual data source is provided. While in many cases overall population estimates might be reasonably well derived from migration and births and deaths data, the spatial

distribution of the population, changing family structures, or dynamics within key social groups will not be as readily or accurately estimated. Generally, in the absence of explicit accuracy comparisons, this impact is assessed on the basis of reasonable ranges. Where possible they have been checked with sector participants for reasonableness and have been developed based on considerations of:

a. an estimate of the relative accuracy of the alternative data source,

b. the extent to which the main spending/investment relies on census based material, and

c. the underlying or contextual pattern of change or uncertainty in the area. As such, for example, areas which are facing rapid population change, or are subject to rapidly changing family structures, receive a greater weighting.

Accuracy impacts are specified for a number of years. In several cases, there is an identified pattern where the impact is expected to gradually rise as a transition is made from a census based world to full reliance on the next best alternative. In all areas, this is assumed to reach a maximum level of impact after 5 years, but the impact and pattern is separately discussed in each area. Generally there will be the ability to rebalance activity or spending so that effects do not continually compound, although rapid population change may mean that a maximum error is sustained in the future.

Evaluation horizon. For pragmatic reasons, the cost and benefit calculations are based on a 25 year period. While to some extent this is an arbitrary choice, on the basis of the evaluation approach taken it provides an accurate set of conservative valuations. In all cases, the pattern of costs and benefits is set after 5 years, so additional years simply increase the net benefit. After 25 years, net incremental benefits are relatively small, especially at discount rates of six or eight percent.

Estimation techniques- limitations

As described in previous sections, versions of revealed preference techniques are adopted below. The absence of any systematic surveys or market prices places particular limitations on these approaches:

- while in some cases the users have been able to identify the “next best” data source, most often for major use areas there is no near replacement so assessments of the accuracy impacts from loss of census data are necessarily subject to wide ranges of uncertainty;
- because the valuations are based on constructed alternatives, they do not factor in the knowledge that market participants would have about emerging trends and changes. These could move valuations up or down, but will not be uniform across all areas.

Consequently, in developing benefit ranges a conservative approach has been adopted, coupled with the use of relatively wide ranges which have been chosen to reflect informed and realistic bounds within which actual values are likely to fall. More detailed survey work would be required to confirm

both the ranges and mean values, but this would typically not be cost-effective. As such, the values identified below serve to identify at a coarse level some relative values for the major areas subject to possible quantification, but they are neither precise nor comprehensive.

Benefits estimation for main use areas

Resource Allocation

The Government allocates large amounts of operational funding based on various demographic criteria. There are several ways in which benefits might arise as a result of more accurate data availability: in some cases total spending might be altered, but in most instances the main benefits accrue through greater accuracy in getting funding shares appropriately matched/distributed to the desired target population subgroup.

- Health: In 2012/13 some $11b was allocated to District Health Boards on the basis of a Population based funding formula (PBFF). Population data are supplied by StatisticsNZ although they are updated annually (some reliance is also placed on the NHI and PHO databases). The welfare costs of inaccurate funding allocations are discussed and calculated.

- Education: most funding is allocated on the basis of enrolments so census data do not form the primary allocation tool but are used for a decile weighting/equity index attached to that funding (around $250m pa for schools, plus extra for early childhood).

- Social Development: While some $18b is allocated to benefit and superannuation payments, almost all direct entitlement is calculated from administrative data. Census data is primarily used in overall forecasting and policy analysis work covered in later sections.

- Te Puni Kokiri: Given that there are limited other administrative data sources that provide a complete source of reliable ethnicity data, the census is critical to a range of TPK policy, service targeting and resource allocation tasks. Funds allocated, though, use a variety of criteria, of which census data are only a small part, so no overall estimate of accuracy benefits has been attempted.

- NZTA: allocations for local authority road funding (some $4b in 2012-2015) use population data as part of the funding allocation tool. Overall funding levels are set by non-census based means, so any accuracy effect derives from the welfare/efficiency loss from any misallocations. No attempt has been made to calculate such potential loss, but it is not expected to be large.

Health

The PBFF is used to determine the amount of funding distributed to each of the country's 20 District Health Boards (DHBs) [18]. Developed with the aim of fairly distributing funding according to the relative needs of their populations and the costs of providing health and disability support services

[18] A detailed analysis of the factors can be found in "The State of the Art? An Analysis of New Zealand's Population---Based Funding Formula for Health Services", Centre for Health Systems, University of Otago, May 2012

to meet those needs, the formula is comprised of two core parts: Cost Weights and Adjusters, which are then applied to expected population levels broken down to the relevant demographics. Cost Weights represent the expected costs per person and are modelled using historical average expenditure according to four demographic characteristics:

- Age
- Gender
- Ethnicity
- Deprivation

While other specific health data are also used to compile the adjusters, census data are critical to accuracy.

From an overall Government perspective, funding misallocations between DHBs do not directly cause an overall change in total expenditure. Overall health spending will be informed by a multitude of factors, including political. So while over time serious misallocations may raise pressures to increase overall funding, such an effect is not relied on for this calculation. Rather the welfare loss from misallocations is estimated, relying on an assumption of diminishing marginal utility, coupled with an analysis of how much misallocation would occur if census data were not available.

If census data were not available, the most likely default allocation tool would be PHO enrolment data (more reliable than NHI data). StatisticsNZ has provided an unpublished analysis which compares accuracy of PHO data with the census, indicating that overall some 90% the estimated resident population is actually enrolled, but with wide variations between DHBs (from 100.7% to 78.1%).

The approach used follows that outlined in HM Treasury's cost benefit analysis guidance[19] and which was also adopted by ONS in their 2011 Census Business case. Where heath funding between DHBs is inaccurate, people in the overfunded area gain at the expense of those in underfunded areas. If sustained, this will have real effects: for example fewer funds would be available in the poorly funded area to undertake immunisation campaigns, fund primary care or hospital care - with increases in avoidable mortality. Rather than attempting to measure such health changes directly (which would be extremely challenging analytically) the approach calculates the amounts needed to compensate the consumers in the more highly funded region (when losing their funding) and compares that with the welfare gained if that funding was reinstated to the consumers in the region with lower funding. Assuming diminishing marginal utility, and a simplified welfare function (for tractability), the overall welfare loss can be calculated. Further detail is provided in Appendix 2.

Using this approach provides an estimate of a benefit of around $15m pa as a result of "fairer" (or more accurate) allocations between regions resulting from the availability of the more accurate census data. A range of +/- 20% of this value has been used.

Education and Social Development

Accuracy benefits have not been calculated as the data required are difficult to obtain and funding levels much lower so it was not judged cost-effective to develop further. However amounts involved

[19] "The Green Book. Appraisal and Evaluation in Central Government" HM Treasury, p93

are not trivial: MSD service purchase and provision could be assessed as anywhere between $400m and $1.5b.

Capital Investment Planning

Central Government

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.

Counterfactual: In some areas there are readily available administrative data that will either be primarily relied on (e.g. Corrections) or in conjunction with census data (e.g. Education where existing school enrolment data will form part of the analysis). But in others there is less readily available data that helps inform either a wider pattern of demand across the country, or demographic components of the demand (for example expected regional energy demands that underpin investment by Transpower in fixed transmission lines).

Impacts: This report estimates impacts for just one area of capital investment: longer-term infrastructure investments. It is based on work undertaken by the National Infrastructure Unit in 2009/10[20] which involved discussions with the main long-term infrastructure providers: Meridian, Solid Energy, Transpower, Education, Health, MoT/NZTA, and some port and airport companies. This work identified the variables which were cited as influencing this group's $9b per annum long-term investments. While not a systematic survey, the work identified that population forecasts affected some 98% of investment (along with exchange rates 30%, energy 48%, and GDP estimates 50%).

A reduction in the accuracy of population data will affect the accuracy of longer-term investments. In some cases, pressure points will emerge that mean urgent and more costly fixes are required. In other cases, assets may be underutilised. Estimating these impacts precisely requires very complex and detailed analysis, so a simplifying approach has been adopted which uses a range of accuracy estimates and impacts.

Accuracy effects are measured in terms of how much investment in a given year might be affected by the non-availability of census data, for example investment that was built ahead of time or in the wrong place. To estimate costs, accuracy impacts of between 1% and 5% have been used (a wide range which reflects the disparate set of investments being made and lack of certainty about the precise impacts of the counterfactuals). The cost of misinvestment is based on these assets then not returning their cost of capital. This investment impact is calculated as a fixed level and applied across the entire investment portfolio. It has not been modelled on an accumulating basis: this conservative approach allows for a mix of misinvestment with differing lagged impacts in various sectors but any particular investment's lagged effect is partially compensated for through either adjusted investment in that sector or other parts of the investment stock which are not as heavily affected. Further detail is set out in Appendix 3.

[20] See reference to population as an infrastructure driver in pp 8-9 of the 2011 National Infrastructure Plan, Treasury http://www.infrastructure.govt.nz/plan/2011/nip-jul11.pdf

This approach indicates an annual benefit from better timed and located long-term infrastructure investments of between $7m and $36m per annum where the main variation is the assessed accuracy impact of between 1% and 5%.

Local Government

Local Government is very involved in providing services for its local population, and currently relies heavily on census data, both for overall population projections as well as more detailed demographic breakdowns. One part of LG involvement is provision of new infrastructure for growth areas- roads, and drinking, waste and storm water. In many cases this infrastructure is partially provided, or funded, by developers.

Counterfactual: Clearly this growth investment, its timing and location, are highly sensitive to demographic changes, currently heavily reliant on the census based material. Local government officials have indicated that if it were not available, they would probably work collectively to create some sort of replacement, because both its significance and the need to integrate demand forecasts nationally. Reliance on each council's own rating database and other demographic data (births and deaths, migration) would be too short term and/or not useful for specific local forecasting, but form the default counterfactual So while it is hypothetical, in the absence of these census based forecasts, an accuracy impact can be estimated.

Impact: The greatest errors will arise in areas of rapid and unexpected change, from the double hit of forecast inaccuracy and the large required expenditure by Councils to provide infrastructure and public facilities to accommodate new residential growth.

The accuracy impacts are estimated to rise gradually over time, as initial data on consents provides a less reliable indicator of population/demographic movement (especially where that also involves relocation within New Zealand, or rapid changes in migrant settlement). As such, the accuracy impact is estimated to rise (in one of two scenarios) from 5% in the first year to either 25% in the fifth forecast year or 15% (in the lower impact case). This level is then held as a ceiling, allowing for the likelihood that developers and local authorities will be able to reshape planned developments over that timeframe. But given the lags involved in the overall design and planning processes, the effects are allowed to effectively linger (covered by two further scenarios, one a single year, the other for three years).

The approach uses reported expenditure on growth assets compiled from the Long Term Plans of all local authorities, and applies a set of estimated reductions in accuracy to develop estimates for the level of investment that is "wasted". The cost of the waste is calculated at their cost of capital. Further detail is set out in Appendix 3.

The calculations indicate a potential cost from investments that might be in the wrong place at the wrong time, and do not generate a return on the capital invested (an opportunity cost), in a wide range from $18m to $90m pa. The variation reflects a range of accuracy impacts (a rising trend settling at either 15% or 25%) and effects which last for 1 to 3 years.

Auckland Council

If the census was not available we would rely on forecasts from Stats NZ and/or Auckland Council's own forecasts. Each has different levels of information to inform forecasts e.g. Council might analyse its rating base more to understand existing population and employment. There would be more scope for disagreement about population and employment forecasts without the census. The costs might arise in relation to gaining more information to support forecasts and potentially multiple modelling scenarios based on different forecasts. The ultimate cost is inaccuracy in evaluating major projects and making errors in when or whether the project is required or the extent of the intervention to address forecast demand. There would be reliance on other surveys to measure targets or KPIs in plans and projects - it would take a lot of time to cost the alternatives that would need to be considered.

The census is relied on for journey to work information - this is useful at the regional level despite some caveats. If this is unavailable, then reliance would be placed on MOT's Household Travel Survey, which gains information about travel patterns. The sample has been low in Auckland so is not very reliable. If the sample size is increased then it may be used as a proxy measure of indicative journey to work.

The land use and transport models are linked to 5 yearly census information (historic and future). We are deeply concerned about the effect on reliability if census information is changed to every 10 years.

Kevin Wright, Manager Transport Strategy

Private sector

The location, scale and timing of many private sector investments rely to some extent on census data. While perhaps the bulk of investment is driven strongly by other factors (especially export related, and very local service industries), many retail investments are heavily influenced by expected changes in the local market areas served by that investment. The success of a store is affected by its location. This section considers some of the larger categories of investment that might be amenable to further quantification, namely retail and aged care.

Retail

ONS in their 2011 Business case used estimates that assumed new stores were 2.5% less profitable due to poor location decisions (but a group of leading retailers argued that 5% was more realistic). Discussion with some retailers in NZ confirmed the importance of census data to store location, but this has not been developed into a quantitative estimate. It is worth noting that retailers use a variety of data to inform location decisions, including risk linkages between GIS databases and payment transactions. But the census still provides unique information, as summed up in the following comment.

"We use data from a variety of sources when making new site decisions. Census data provides us with some key variables by catchment such as; household income, household ownership (owned, mortgaged, rented) and household type i.e. apartment. These impact potential market size, for instance, people in rentals tend to spend less on home improvements. People in apartments are unlikely to buy outdoor equipment or spend much on gardening."

Rod McHugh, Mitre 10

Aged care

An ageing population coupled with changing societal patterns for elder care combine to create a significant demand for retirement villages and more intensive forms of aged residential care. As with previous investment categories, census data are used in location decisions by the many private sector operators. Poor decisions will reduce uptake and can lead to lower returns on investment. The significant fixed capital expenditures are investigated in two parts: intensive residential care and retirement villages (although there is some overlap).

Residential aged care

A recent study[21] indicates that over the period 2010-2026 an additional 30,000 residential care beds are likely to be needed, at a cost per bed (excluding land) of $132,750.

Counterfactual: The most likely alternative data source would be health data (especially PHO rolls). Provided they were made available, they are reasonably accurate, on average, for older age cohorts. But these data will not provide reliable indicators for regional shifts in resettlement to retirement locations, confirmed in discussions with a leading sector provider. Given those patterns, and their shifts over time, an estimated accuracy impact of 10% is adopted.

Impact: Residential care providers will be able to ameliorate impacts of lower than expected demand, by lowering prices and changing patterns of future investment. As such, the impact of less accurate forecasting is calculated on the basis that the loss is temporary- it halves the expected return on that portion of investment (the 10%) for 5 years after which occupancy drives returns back to target levels. This level becomes a fixed ceiling, reflecting a pattern across the country and a range of providers where new investments are being made through the period, all subject to the errors set out above.

Using a similar methodology to that described above, this annual opportunity cost of possible misinvestment has been calculated using an industry cost of capital of 12 percent.

This provides an estimated census benefit of around $7m pa (central estimate), with upper /lower bounds at plus 30% and minus 30% respectively.

Retirement villages

While investment in retirement villages overlaps with more intensive care, the overall market is much greater. Between 2012 and 2032 the number of over 65 year olds is expected to grow by about 518,400. If some 15%[22] choose retirement village care then this requires investment in places for some 48,000 people over the period, (after netting off more intensive beds). Using a cost per "bed" of $150,000 this indicates required investment of some $360m pa through the period.

Using similar assumptions around the benefits of improved accuracy from the census (to those set out for residential care above)yields an annual benefit of around $11m pa (central estimate), with a lower bound at 70% and an upper bound at 130%.

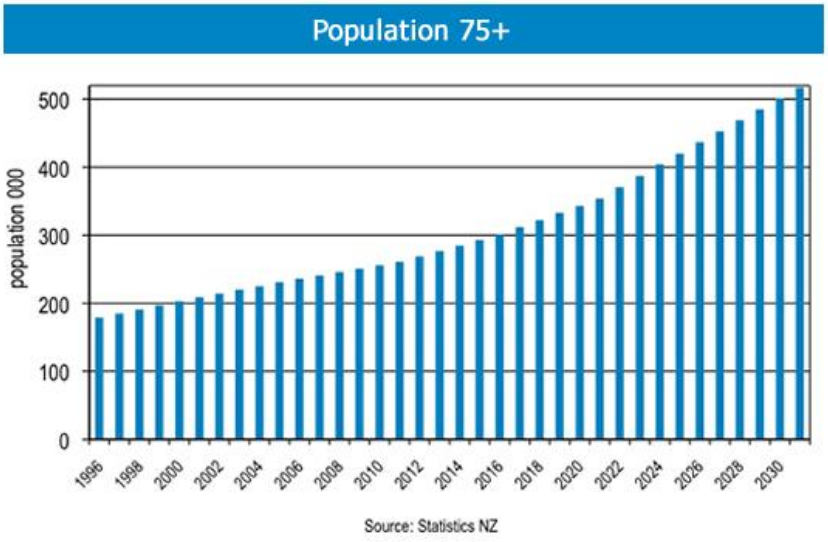
[21] "Aged Residential Care Service Review" Grant Thornton, for the DHBs and the Aged Care Association, September 2010. These estimates have recently been checked and appear to be underestimates, but this needs to be balanced against potential criteria tightening by DHBs over the next 15 years.

[22] Take up for retirement villages drawn from estimates in "New Zealand Retirement Village Database, Whitepaper 2012" produced by Jones Lang LaSalle and comments from Retirement Villages Association staff.

Webpage from Ryman Healthcare: http://www.rymanhealthcare.co.nz/investor-centre/underlying-growth-drivers

Underlying Growth Drivers

We are confident that Ryman will continue to deliver long term growth for shareholders. This is because of a number of unique factors:



Source: Statistics NZ

Growing elderly population – there is a rapidly growing elderly demographic. There are currently 250,000 people aged 75+ years, who are the primary market for our villages, and this number has been growing at the rate of 5,000 per annum for the past 15 years. According to Statistics New Zealand projections over the next 5 years (2011-2016) this population is expected to grow at the rate of 8,000 per annum, and in the following 5 years (2016-2021) the rate is 10,500 per annum, before peaking at over 16,000 per annum in the period 2021-2026. By 2031 the population 75+ will have more than doubled to over 516,000.

Long term care demand growing – people are living longer, albeit frailer. The afflictions of old age (including dementia, diabetes and arthritis) mean that the need for long term residential aged care will increase.

Additional comment from Gordon MacLeod, Ryman CFO: "We are investing between $130m and $140m each year and wouldn't choose a site in an area if data wasn't available. We find census data incredibly important, we are obviously very interested in age and demographic profiling and population numbers in each region."

Policy making and monitoring

Census data are extensively used in policy work, identifying patterns and linkages in past data and building a wide variety of forecasts. For many applications, the census is a unique data source, particularly for its linkages between geographic location and demographic factors. This is of critical importance when detail is required on minorities or small population groups.

Valuing such a diverse set of uses is challenging, and further comments are made in the non-quantified benefits area. But some attempts to value key outputs are described here.

Ministry of Social Development

Census data are a crucial component of MSD's tasks in forecasting uptake and fiscal impact of many forms of financial assistance. Small variations in quality of estimates can have a significant impact on assessing the fiscal risk for the Government.

MSD's expenditure on Social Policy Advice (which includes cross-sectoral and long-term research) in 2010/11 was some $37m. Using a central estimate that its benefit is enhanced by 10% by the availability of census data suggests a central benefit estimate of $3.7m per annum from this part of the Ministry alone. Bounds are set at +/-50%.

Modelling and forecasting benefit numbers

MSD runs forecasting models to estimate future benefit numbers and numbers expected to come onto New Zealand Superannuation. These allow the Ministry and Government to be aware of out-year fiscal impacts and are critical to the Government's budget process.

These models directly use Statistics New Zealand population estimates and projections and draw on information from official surveys such as the HLFS. For example:

- *The Superannuation Model is dependent on population projections.*
- *Forecast models for Sickness benefit, Childcare, Child Disability Allowance, Unsupported Child and Orphan's Benefit, Disability allowance, Student Loans and Student Allowance all use population projections.*
- *Domestic Purposes Benefit modelling uses information from the HLFS.*

Beyond the daily use of projections and surveys in forecasting, research used in developing and designing these models has drawn directly on census information.

The Census sits behind all of the projections, estimates and official surveys used in these forecasting models and inaccuracies can have significant impacts on the Government's books. New Zealand Superannuation currently accounts for around $10.4 billion of expenditure and even small inaccuracies may mean estimates are out by tens or even hundreds of millions of dollars.

Producing accurate forecasts will become far more difficult without the regular updates provided through the five yearly census. In the absence of a five yearly census greater risk ranges would have to factored into forecasts and Government programmes and goals could be put at risk. The postponement of the 2011 Census has already caused concerns in this regard.

Te Puni Kokiri

The census is a key source of information on the characteristics and circumstances of Māori. It provides the only national count of te reo Māori speakers and one of the only government collections of iwi affiliation. 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. The census is also the primary source of information on the characteristics of Māori tribal areas (rohe).

For TPK census data are critical, administrative data on ethnicity are poor and many surveys are limited in coverage and accuracy. Recent examples of work which required census data includes examining patterns of underachievement and subsequent labour market success of Māori.

An approximate benefit estimate can be obtained by estimating the additional advantage that census data provide for policy in this area. This approach uses the cost of policy advice as a proxy for the benefit value, which is clearly likely to be a significant underestimate where policy identified ways of assisting Māori to succeed.

Some $30m is spent annually on policy advice most directly related to improving outcomes for Māori. If census data improve its effectiveness by 20% this provides an annual benefit of $6m pa. In addition, some $49m pa is spent on Whānau Ora where again census based advice will improve effectiveness. If this is valued at 5%, it adds a further $2.5m pa of benefit. Bounds are set at +/- 50%.

Overall expenditure on Policy advice

A 2010 review[23] estimated that in 2009/10 some $888m was spent on policy advice by the New Zealand Government. While good policy advice requires a combination of factors for effectiveness, good data is a significant contributor. While there is no single measure of the contribution of census data, its use is widespread and goes well beyond the highlighted examples set out above. A very conservative impact estimate, that the availability of census data lifted the value of this advice by 1%, would support an annual benefit of $8m pa (after netting off the policy expenditure specifically included in the previous two areas). Bounds are set at +/- 50%.

Academic and market research/census based analysis

The ONS 2011 Business Case provided an estimate for the value of the census for market research companies, where it is used widely. In particular, they estimated the benefits from census data which provided a frame for survey work, allowing the research companies to target marketing campaigns more tightly, and to reduce the sample size for market research work. This work indicated significant benefits (with lower bounds of £32m pa for targeted marketing and £15mpa for sample size improvements).

For this study, a market research company contacted confirmed the “enormous value of census data” but further specific valuation work has not been completed. However, on the basis that the same activity occurs in New Zealand, and on a scale which is proportionate to shares of overall GDP, would support a benefit of some $6.5m pa. Sensitivities of +/- 33% have been applied.

Census based analysis refers to the wide range of private economic research/advisory activity which provides services to private clients, local authorities and central government using census data as a core part of the analysis. This activity includes for example, analysis for MBIE/CERA of possible

[23] “Improving the Quality and Value of Policy Advice”, Findings of the Committee Appointed by the Government to Review the Expenditure on Policy Advice, Dec 2010

labour market impacts of the Canterbury recovery including understanding of the links between industries, occupations and location, advice to local authorities in respect of district plans about expected patterns of residential and commercial activity, work for regional councils to support environmental impact assessments, reports for firms/event organisers and local authorities on economic impact assessments for significant proposals and projects. The value of such work is not available: it involves part of the output of a diverse range of private firms.

From limited discussions with some of the firms involved and some knowledge of the sector, it seems that the value of work in this area is unlikely to be less than $20m pa and could be much greater. While the services supplied add significant value to basic census data, it seems reasonable to estimate a census related contribution of around 10%- without census data to provide similar quality outputs would require considerable increased effort (conservatively estimated at 10%). This suggests an ongoing benefit from the census at $2-4m pa. Sensitivities of +/- 20% have been applied.

Statistical benchmark

StatisticsNZ

The census provides the overall reference point or denominator for many social and economic indicators- sample surveys cannot provide this kind of detailed and cross-referenced information below national levels. This is especially true in New Zealand, where sample surveys are relatively small compared with larger countries and administrative datasets are not very complete. As such, the census is used as the denominator for:

- distributional information used as the basis of the Household Sampling Frame;
- calculating a range of social outcome measures including: rates of health measures (such as cancer and heart disease rates), education participation, and rates of crime;
- a wide range of economic surveys, including employment and unemployment rates; and
- grossing up sample survey data where the census underpins socio-economic surveys carried out by both the public and private sectors.

Without the census surveys would need to be much larger. A very approximate estimate can be attempted based on StatisticsNZ spending on Economic and Business Statistical Information Services output costs, some $40m. In the absence of census data, analysis and survey costs would rise- for both StatisticsNZ, other departments and for private survey firms.

StatisticsNZ estimates this ability to stratify survey samples reduces sample size requirements by approximately 40% (saving $1.4m over the three main household surveys- HLFS, HES and GSS) and similar proportions for the Ministry of Health's Health Survey (saving $0.6m pa).

Survey methodologists argue that post-censal surveys are the only robust way to survey sub-population groups like Māori. The census enables more efficient and robust surveys that accurately represent smaller population groups, these surveys include Te Kupenga (Māori Social Survey) and

the Disability Survey. Cost savings are estimated to be around $2.4m pa on current sampling frequencies.

A crude overall estimate of savings can be made using StatisticsNZ survey costs, increased by perhaps a further 20% by spending by other organisations, and a range of cost increases of between 10% and 30% provides a value for the census of between $5m and 14m pa.

Sample Surveys

*The quality of survey results depends on **population weightings** which are almost universally derived from census data. Products such as the HLFS population estimates are rebased after each census to ensure accurate results for total and sub-group populations. Without the Census the robustness of total and sub-population estimates could come into question. Even with the five yearly Census there are concerns about accuracy deteriorating through time. Accuracy in turn affects the reliability of research into household incomes, poverty, inequality and other social measures, which in turn affects the integrity of data the OECD and other international agencies use for international comparative studies and reports.*

The Disability survey uses the Census to provide a sample frame for the survey. The advantage of the Census in this case is directly related to the ability to provide accurate information on a population sub-group.

To fill the gap if the Census becomes more infrequent, or less comprehensive, may require official surveys to become much larger or new surveys to be developed in the intercensal period. This will make them more expensive and will impose a greater compliance cost on the New Zealand population, which is relatively small and arguably already over surveyed.

Administrative data

For administrative data to be utilised to the full extent requires this data to be put into the context of the wider population of which all current administrative data form a subset. The Census is critical to allowing agencies and researchers to understand and verify administrative data.

While administrative data is an important source of information and one that has great potential for research and administration through data matching and other activity it is currently not a substitute for the Census. While some existing administrative data sets are regarded as Tier 1 statistics by Statistics New Zealand greater resources will be required to ensure collection consistency and maintenance should these data sets act as substitutes for the Census. There will be costs to collecting agencies to bring legacy computing systems up to speed for this purpose and the conflict with policy and administrative imperatives and maintaining consistency will be an issue.

Electoral Boundaries

Electoral boundary adjustments

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.

The number and placement of boundaries are based on total population. Utilising census data ensures a high level of public trust and confidence in the independence of electoral boundary setting.

Māori Electoral Option

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. The size of the Māori roll contributes to determining the number of Māori seats in Parliament.

Valuing these statutorily mandated contributions is challenging, and would reflect deeply held views about the benefits of fair and open participation in a democracy. But some lower limit on value could be assessed from the amounts spent maintaining electoral rolls ($21m pa) and on the work of the Electoral Commission ($14m for 2010/11- outside an election year). The census is an important but partial contributor to a fair outcome- so assessing a benefit in the 5-10% of the amounts spent each year maintaining rolls and reviewing arrangements does not seem unreasonable.

It is worth noting the impact of MMP on these valuations. Under MMP, so long as a voter is registered, it could be argued that their vote counts irrespective of the local electorate in which they vote. This effect would have reduced the expected value contributed by the census, although it has greater significance for Māori seat determinations.

Non-quantified/quantifiable benefits

Widespread user base

This report has identified a few key areas of census data use that are reasonably amenable to some form of quantification, and followed that up with discussions and quantification for 11 areas. While some areas involve just one user, and others groups of users, they are not comprehensive valuations of all census data use by those organisations.

The Census Information Needs, data Uses and Outputs (CINDUO) work is a wider and more formal process of engaging with census users on their needs and has identified a much wider group of census data users. Indicators of this widespread user base include:

- some 2,500 subscribers to the monthly Census Advisory newsletter;
- 67 Territorial authorities and 11 Regional Councils who are significant census data users along with their representative associations
- a primary tier of heavy data users in central government: Ministries of Business Innovation and Employment, Education, Health, and Social Development, Treasury and Te Puni Kōkiri as well as significant use from other departments

- a wide contact network at the universities and some 70 iwi groups

Resource Allocation

Education:

Funding for schools and early childhood education contain census based components[24]:

- Schools. A funding component is allocated on the basis of a school's decile, which indicates the extent to which the school draws its students from low socio-economic communities. The lower the school's decile, the more funding it receives. Deciles are reassessed after each census to take account of the latest information. The reassessment also ensures that changes in the catchment area for each school are picked up. Each year schools can also request a review of their decile, so inaccuracies can contribute to more frequent reviews (and cost for the Ministry) or funding misallocations, potentially depriving areas of high need the support intended for them. The five factors that make up the decile are:
    - Household income – percentage of households with income in the lowest 20% nationally.
    - Occupation – percentage of employed parents in the lowest skilled occupational groups.
    - Household crowding – number of people in the household divided by the number of bedrooms.
    - Educational qualifications – percentage of parents with no tertiary or school qualifications.
    - Income support – percentage of parents who received a benefit in the previous year.

- A wide range of funding is affected by deciles:
    - Targeted Funding for Educational Achievement (TFEA) (deciles 1-9)
    - Special Education Grant (SEG) (deciles 1-10)
    - Careers Information Grant (CIG) (deciles 1-10)
    - Kura Kaupapa Māori Transport (deciles 1-10)
    - Priority Teacher Supply Allowance (PTSA) (deciles 1-2)
    - National Relocation Grant (NRG) (deciles 1-4)
    - Decile Discretionary Funding for Principals (deciles 1-4)
    - Resource Teachers of Learning and Behaviour (RTLBs) Learning Support Funding (deciles 1-10)
    - RTLBs for years 11-13 (deciles 1-10)
    - School Property Financial Assistance scheme (deciles 1-10)
    - Study Support Centres (deciles 1-3)
    - Social Workers in Schools (deciles 1-5)
    - District Truancy Service (deciles 1-10)

- Early childhood education. An equity funding component is applied based on an Equity Index (EQI). This index measures the extent to which a service draws children from low socio-economic communities. It is derived on the basis of enrolled children's addresses and information taken from the census.

[24] Ministry of Education website, Funding handbook for ECE and for schools

Health

Funding for primary healthcare is allocated on the basis of enrolments with local area PHOs. Addresses are coded against census meshblocks to determine the relevant NZ Deprivation index applies, which affects funding levels.

Financial Markets

Financial services firms use census data in a range of direct and indirect ways. ONS in their 2011 Business Case estimate a value for the benefit gained by firms which used census data to model a customer's likely attitude to risk (for example the data can indicate that an area is largely made up of retirement bungalows whose residents are more likely to have a risk averse attitude). This allows firms to design products and introduce them in areas where demand is likely to be high.

While not confirmed, it seems likely that population data are an integral component in life and health insurance policy setting and pricing.

ONS is also currently exploring more indirect uses of census material. They are working with the Bank of England to identify possible costs from less accurate census data. These impact on estimates of future labour market pressures, in turn affecting judgements about monetary policy settings, so may affect interest rates and economic growth. This has not been attempted here.

Policy making and monitoring

Census data are routinely used in a wide variety of policy settings. Some significant, unquantified uses include:

- Treasury is statutorily required to produce Long-term Fiscal Projections at least every four years and cover at least 40 consecutive financial years. A significant input to Treasury's long-term fiscal model is the demographic and labour force projections arising from census based material. Treasury comments that the long-term model serves to frame key fiscal and expenditure areas so errors in the base year population and labour force estimates will affect the five year macro forecast and feed through to errors in the long term fiscal projections. This may then overstate (or understate) the potential future pressure on the fiscal position and lead to tighter (or looser) fiscal consolidation than necessary. This is framed with considerable uncertainty around projections with a long horizon

  Another model, Taxwell, is used to analyse the potential impacts of tax and expenditure changes. Taxwell is based on HES reweighted by census-derived demographic data.

- Local Government. Census data allows analysis of income trends that aren't possible with the HLFS, particularly income bands by household type. These considerations inform housing affordability problem analysis and the development of responses.

- MSD. "Raw administrative data are useful to a point but to get the best use and value out of these data for research and analysis they need to be matched with census data derived rates, ratios, percentages and other monitoring tools. Administrative data is almost always incomplete and seldom captures the entire population group... Derived variables from census data are equally important such as identifying low income households or household

crowding. The ability to measure at the individual, family and household and community level using derived census measures is critical for research and investment decisions."

- MBIE. Census data are used for: job vacancy monitoring and assist with research into factors affecting supply and demand for selected occupations at a regional level, monitor outcomes for migrants and their settlement patterns, development of regional labour market reporting, monitoring trans-Tasman skills flows, and a wide variety of housing supply and demand analysis including future projections.

- Any policy requirement for household or labour market data at the local level is dependent on the sole source, census data.

- Cross agency work. The recent Government work on vulnerable children[25] used analysis based on a mix of administrative and other data, including the NZ General Social Survey[26] which in turn used census data to frame the survey and the sample selected.

Service planning

MSD: The Ministry is increasingly following a targeted approach to service delivery. This often involves small population groups both in terms of demographic makeup and geographical location. Significant funding is involved and decisions will impact on wellbeing and social outcomes. Census data is used as well as administrative data.

Social Sector Trials – innovative service delivery models at a local level (MSD)

This project was aimed at targeting youth in small geographic locations. The initial six trials were located in small townships with populations between 4,000 and 25,000 with an identified relative need for the services being provided. The needs based model used was developed at the area unit level but also used territorial authority level information. The model has subsequently been used to expand Trial's activity and for other subnational location exercises including assessing Vulnerable Children trial locations.

Census data used:

- *Refined age data (not normally available from estimates).*
- *NZDep 2006 deprivation decile rankings (directly derived from Census meshblock data in the Data Lab).*
- *Numbers living in low income households. MSD provides regular national information from the HES on income trends, inequality and hardship however HES cannot provide sub-national information and the Census is used to derive a comparative measure at various levels down to area unit level. This measure has been used for monitoring in the Social Report and a range of needs assessment exercises. The most recent data is from 2006 but has been calculated back to the 1986 Census to provide time series analysis.*
- *Cigarette smoking (a proxy measure for poor health behaviour only available at area unit level from the Census).*
- *Ethnic data for each locality (unavailable at area unit from any source other than the Census).*
- *Household crowding (another imputed measure derived from the Census).*

[25] Culminating in the White Paper for Vulnerable Children, released 2012

[26] "Vulnerable Children and their Families. Some Findings from the General Social Survey" Statistics NZ, Oct 2012

Information based on census data:

- *Population estimates.*
- *Various measures that use population estimates to derive population based rates such as the rate of youth apprehensions and benefit receipt. While measures such as numbers on benefits are useful, to accurately compare across locations there is a need to derive population rates and other comparative measures. These help put administrative data (which does not capture the entire population) into the context of the wider population.*

The Social sector Trials needs assessment exercise could not have been successfully conducted without census data and it is likely decisions would have been made using anecdotal information in the absence of the Census. The postponement of the 2011 Census has meant that data behind the model has not been updated and results may not be as accurate as they could have been. In small locations population dynamics can be quite mobile, especially for youth, and the Census is the most effective way of capturing change. Inaccuracies in this regard may lead to poor targeting of services, less confidence in decisions being made and ineffective results.

Health: Census data are used to assist with development and targeting of health services, for example, the Cervical and Breast Screening cancer programmes utilise ethnicity and age group data combined with area.

DHBs also use population forecasting data to conduct annual assessments and to assist future service planning.

Education: Census data are used to project school rolls by type and year of schooling out for 20 years. These forecasts are used for a variety of purposes, including teacher numbers, national salary forecasts, national school operations funding forecasts and policy costings. In the early childhood sector, census data are used to analyse whether services will be available to meet the needs of local communities.

IRD uses census data for regional planning.

Academic and market research/census based analysis

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.

Summary

The table summarises the estimated benefits from the areas discussed in the previous section. It reflects the wide range in the estimates of reasonable value ranges, just for the identified areas as covered in the relevant section. As such, the values should be seen as partial estimates, generally representing a reasonable lower bound estimate for the value to New Zealand from the use of census and population information.

Present values: A present value represents the value to someone today of a series of future payments or benefits. For this report, the benefits in each area were modelled over the next 25 years. This stream of benefits is converted into a single present value using a discount (or interest) rate, reflecting the fact that a dollar promised in a year's time is less valuable than a dollar today (ie if interest rates were 8%, then 93 cents invested today would yield $1 in a year's time).

Net present value: If an investment involves both costs and benefits, the net present value (NPV) represents the present value of those combined streams, representing the net worth of the investment to an investor today.

Table 4: Present value for quantified benefits

	Areas	**Indicative value range, $m Present value using an 8% discount rate**		
		Low	**Medium**	**High**
Resource Allocation				
Central Govt	Health	119	149	179
	Education			
	Treasury			
	MSD			
	TPK			
Investment planning				
Central Govt	Education			
	MBIE/HNZC			
	Infrastructure providers	69	206	353
Local Government	Infrastructure	154	249	650
Private sector	Retail: new stores			
	Aged care	101	145	188
Policy making and monitoring				
Small populations	MSD	20	39	79
	TPK	39	79	118
	Overall policy	40	81	121
Policy and LTFM	Treasury			

Service Planning				
Central Government	MBIE/CERA			
Local Government	District planning Service provision			
Academic and market research				
	Academic			
	Census based analysis	20	29	39
	Market research	51	63	76
Statistical benchmark				
Denominator/ Frame setting	Statistics NZ	49	93	137
	MSD			
Electoral boundaries and representation				
	Electoral Commission	17	26	34
Total		**679**	**1159**	**1975**

Costs

For this report, the costs used are based on an adjusted five yearly pattern of costs that best reflect the costs for the 2013 Census[27]. These costs (about $90m in total over the five years) have then been applied on a constant per-person basis to future years (using the 5 yearly pattern, and levels) but using the projected population from the latest long-term population projections. As such this represents a base case where future censuses are carried out in effectively the same way as the most recent census/at similar overall cost. This approach provides a base costing for any proposed changes to census methods in the future.

In addition, the time costs involved in completing the census also need to be included. These are estimated in Table 5 below from a national welfare perspective.

Table 5: Compliance costs

	Time to complete in Minutes	**Value of time $/hour[28]**	**Population numbers as at 31/12/2012**	**Total cost $M**
Individual forms for those > 15 years	10-12	6	3560700	3.92
Individual forms for those < 15 years	5-7	3	891560	0.27
Overseas visitors	2-4		165596	0.00
Dwelling forms	10-12	6	1752100	1.93
Subtotal				6.11
On-line efficiency saving	10%			
Total compliance cost				5.5

[27] Provided by StatisticsNZ and adjusted to account for the impacts of the 2011 census deferral
[28] Values taken from NZTA Economic Evaluation Manual, 2010, Table A4.2: Base Values for Time

Note

- The benefit calculations represent an estimate of the overall value that users would place on the data at that level of accuracy, so are net of the other resources used to produce outputs using that data.

Table 5: Present value costs of a 5 yearly census

	$M, Present value of costs
Costs discounted at 6%	236
Costs discounted at 8%	198

Discussion

Interpreting the results of this valuation

Given the difficulties in assessing values for many benefits, this report provides a set of reasonable ranges in which a value is likely to lie for some key benefit areas. Typically these have been estimated relatively conservatively. In most cases given the lack of stated or revealed preference valuations, estimates have been made using externally referenced data on investment and/or expenditure and an assessed accuracy impact has been applied. In some cases, this has been checked with practitioners, but in most instances it reflects the application of a set of judgements. Only in the health expenditure area has this been able to be rigorously estimated.

A cost for carrying out the census (including compliance costs) has been deducted from these benefits to provide an overall net present value. This has been derived on the basis of carrying forward the level of costs on a constant real per head cost for the census.

The value estimates represent eleven major areas of benefit out of the much larger range of unquantified benefits discussed. On this basis, it does not seem unreasonable to conclude that a true value for the census's value to New Zealand is safely in a range for which the estimates provided in this report represent a lower bound.

Risks and sensitivities

Some basic sensitivities are provided by use of alternate discount rates from the default rate of 8% currently still prescribed by the Treasury.

In addition to the uncertainties in estimating impacts discussed above, when considering patterns of benefits (and costs) over reasonably long time frames, additional sources of uncertainty arise. These include:

- impacts of changing information technologies and database interconnections. Rapid change is occurring in technologies and applications so that a rich variety of information is available, and is being connected in new and rapidly changing ways. This report does not forecast developments over the next 25 years, except to suggest that a wide range of new information sets are likely to emerge, often highly targeted. In some areas, this may reduce demand from some current census users (for example in targeted marketing campaigns) but this may be ameliorated as it is unlikely that a replacement will emerge to the census as a complete data frame for the population. On the other hand, better linkages may improve census outputs.

- whether internal migration or family structures change at significantly different rates in the future. There is some evidence of increased dynamism and greater instability in family structures which places an increased premium on the core micro-level information only available from the census.

- the potential for significant relative real cost shifts. While the census relies on a mix of skilled staff and IT resources, there seems no particular reliance on an input that is likely to

move significantly relative to other factors. Rather the main change is likely to come from competing information sources which increase in availability at reducing cost.

- adaptability of the census to changing information demands and priorities. Strength of the census has been the stability of a core set of questions allowing time series analysis. But over the next 25 years new demands will arise, and the value placed on some information will inevitably change (as will the techniques for accessing and transferring data). As such, the valuation approach assumes that the main outputs of the census will continue to be aligned with the main user requirements- a task that is being separately addressed in Census Transformation workstreams.

Further Work

Overall, this report provides confidence that the census delivers benefits well in excess of its costs, and some guidance on the level of benefit (and hence relative values) in key areas. This relatively coarse filter will help guide possible further work.

More rigorous benefit assessment: Many of the benefit estimations in this report have wide ranges, and only a relatively small number of areas have been included for quantification. Looking ahead, some further effort could be put into further assuring key benefit areas. If adopted, this would most likely involve targeted surveys or discussions amongst key users to provide greater assurance around benefit ranges identified in this report. However, in many areas, developing more robust benefit assessment would be costly, and for a wide set of users is unlikely to capture the value derived.

Inclusion of new areas: This report has been informed by the work carried out by ONS for their 2011 Business Case, and some discussion about the new valuation areas currently under exploration or revision. Of that work, the most likely area that may be relevant is the exploration of benefits accruing through the use of economic statistics which in turn have some base or connection with census data. This work should be followed as it develops through 2013.

Exploration of alternatives: The Government will continue to be interested in value for money in Statistics, as in other areas. This is involving exploration of alternate means of producing much of the same set of outputs (in terms of range, quality and timeliness), and methods which involve changes to aspects of range, quality and timeliness. Where no output change is involved, investigation is relatively simple; cost and reliability improvements for no output value reductions should be pursued. Clearly more complex are the choices where the output mixture is changed, for example in a move to a ten yearly census.

Such a change will require exploration of a range of collection alternatives (including greater reliance on a range of administrative datasets), many involving changes to the quality or set of outputs. Such work can be informed by the findings of this report, identifying where the most care and attention should be placed in identifying the impacts on users. For key areas, estimations would need to be made of the impact on accuracy, and marginal calculations of value change could then follow the approaches outlined here to identify the extent to which the cost savings were commensurate with any loss in user value, or at least to identify the most cost-effective change proposals. This work will require the clear identification of the main change proposals, and more detailed consequential work which provides robust accuracy impacts.

Initial work on the valuation of proposed changes should start with areas where the census is known to provide significant value, and where the rates of demographic change are high. This suggests areas such as local authority spending on growth assets, health funding allocations, retail and aged care capital investments, and the work of census based analysis firms (asked by clients to “fill in the gaps”) will provide real tests of the marginal value of changed outputs.

Conclusion

This report provides estimates of the dollar value to New Zealand gained through the use of census and population statistics information. The conclusion is clear: despite significant difficulties in developing a rigorous quantification, it is reasonable to conclude that the census delivers benefits well in excess of its direct costs.

The valuation task is complex, reflecting the fact that currently internationally there are no directly applicable models or approaches, and that there are costly hurdles in place to obtain precise estimates of user values for the information. As a consequence, this report utilises a range of approaches to valuation.

The resulting valuation needs to be interpreted appropriately. It does not have the rigour associated with a valuation reported on a balance sheet; rather it provides a guide to a reasonable lower bound estimate of value.

Given the difficulties in assessing values for many benefits, this report identifies a set of reasonable ranges in which a value is likely to lie for some key benefit areas. Many other areas are identified but left unquantified. While compliance costs are not included amongst the costs, it does not seem unreasonable to expect that these are lower than the benefits left unquantified, supporting use of the net valuation as a lower bound estimate overall.

On this basis it seems reasonable to conclude that a lower bound for the census's value to New Zealand is in a range as set out below:

Table 6: Overall value estimate for use of census and population information

	Net Present Value $M		
Discount rate	**Low**	**Medium**	**High**
3.5%	710	1420	2670
6%	570	1130	2110
8%	480	960	1780

Using the most generally applicable discount rate of 8%, this suggests a net present value of close to $1 billion for the benefits to New Zealand gained through the use of census and population statistics information, or a net return of about five dollars for every dollar spent.

There are some trends and future uncertainties that will impact on this valuation: notably that information is proving increasingly valuable. This trend though needs to be balanced against the rapidly emerging changes in technology that allow new information sources to develop and to be interconnected with other data sources. It is not clear at this stage whether such trends will provide an overall increase or decrease to census value over the next 25 years.

This report does not address the issue of whether the current collection and analysis system provides the best value-for-money. It could be that net expected value might be greater if either some additional accuracy or new outputs could be produced (even involving an increased cost), or a

combination of changes to the collection and processing systems along with changes to the types and quality of outputs produced was adopted.

This would require a much more detailed set of analyses, for which the information in this report provides a starting platform. For key areas, estimations would need to be made of the impact on accuracy, and marginal calculations of value change could then follow the approaches outlined here to identify the extent to which the cost savings were commensurate with any loss in user value, or at least to identify the most cost-effective change proposals. This work will require the clear identification of the main change proposals, and more detailed consequential work which provides robust accuracy impacts for the various changed sets of outputs.

Appendix 1: Historic cost valuation for the census

Year	Annual cost Nominal $	CPI mid point	$2012	Population	Uniform Cost/person	Spliced series Annual Cost
1881			8,097,419	545,007	1,178,915	1,178,915
1882			4,752,806	561,804	755,473	755,473
1883			4,354,775	584,974	711,593	711,593
1884			3,567,851	608,401	597,919	597,919
1885			32,490,400	619,323	5,455,052	5,455,052
1886			8,097,419	631,355	1,365,696	1,365,696
1887			4,752,806	645,330	867,793	867,793
1888			4,354,775	649,349	789,902	789,902
1889			3,567,851	658,021	646,684	646,684
1890			32,490,400	667,477	5,879,197	5,879,197
1891			8,097,419	676,051	1,462,379	1,462,379
1892			4,752,806	692,426	931,124	931,124
1893			4,354,775	714,258	868,860	868,860
1894			3,567,851	728,121	715,576	715,576
1895			32,490,400	740,699	6,524,143	6,524,143
1896			8,097,419	754,016	1,631,026	1,631,026
1897			4,752,806	768,910	1,033,975	1,033,975
1898			4,354,775	783,317	952,867	952,867
1899			3,567,851	796,359	782,638	782,638
1900			32,490,400	808,132	7,118,099	7,118,099
1901			8,097,419	830,800	1,797,119	1,797,119
1902			4,752,806	851,072	1,144,460	1,144,460
1903			4,354,775	875,648	1,065,183	1,065,183
1904			3,567,851	900,682	885,164	885,164
1905			32,490,400	925,605	8,152,812	8,152,812
1906			8,097,419	956,457	2,068,930	2,068,930
1907			4,752,806	977,215	1,314,088	1,314,088
1908			4,354,775	1,008,373	1,226,637	1,226,637
1909			3,567,851	1,030,657	1,012,900	1,012,900
1910			32,490,400	1,050,410	9,252,105	9,252,105
1911			8,097,419	1,075,250	2,325,894	2,325,894
1912			4,752,806	1,102,471	1,482,523	1,482,523
1913			4,354,775	1,134,506	1,380,072	1,380,072
1914			3,567,851	1,145,838	1,126,096	1,126,096
1915			32,490,400	1,152,638	10,152,539	10,152,539
1916			8,097,419	1,150,339	2,488,320	2,488,320
1917			4,752,806	1,147,448	1,543,005	1,543,005
1918			4,354,775	1,158,149	1,408,832	1,408,832
1919			3,567,851	1,227,181	1,206,038	1,206,038

1920	32,490,400	1,257,611	11,077,150	11,077,150
1921	8,097,419	1,292,717	2,796,300	2,796,300
1922	4,752,806	1,318,884	1,773,540	1,773,540
1923	4,354,775	1,343,021	1,633,720	1,633,720
1924	3,567,851	1,370,403	1,346,792	1,346,792
1925	32,490,400	1,401,230	12,342,159	12,342,159
1926	8,097,419	1,429,555	3,092,297	3,092,297
1927	4,752,806	1,450,090	1,949,976	1,949,976
1928	4,354,775	1,466,952	1,784,476	1,784,476
1929	3,567,851	1,485,564	1,459,969	1,459,969
1930	32,490,400	1,506,809	13,272,108	13,272,108
1931	8,097,419	1,522,762	3,293,915	3,293,915
1932	4,752,806	1,534,735	2,063,801	2,063,801
1933	4,354,775	1,547,124	1,882,001	1,882,001
1934	3,567,851	1,558,373	1,531,524	1,531,524
1935	32,490,400	1,569,689	13,825,961	13,825,961
1936	8,097,419	1,584,617	3,427,715	3,427,715
1937	4,752,806	1,601,758	2,153,928	2,153,928
1938	4,354,775	1,618,313	1,968,599	1,968,599
1939	3,567,851	1,641,639	1,613,355	1,613,355
1940	32,490,400	1,633,645	14,389,291	14,389,291
1941	8,097,419	1,631,276	3,528,644	3,528,644
1942	4,752,806	1,636,403	2,200,517	2,200,517
1943	4,354,775	1,642,041	1,997,463	1,997,463
1944	3,567,851	1,676,293	1,647,412	1,647,412
1945	32,490,400	1,728,441	15,224,263	15,224,263
1946	8,097,419	1,784,334	3,859,726	3,859,726
1947	4,752,806	1,823,074	2,451,538	2,451,538
1948	4,354,775	1,861,923	2,264,939	2,264,939
1949	3,567,851	1,892,042	1,859,444	1,859,444
1950	32,490,400	1,927,629	16,978,729	16,978,729
1951	8,097,419	1,970,522	4,262,473	4,262,473
1952	4,752,806	2,024,556	2,722,477	2,722,477
1953	4,354,775	2,074,781	2,523,871	2,523,871
1954	3,567,851	2,118,434	2,081,935	2,081,935
1955	32,490,400	2,164,734	19,067,171	19,067,171
1956	8,097,419	2,209,132	4,778,615	4,778,615
1957	4,752,806	2,262,814	3,042,869	3,042,869
1958	4,354,775	2,315,900	2,817,180	2,817,180
1959	3,567,851	2,359,746	2,319,090	2,319,090
1960	32,490,400	2,403,567	21,170,833	21,170,833
1961	8,097,419	2,461,243	5,323,961	5,323,961
1962	4,752,806	2,515,835	3,383,113	3,383,113
1963	4,354,775	2,566,915	3,122,528	3,122,528
1964	3,567,851	2,616,970	2,571,882	2,571,882
1965	32,490,400	2,663,843	23,463,367	23,463,367

1966				8,097,419	2,711,318	5,864,903		5,864,903
1967				4,752,806	2,744,963	3,691,228		3,691,228
1968				4,354,775	2,772,933	3,373,139		3,373,139
1969				3,567,851	2,804,059	2,755,747		2,755,747
1970				32,490,400	2,852,137	25,121,878		25,121,878
1971				8,097,419	2,898,500	6,269,800		6,269,800
1972				4,752,806	2,959,700	3,979,991		3,979,991
1973				4,354,775	3,024,900	3,679,644		3,679,644
1974				3,567,851	3,091,900	3,038,629		3,038,629
1975				32,490,400	3,143,700	27,689,991		27,689,991
1976				8,097,419	3,163,400	6,842,810		6,842,810
1977				4,752,806	3,166,400	4,257,946		4,257,946
1978				4,354,775	3,165,200	3,850,312		3,850,312
1979				3,567,851	3,163,900	3,109,389		3,109,389
1980				32,490,400	3,176,400	27,978,015		27,978,015
1981				8,097,419	3,194,500	6,910,083		6,910,083
1982				4,752,806	3,226,800	4,339,168		4,339,168
1983				4,354,775	3,264,800	3,971,471		3,971,471
1984				3,567,851	3,293,000	3,236,264		3,236,264
1985				32,490,400	3,303,100	29,094,000		29,094,000
1986				8,097,419	3,313,500	7,167,494		7,167,494
1987				4,752,806	3,342,100	4,494,215		4,494,215
1988				4,354,775	3,345,200	4,069,274		4,069,274
1989				3,567,851	3,369,800	3,311,741		3,311,741
1990				32,490,400	3,410,400	30,039,108		30,039,108
1991				8,097,419	3,498,100	7,566,806		7,566,806
						Cost per person		
1992/3	$	3,139,000	749	$ 4,752,806	3,534,400	1.34	$	4,752,806
1993/4	$	2,914,000	759	$ 4,354,775	3,579,900	1.22	$	4,354,775
1994/5	$	2,466,000	784	$ 3,567,851	3,630,400	0.98	$	3,567,851
1995/6	$	23,054,000	805	$ 32,490,400	3,688,700	8.81	$	32,490,400
1996/7	$	5,858,000	820	$ 8,097,419	3,743,400	2.16	$	8,097,419
1997/8	$	2,440,000	830	$ 3,332,722	3,781,500	0.88	$	3,332,722
1998/9	$	2,899,000	834	$ 3,943,446	3,804,000	1.04	$	3,943,446
1999/2000	$	3,680,000	841	$ 4,962,741	3,824,148	1.30	$	4,962,741
2000/1	$	25,870,000	869	$ 33,768,321	3,843,007	8.79	$	33,768,321
2001/2	$	4,214,000	890	$ 5,371,960	3,880,954	1.38	$	5,371,960
2002/3	$	2,426,000	910	$ 3,021,981			$	3,021,981
2003/4	$	5,224,000	926	$ 6,396,288			$	6,396,288
2004/5	$	13,063,000	951	$ 15,571,279			$	15,571,279
2005/6	$	45,088,559	984	$ 51,951,625			$	51,951,625
2006/7	$	7,140,000	1011	$ 8,012,627			$	8,012,627
2007/8	$	3,500,000	1036	$ 3,830,039			$	3,830,039
2008/9	$	7,200,000	1062	$ 7,691,166			$	7,691,166
2009/10	$	10,500,000	1087	$ 10,957,725			$	10,957,725
2010/11	$	54,000,000	1110	$ 55,146,338			$	55,146,338

2011/12	$ 9,600,000	1134	$ 9,600,000		$ 9,600,000
2012/13					
Totals:		Steady real pattern	$1,456,710,439	Constant per head, no depreciation	$ 857,168,802

Appendix 2: Detailed benefit estimation from health funding accuracy improvements

Underlying approach

Using an assumed diminishing marginal utility function (simplified for tractability), a calculation is made which compares the net gain in welfare if funding is taken from an over-funded DHB and given to the underfunded DHB.

In simple terms, when money is allocated to society, any misallocation to one group comes at the expense of another and results in a social cost of money does not go to the targeted group. This is based on the premise that "a dollar in your pocket is worth more to you if you're poor than if you're rich". In this context, the cost to a local DHB population if it inappropriately loses $1m is greater than the gain to another DHB population if it inappropriately gains $1m. So whilst the net cost of misallocation is zero (because the total pot allocated is fixed), the net cost to society is not.

Key modelling factors

Two main components are required for this approach:

1. a clearly estimation of the accuracy difference that use of census data provides when compared with the next best alternative (PHO enrolments). This has been undertaken by Stats NZ.
2. a tractable welfare function and estimation process[29].

Accuracy calculations

In the case of the census, we have access to "optimal" allocations based on estimated resident population (ERP) and an estimate of the variance of the ERP and PHO rolls at the level of each territorial authority (which shows a wide range, from 101% in Northland, to 76% in Westland.

Because total PHO enrolment is some 10% below the total population, the PhO enrolment rates have been reweighted upwards so that the average rate is 100% of the ERP. This reflects an assumption that total health funding is set by exogenous factors, so if only PHO enrolment data existed, the current health funding would be reallocated.

The accuracy calculations are detailed in the table below, with the right hand column containing the welfare calculation- indicating a negative sign in those DHBs where their funding would need to be reduced, ie they would want compensation.

Welfare model

Supposing the government seeks to maximise the utility of NZ residents by allocating total health expenditure H across areas {a}. This can be written as:[30]

$$\max \quad \sum_a \lambda_a \cdot U(X_a / N_a, H_a / N_a)$$

$$\text{subject to } H = \sum_a H_a \quad \textit{and} \quad Y(Income) = H + \sum_a X_a$$

[29] As noted earlier, this draws from HM Treasury's Green Book and Appendix C of ONS's 2011 Business Case.
[30] This model is consistent with the Green Book section on distributional impacts. http://greenbook.treasury.gov.uk/annex05.htm#six

Note: H_a = optimal health expenditure in region a, and $\hat{H}_a$ / H_a the ratio of the actual expenditure to the optimal. For tractability, we assume that the utility contributed by the representative individual within each area can be modelled as a quasi-linear utility function of other final consumption expenditure X/N and health expenditure per capital H/N. This implies:

$$U(X_a, H_a) = X_a / N_a + v_a(\log(H_a) - \log(N_a))$$

For simplicity, we consider that the weight of an area's utility in total social welfare is given by its share of the total population.[31] $\lambda_a = N_a$

The solution to this problem requires that $v_a = \frac{H_a}{N_a}$. Hence if the population information available $\widehat{N}_a$ from other sources provides an inaccurate representation for population shares, the expenditure allocation will be different $\frac{\widehat{H}_a}{H}$ and suboptimal.

This provides a rule for allocating health expenditure H on the basis of the combined role of population and health weights.

From here it is possible to establish the theoretical money compensation C (or penalty) that should be allocated to areas to leave individuals in them as well off under the accurate and inaccurate health allocations. These compensation payments will satisfy:

$$\lambda_a(X_a / N_a + v_a \log(H_a / N_a)) = \lambda_a((X_a + C_a) / N_a + v_a \log(\widehat{H}_a / N_a))$$

Using the previous result, this implies a financial compensation (penalty) to each area:

$$C_a / N_a = v_a \cdot (\log(H_a) - \log(\widehat{H}_a)) = \left(\frac{H_a}{N_a}\right) \cdot (\log(H_a) - \log(\widehat{H}_a))$$

The net total loss will be then given by:

$$C = \sum_a C_a = \sum_a H_a \cdot (\log(H_a) - \log(\widehat{H}_a))$$

This is calculated in the right hand column in the table below.

[31] With additional information, this could be relaxed to account for other factors driving the spatial allocation of public expenditures.

TA code	TA name	Enrolment (% of ERP)	DHB	2012/13 DHB Revised Funding Package minus one-off payments Funding $M	Reweighted	Compensation required $M
1	Far North District	100.7	Northland	463	106	-11
2	Whangarei District	96.6	Northland		106	
3	Kaipara District	99.6	Waitemat	1220	109	-41.1
4	Auckland	90.6	Auckland	1052	99	4.8
11	Thames-Coromandel District	89.7	Counties-	1177	98	8.9
12	Hauraki District	90.2	Counties-M		98	
13	Waikato District	67.2	Waikato	941	98	7.1
15	Matamata-Piako District	90.6	Waikato		98	
16	Hamilton City	88.7	Waikato		98	
17	Waipa District	90.2	Waikato		98	
18	Otorohanga District	83.5	Waikato		98	
19	South Waikato District	94.1	Waikato		98	
20	Waitomo District	89.4	Waikato		98	
21	Taupo District	94.8	Lakes		104	
22	Western Bay of Plenty District	90.5	BoP	586	103	-6.5
23	Tauranga City	94.2	BoP		103	
24	Rotorua District	96.9	Lakes	268	104	-4.1
25	Whakatane District	91.6	BoP		103	
26	Kawerau District	92	BoP		103	
27	Opotiki District	80.2	BoP		103	
28	Gisborne District	95.8	Tairawhiti	138	105	-2.7
29	Wairoa District	90.3	Hawkes Bay		105	
30	Hastings District	96.3	Hawkes	420	105	-8.3
31	Napier City	97.2	Hawkes Bay		105	
32	Central Hawke's Bay District	92.6	Hawkes Bay		105	
33	New Plymouth District	90.8	Taranaki	291	97	3.7
34	Stratford District	89.8	Taranaki		97	
35	South Taranaki District	84.5	Taranaki		97	
36	Ruapehu District	78.4	Taranaki		97	
37	Wanganui District	94.8	Whangan	196	98	1.5
38	Rangitikei District	78.1	Whanganui		98	
39	Manawatu District	80.1	Mid	440	91	20.7
40	Palmerston North City	83.6	Mid Central		91	
41	Tararua District	87	Mid Central		91	

42	Horowhenua District	88	Mid Central		91	
43	Kapiti Coast District	90.6	CC		95	
44	Porirua City	97.5	CC		95	
45	Upper Hutt City	93	Hutt	343	103	-3.8
46	Lower Hutt City	95.2	Hutt		103	
47	Wellington City	86	CC	644	95	15
48	Masterton District	88.9	Wairarap	116	96	2.1
49	Carterton District	87.4	Wairarap		96	
50	South Wairarapa District	86	Wairarap		96	
51	Tasman District	94.4	Nelson M	359	103	-4
52	Nelson City	98.5	Nelson M		103	
53	Marlborough District	86.1	Nelson M		103	
54	Kaikoura District	92.2	Canty		98	
55	Buller District	88.2	West	115	97	1.4
56	Grey District	93.2	West		97	
57	Westland District	76.2	West		97	
58	Hurunui District	86.8	Canty		98	
59	Waimakariri District	92.9	Canty		98	
60	Christchurch City	90.2	Canty	1189	98	9
62	Selwyn District	83	Canty		98	
63	Ashburton District	91.6	Canty		98	
64	Timaru District	92	Sth Canty	156	98	1.2
65	Mackenzie District	88	Sth Canty		98	
66	Waimate District	86.4	Sth Canty		98	
67	Chatham Islands Territory	0			0	
68	Waitaki District	89.9	Southern	744	94	21.5
69	Central Otago District	87.3	Southern		94	
70	Queenstown-Lakes District	85.8	Southern		94	
71	Dunedin City	82.9	Southern		94	
72	Clutha District	92.6	Southern		94	
73	Southland District	85	Southern		94	
74	Gore District	98.7	Southern		94	
75	Invercargill City	94	Southern		94	
			Total:	10,860		
			Total annual gain $M			15.2

Appendix 3: Detailed benefit estimation for long- term investment decisions arising from improved accuracy

Capital Investment

A: Major Infrastructure Providers[32]

Expenditure affected: Long term fixed capital investment by Meridian, Solid Energy, Transpower, Education, Health, MoT/NZTA, and some port and airport companies. The NIU work identified the variables which were cited as influencing this group's $9b per annum long-term investments (this amounts to about 25% of total fixed capital formation). While not a systematic survey, the work identified that population forecasts affected some 98% of investment (along with exchange rates 30%, energy 48%, and GDP estimates 50%).

Assessed accuracy impacts: A reduction in the accuracy of population data affects the demand for, and location of, long-term fixed investments. In some cases, pressure points will emerge that mean urgent and more costly fixes are required, e.g. new power transmission lines. In other cases, assets may be underutilised. Estimating these impacts precisely requires very complex and detailed analysis, so a simplifying approach has been adopted which uses a range of accuracy estimates and impacts.

Each company invests heavily in demand forecasting, and population forecasts are only one component, albeit significant. Accuracy effects are measured in terms of how much investment in a given year might be affected by the non-availability of census data, for example investment that was built ahead of time or in the wrong place. To estimate costs, accuracy impacts of between 1% and 5% have been used. This range has been chosen to reflect a balance between: population data as just one input to overall judgments (a lower impact), but balanced against the fixed long-term nature of the investment (increased impact).

The cost of mis-investment is based on the affected assets then not returning their cost of capital for one year, where a WACC of 8% has been used to estimate the value lost.

Annual cost of misinvestment, $M

	Annual cost of lost investment returns	
Accuracy	6%	8%
1%	5.4	7.2
3%	16.2	21.6
5%	27	36
7%	37.8	50.4
10%	54	72

[32] Drawn from unpublished National Infrastructure Unit work of 2010.

B: Local authority infrastructure investment

Expenditure affected: A particular component of local authority spending is associated with the provision of services for growth areas: roads, sewerage, drinking and storm water, and some community facilities. This area will be directly dependent on population forecasting work, and excludes repairs or replacements to the existing networks.

Data on this "growth" spending is taken from DIA's summary tables on all local authority spending in their 2012-2022 Long Term Plans[33] (Item D 4001: Capex to meet additional demand). An equal expenditure by private developers has been included- note this does not include the residential building costs as these are much more closely aligned to short-term actual effects.

Assessed accuracy impacts: Two levels of accuracy impact are modelled, rising over time as data from consents becomes more dated and inaccurate. The low impact level increases to an accuracy impact of 15%, the higher track rises to 25%, with impacts lasting between 1 and 3 years.

Council spending (from DIA website)			Fiscal year ending, $M									
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
D_*Applications* of capital funding	4001_CapEx to meet additional demand		693,170	614,231	545,266	600,105	738,253	725,644	782,761	770,103	748,833	857,621
Assume private developers spend similar amount		Total	1,386,340	1,228,461	1,090,531	1,200,211	1,476,505	1,451,288	1,565,523	1,540,205	1,497,667	1,715,241
Impact of no census	Accuracy loss	High	5%	10%	15%	20%	25%	25%	25%	25%	25%	25%
		Low	5%	7%	10%	13%	15%	15%	15%	15%	15%	15%
	Cost of capital 8%											
one year	lost return on capital	high acc loss	5,545	9,828	13,086	19,203	29,530	29,026	31,310	30,804	29,953	34,305
three year			5,545	15,373	28,459	42,117	61,820	77,759	89,866	91,140	92,068	95,062
		low acc loss	5,545	6,879	8,724	12,482	17,718	17,415	18,786	18,482	17,972	20,583
		3 yr	5,545	12,425	21,149	28,086	38,925	47,616	53,920	54,684	55,241	57,037

[33] http://www.localcouncils.govt.nz/lgip.nsf/wpg_URL/Resources-Download-Data-Local-Authority-Long-Term-Plans?OpenDocument

C: Aged care

Expenditure affected[34] and Accuracy impacts

Residential care

Increase in beds required: 2010-2026	30,000				
Capital required per bed (excl land)	$132,750				
Target rate of return, 12%					
Capex, excluding land	$3982.5m	Or per year	$ 249	million	

Accuracy impact- for 10% of the new investment sustaining a halving in ror for 5 years	Yr 1	Yr 2	Yr 3	Yr4	Yr5
Impact $M	1	3	4	6	7 and continues at this level

Retirement homes

Net increase in over 65 year olds 2012 to 2032		518,400	
Estimated proportion needing new homes[35]	15%	77,760	
Balance after deducting those in residential care		47,760	
Capex cost per person (excl land)		$150,000	
Total capex over the 20yrs	$million	7,164	
per annum		358	

Accuracy impact- for 10% of the new investment stock a halving in ror for 5 years, expected rate of return 12%. $Million

Yr 1	Yr 2	Yr 3	Yr4	Yr5
2	4	6	9	11

Sensitivity: sensitivities of +/- 30% on the central estimate are provided

Cross check: Ryman expects to spend $130-140m pa (incl land). Current market share (by units/dwellings) is about 15%, so this suggests total annual spend above is an under-estimate, even allowing for potential market share growth by Ryman although Ryman's spend will also include some residential care component.

[34] "Aged Residential Care Service Review" Grant Thornton, for the DHBs and the NZ Aged Care Association, September 2010

[35] Based on data from "New Zealand Retirement Village Database, Whitepaper 2012", Jones Lang LaSalle

Appendix 4: Alexander Turnbull Library valuation

One example provides a partial point of reference for the census- the Turnbull Library [36]

The Alexander Turnbull Library (ATL) Heritage Collections are measured at fair value. Due to the unique nature of the Heritage Collections it is not always practical or possible to obtain a market valuation. In these circumstances collections have been adjusted by the movement in the Consumers Price Index to better reflect their current value. There are also difficulties associated with obtaining an objective valuation for the specified cultural and heritage assets. The carrying value includes the value of purchases for the collections since the last revaluation and the value of material received through donations and legal deposits.

A valuation is performed every three years. The collections are not depreciated.

Asset Class	Balance 1 July $000	Additions $000	Balance 30 June $000
Cartographic	24,711	15	24,726
Children's Historical	1,437	132	1,569
Drawing and Prints	63,322	203	63,525
Ephemera	4,613	59	4,672
Formed	446	–	446
General	99,171	10	99,181
Manuscript/Archives	72,508	290	72,798

[36] *From website of the friends of Turnbull Library: "*The breadth and depth of the Turnbull's collections must be emphasised: it has New Zealand's largest collection of art works, documenting the settlement of New Zealand; the published collections contain every work written about New Zealand, by New Zealanders and/or published in New Zealand; its collections in media other than print and manuscript include photography, maps, charts, music, newspapers and oral history; its collections of digital materials are growing rapidly and will be New Zealand's comprehensive digital collection in the same way as its published print collections now are; its collections of Maori language and literature materials are unique and of fundamental importance in the evolving history of the peoples of New Zealand under the Treaty of Waitangi. The rare books collection is not only internationally valuable but is internationally recognised and used by scholars throughout the world. The Turnbull, in other words, maintains and provides access to resources essential to a very wide spectrum of academic and public research on cultural New Zealand."

Asset Class	Balance 1 July $000	Additions $000	Balance 30 June $000
Music	1,576	28	1,604
Newspapers	44,752	51	44,803
New Zealand and Pacific	29,253	371	29,624
Oral History	12,596	167	12,763
Others	429	–	429
Photographic	65,749	318	66,067
Serials	39,314	253	39,567
Short Title	4,583	34	4,617
Rare Books and Fine Prints	379,418	364	379,782
Total Alexander Turnbull Library Heritage Collections	843,878	2,295	846,173
Total Cost of Collections	1,283,982	8,036	1,292,018
Total Cost	1,306,138	8,361	1,314,499
Buildings – Residential	–	198	198
Buildings – Commercial	311	140	451
Total Accumulated Depreciation	311	338	649
Property, Plant and Equipment	21,845	(13)	21,832
Collections	1,283,982	8,036	1,292,018
Total Net Book Value	1,305,827	8,023	1,313,850

*

Transfers between Government Departments.

Source: Department of Internal Affairs 2011/12 Annual Report p 151

The Alexander Turnbull Library Heritage Collections were revalued as at 30 June 2011 by National Library staff. The revaluations were made based on an assessment of the change in the market price of similar collections between the date of the last valuation conducted on 30 June 2008 and 30 June 2011.